

PROMOTING READING COMPREHENSION SKILL THROUGH MIND MAPPING TECHNIQUE

**The Thesis Submitted to the Department of Education Jadavpur
University, Kolkata for the Award of the Degree of Doctor of
Philosophy in Arts**

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2022

DEDICATED WITH EXTREME AFFECTION AND GRATITUDE TO
My Parents

CERTIFICATE

Certified that the Thesis, entitled, PROMOTING READING COMPREHENSION SKILL THROUGH MIND MAPPING TECHNIQUE, submitted by me for the award of the Degree of Doctor of Philosophy in Arts at Jadavpur University is based upon my work carried out under the Supervision of Professor Bishnupada Nanda, Department of Education. And that neither this thesis nor any part of it has been submitted before for any other Degree or Diploma anywhere/elsewhere.

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At the outset, I express my deepest sense of gratitude to my research supervisor Professor Bishnupada Nanda, Department of Education, Jadavpur University. I feel, it has been a fortunate opportunity to me to come into contact with him. As the supervisor, he has constantly encouraged me with his erudite scholarship and provided the valuable suggestions, whenever I required. I sincerely believe that without his immense help it could not be possible to complete the thesis in the present form.

I also convey my sincere gratitude to Professor Muktipada Sinha, HOD, Department of Education, Jadavpur university for their guidance, encouragement and insightful support during the study. I would like to thanks other Faculty of the Department of Education, Jadavpur University for their spontaneous academic supports and encouragements. At the same time, I express my indebtedness to office staff of the Department for their kind supports, whenever needed.

I am especially thankful to Mr. Bijoy Krishna Panda (Dada) and Mr. Amal Kumar Das for their technical helps and supports throughout the span of my research. My special gratitude to my parents for their blessings, inspiration and encouragement they extended to me.

My heart-felt thanks for all others who are not mentioned here but have helped me spontaneously during this period. I confess that, the error, which may remain in the study, is entirely my responsibility.

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LIST OF ABBREVIATIONS

ANCOVA	Analysis of Co-variance
ANOVA	Analysis of Variance
BST	Basic Science and Technology
EFL	English as a Foreign Language
HSRT	Health Science Reasoning Test
M	Mean
MLA	Mastery Learning Approach
MMA	Mind Mapping Approach
MMS	Mind Mapping Strategy
MM	Mind Mapping
SD	Standard Deviation
SEM	Standard Error of Mean
CIERA	Centre for the Improvement of Early Reading Achievement
DMM	Digital Mind Mapping
PMM	Paper Mind Mapping
MMCL	Mind Mapping with Co-operative Learning
CL	Co-operative Learning
SNT	Standard Note Taking
BCA	Brain Compatible Activities
TBLT	Task Based Language Teaching and Learning
CSL	Citation Style language
CAPTE	Commission on Accreditation in physical Therapy Education

CHAPTER-I

INTRODUCTION

1.1 Introduction

1.2 Definition of mind mapping

1.3 Characteristics of mind mapping

1.4 Steps of mind mapping

1.5 History of mind mapping

1.6 Advantages of mind mapping

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CHAPTER-I

INTRODUCTION

1.1 Introduction:

To make the learning process successful, four types of important skills are required: reading, writing, speaking and listening skills. Reading skills are involved with the entire learning process. Reading is a must for successful learning. An in-depth study of the students who dropped out of school shows that they fail in reading first. So, reading is an important part of the whole educational process.

Reading is a process that helps to understand the meaning of written text. Reading skills create a good communication between the reader and the writer. Reading and comprehension are two sides of the same coin. There are various problems in reading comprehension among students. This problem is more common when students read an English Textbook, Bengali speaking students do not understand the meaning of the text. Students get more hindrances when they find a difficult word or new word to read. As the text is too big, therefore, sometimes they cannot understand the meaning of the text. Teaching English as a second language is a complex task. To learn English, one has to create a creative environment, increase the motivation and interest of the students towards reading.

Researchers have found that mind mapping techniques help students to read, learn and understand English. Reading comprehension levels can be improved using this technique (Kim & Kim, 2012). Ausubel (1968) noticed that learning depends on the relationship between the different content, the prior knowledge of the content, the relationship between the stimulus and the response and the meaning of the subject matter to the students. Nashwati (2003) observed that presenting any content in an organized way will make it understandable, significant to the learners and will be in a position to link to different topics.

Buzan and Buzan (1996) observed mind mapping as a visual organizing method by which a large amount of information can be stored together in the brain. It is an effective learning technique that helps students to organize note taking in an organized way and remember them easily (Tucker, Armstrong, & Massad, 2010). Holzman (2004) mentioned that this technique speeds up the learning of slow learners and increases their achievement. Buzan (2006) observed that this technique allows students to accurately sequence different content, which enhances their decision-making, problem-solving ability, and improves reading skills. Other techniques

occupy our right-side hemisphere, which is associated with Imagination, Creativity, Colours, Emotions and Images. Mind mapping uses our left and right-side hemisphere properly integrated (Murley, 2007). Farrand, Hussain & Hennessey (2002) established that using this strategy, students transfer data from working memory to long-term memory and improve cognitive processes.

Mind map can be drawn in two ways: 1. Traditional hand-made mind map, 2. Electronic mind map. Some researchers have done a comparative study between the two types of mind maps and found that e-mind map is better than handmade mind map because e-mind map can be drawn very fast and it is much more attractive (Nong, Pham & Tran, 2009; Dara, 2010).

Various researchers have investigated how mind mapping (e -mind map, hand- made mind map) has promoted reading comprehension skill. Peng (2011) noticed that mind map develops reading comprehension skill because it uses both side of the brain equally. It combines word, language with image, colour, creativity at the same time. Stankovic, Besic and Aleksic (2011) mentioned mind mapping as a powerful method that improves students' reading comprehension skills as it combines sub-topics with main - topics. MalckZadeh and Bayat (2015) reached the same results, they find that mind mapping technique helps to understand different contents of English text. Students happily read each text using this technique and they can correctly use colours, images, keywords and establish relationships between different subjects which improves their reading comprehension ability (Siriphanich & Laohawiryanan, 2010). Gomez and King (2014) found that mind map establishes connections between different vocabularies of a text by different images. Bidarra, Kommers & Guimaraes (2000) revealed that e-Mind Map enhances students' motivation, confidence, english reading and writing skills, and critical thinking towards learning English.

Al-Jamal, Al-Hawamleh & Al -Jamal (2013) observed that learners are faced with various problems while reading English. Such as -1. they do not know meaning of each vocabulary, 2. cannot create notes by properly summarizing the content, 3. does not use proper strategy to understand written text, 4. don't know grammar. That is why they focus on improving grammar in research rather than reading comprehension, which has a negatory effect on learners' reading comprehension.

The benefits of mind mapping have a positive effect on various aspects of reading comprehension. So, the present researcher wants to study how mind mapping promotes reading comprehension skills of 8th class students.

1.2 Definition of mind mapping:

Buzan (1991) noted mind mapping as a graphic by which we can represent tasks and ideas, can make connections between different content, sub-topics spread like a ray from a main topic. Organize and classify ideas using it. Buzan (2007) opined that anyone can easily and happily receive new information through mind mapping. In mind mapping we can use colours, symbols, curved lines and images which are related to brain function. Mind mapping makes the best use of students' brains when creating notes. Using this technique students' can increase their memory up to 78%. Sugiarto (2004) mentioned mind mapping technique as a summarizer of the learning content by arranging the hard topic in an organized way through the map so that the students can easily understand.

Buzan defined mind mapping as a strong visual strategy that acts as a global key that exposes the potential of the caliber. Buzan used that technique to collect infinite information in the brain. Mind mapping, can be applied in every aspect of our lives. It improves learning, clears thinking power and increases human performance.

Murley (2007) noted that it is an effective tool that generates new ideas. With the help of this technique learners can easily express those new ideas in the paper, helps to present easily by oral method. Budd (2003) mentioned mind mapping as a visual layout tool that presents the main topic and sub topic through the branch, connecting between each. It is an ocular tool used to produce ideas, note taking and figuring out. When creating a mind map, the person usually puts the main idea in the middle of a page. Each line is then represented by a keyword. An image is drawn in each branch. Different colour pens and pencils are used. Murley (2007) noted that mind maps can be created in two ways, a. traditional mind map which is drawn using paper and pen, b. can be created using more than one computer application.

Weinstein and Mayer (1986) mentioned that this technique can be used in the classroom for learning which helps the students to remember the important points, can easily present in front of the classroom and everyone can learn the subjects with pleasure.

Based on the above explanation we can comment that it is an important method for developing reading comprehension skill of students. Students can understand each other in their own way, helping students to remember important points and increasing the potential of their brain. Teachers can also use this technique to make the teaching process interesting. Students can easily create a mind map.

1.3 Characteristics of mind mapping:

In the field of cognitive psychology and educational research, various studies have been done using mind mapping. Based on the findings of these studies, we can see different characteristics of mind mapping.

This technique helps to develop creativity (Mento, et al., 1999; Michalko, 2003). Mind map promotes gestalt principles, “equality” (easily attracts words by using colour and thicker lines, increases visual awareness) and “proximity” (combines related factors) for quick identification, remembering, recalling and storing a lot of information (1 image = 1000 words according to Buzan) (O’Donnell, Dansereau, & Hall, 2002; Wallace, West, Ware & Dansereau, 1998).

Buzan (2005) defines some characteristics of mind mapping, like

1. Curve line is used instead of straight line, because curve line attracts more brain.
2. The prime idea will be in the middle of the paper.
3. The branches that will come out of the main theme will be thicker. Branches from sub theme will be gradually thinner.
4. Each branch will be associated with each other.
5. Pictures will be used all over the map.
6. Different colour pens and pencils will be used.

Budd (2003) defined that mind mapping has 4 main characteristics. They are

- A. The main idea of each mind mapping is expressed by a picture, from here the mapping begins as the picture helps to generate the ideas easily.
- B. Sub - themes are released from the main theme of mind mapping. Main theme and sub theme are connected to each other. The branches come in different sizes and each branch has a keyword that supports the main theme.
- C. Looking at the final structure of mind map, it seems that the various ideas are arranged hierarchically. It supports our brain to associate different things.
- D. Each branch has a keyword that is expressed by the image. The use of colour is very important in creating mind map, which increases attention, maximum four types of colours are used.

1.4 Steps of mind mapping:

Tony Buzan (2013) says that making a mind map is very easy because it requires - blank unlined paper (the paper must be taken in landscape), your brain, your imagination, and pens and pencils

Seven steps are followed to create it-

- i. We have to start from the centre of the blank page because it is supposed to be like our brain is a blank slate where the information can be spread like our own.
- ii. Draw a picture related to the main idea or topic written in central because an image is worth a thousand words which enhances the power of imagination. A central image enhances person's attention by helping to attract topics.
- iii. Use colour everywhere. Because colour makes mind map extra attractive. Colour is just as important as the image in our brain. Colour helps the person to think creatively which makes it fun for the person.
- iv. Sub - branches need to be connected to the main- branch. Because the more individuals can establish connection between branches, the more they will be able to grasp and reminisce. One of the natures of our brain is to establish association.
- v. Each branch will be curved linear. Because straight lines are very boring for the brain. The curve line person can remember for a long time.
- vi. Each line will have to express a keyword which will be placed in each branch. Because makes a keyword mind mapping flexible. With this one keyword we can easily represent the content.
- vii. Images must be used everywhere. Because each image also worth about one thousand words.

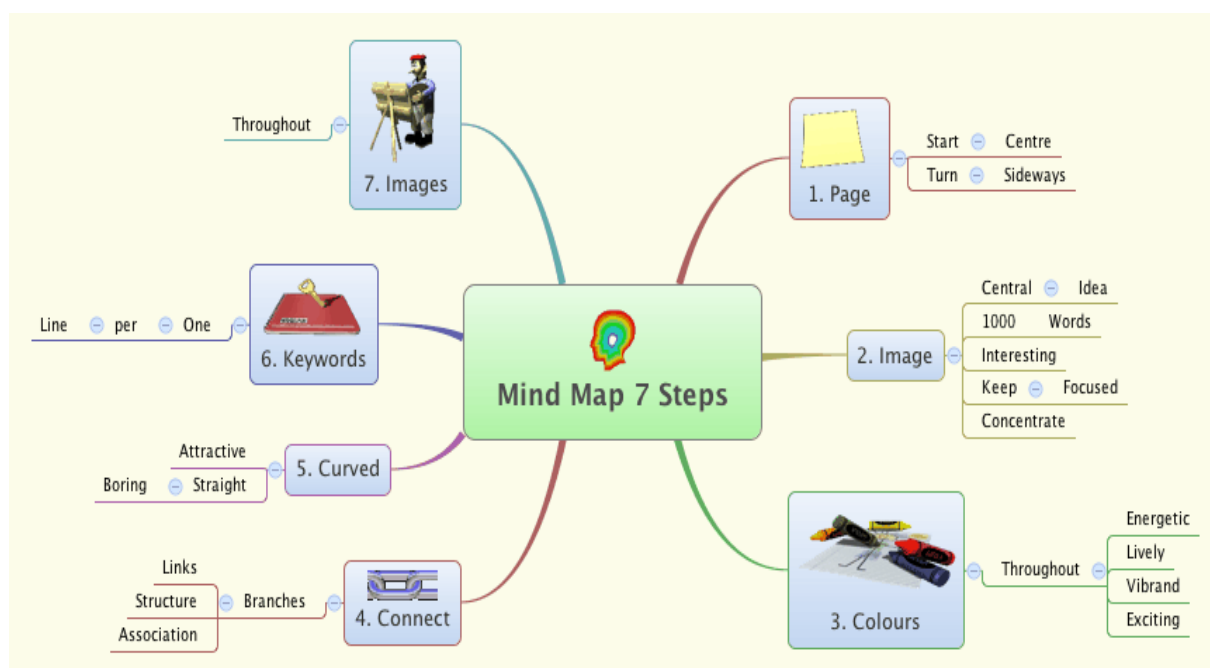


Figure- 1.1 Diagrammatic representation of mind map (Source: usingmindmaps.com)

1.5 History of mind mapping:

Many educators, psychologists, researchers and others have been using mind maps for centuries on problem solving, critical thinking, motivation, memory, intelligence, brainstorming and visual thinking. The famous thinker Porphyry of tyros created some mind maps in the third century, as he graphically imagined Aristotelian concept categories. Ramon Llull (1235-1315) conducted mind mapping. In the late 1959 semantic network was used as a method to understand learning process of human. In early 1960's Allan M. Collins and M. Ross, Quillian developed mind map. Collins is called inventor of the modern mind map because he was the first to research and publish work using mind maps on how to develop graphical thinking, learning and creativity.

Tony Buzan asserts that, he invented the modern mind map. This is the general semantics concept of Alfred Korzybski's claims to have been inspired and developed. Buzan argues that the traditional method is through top to bottom and left to right scanning and they do this scanning in a non-linear way. Buzan further promotes notes can be made using the cerebral hemisphere. There are various forms of mind maps that are used for planning, learning, engineering and education. There is another concept related to this which is concept map. Its structure is radial (starting from a common central point and going towards the edge of a circle) like mind map. The difference is that the lines are expressed by a key word in the mind map.

1.6 Advantages of mind mapping:

Al- Jarf (2011) stated mind mapping is applied for enhancement of learning process. It is used as an effective tool for visual learners to improve students' thinking process, provide instruction in learning and establish associations in each subject. Al- Jarf (2011) further stated that this technique helps pupils to arrange a subject structurally and to present the materials of a course in an integrated manner.

Pramono (2013) noted that the mind mapping strategy develops students' speaking ability, especially pronunciation, vocabulary, clarity of speech, achievement of assessment and communication skills. They can speak English fluently with confidence. Murley (2007) explained that mind mapping technique is much more flexible which increases the motivation of students, develops creativity, increases memory storage, increases concentration and draws students' attention. This technique is an attractive and enjoyable technique for students' eye and brain.

Based on the above discussion, here are some of the benefits of mind mapping.

- a) An accurate and proper mind map helps students to capture a large amount of information.
- b) Constantly aware of new concepts, it helps in brainstorming and presenting any subject easily.
- c) Helps in creative thinking and formation of new ideas.
- d) Helps in the presentation and classification of information.
- e) Assists in data collection and teaching.
- f) Helps to exchange information.
- g) Helps to understand information.
- h) Can remember the information as a whole while doing any work.
- i) Helps to remember information for a long time and recall at the right time.
- j) Helps the brain to store a lot of information at once.
- k) It develops critical thinking and reasoning thinking, speeds up the learning of slow learners.

1.7 Reasons behind effective working of mind map

Mind Maps help us to arrange information in the same way that our brain does. This makes it seem natural and straightforward.

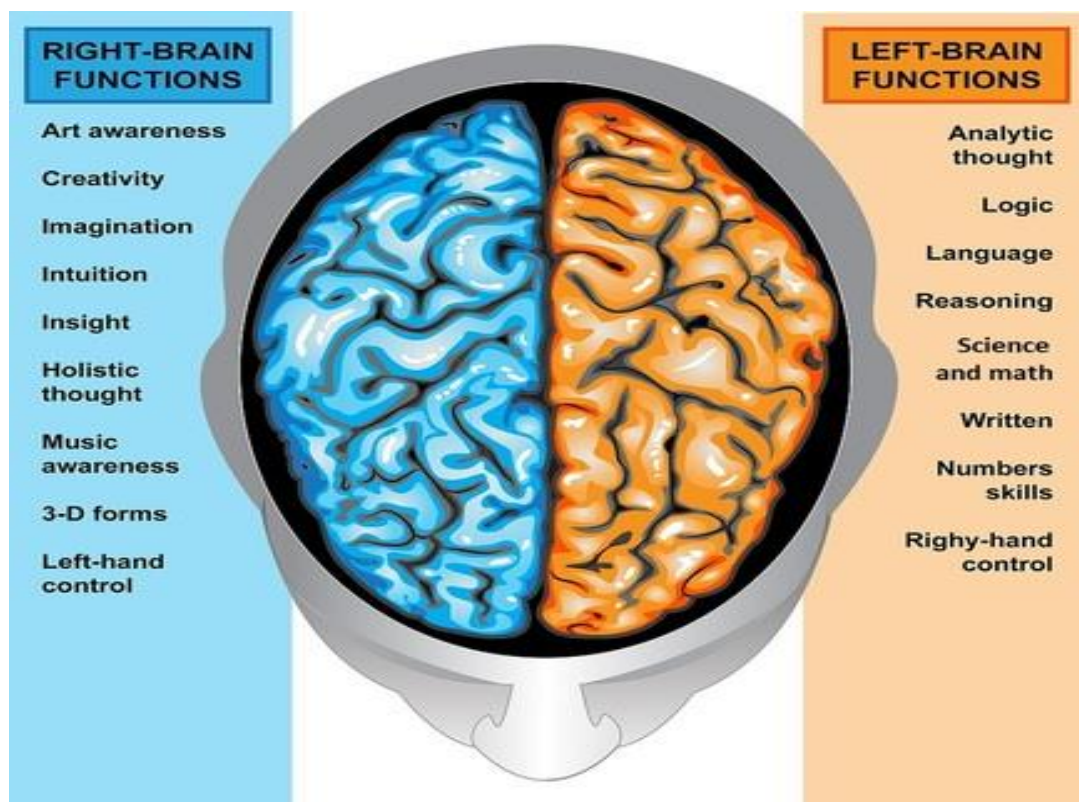


Figure-1.2 The Functions of the two hemispheres (source: brainmadesimple.com)

Our minds prefer to think in visuals. When a student use mind map, the smooth curves and colourful graphics he/ she produce build compelling images for his/her brain to recall.

Our brains are divided into two sides that think in distinct ways. The left half works in a linear fashion, with direct connections to related concepts. Our right brain prefers to perceive the big image, with all the colours and movement.

A mind map engages both part of the brain at ones, making it an excellent tool for storing and retrieving information, presenting information to others, and generating new ideas.

1.8 The impact of mind mapping on learning and teaching:

Mind maps could be utilised in education to

* **Brainstorm:** Students can build thoughts on a given issue and list all thoughts linked to the issue using mind maps in the classroom.

* **Categorize concepts:** After listening to all of the ideas, students can try to uncover connections and categorise them to make the Mind Map more systematic and easier to grasp.

***Identify problems and solutions:** Mind Maps can assist learners in identifying difficulties and finding appropriate solutions in some circumstances.

* Mind Maps can be used to capture, note, and visually display ideas to a group.

1.8.1 Application of mind mapping in Learning:

Mind maps can assist in making the learning environment more learner-centered. Research indicates, the proper usage of mind maps can trigger the paradigm change of pedagogical content knowledge which is at the heart of 21st-century education reform. If correctly developed and implemented, mind map aided education can help students acquire the knowledge and skills they need for lifetime learning. When utilised properly, mind maps—particularly computers and Internet technologies—enable new methods of teaching and learning instead of merely allowing teachers and students to perform what they have always done in a more efficient manner. These innovative approaches to teaching and learning are based on creativity and theories of learning that indicate a change away from a teacher-centered pedagogy—in its worst form, marked by acquisition and memorization learning—to one that is learner-centered.

Mind mapping facilitates collaborative learning. No matter where students, teachers, or specialists are, a mind map stimulates intention and teamwork. Apart from simulating real-world encounters, mind mapping allows students to collaborate with people from various cultures, enhancing their teaching and conversational abilities and also their global awareness. It depicts learning that takes place throughout the course of a learner's lifetime by expanding the learning environment to include not just peers but also supervisors and consultants from many areas.

Mind mapping can also be used to carry out integrative learning. A theme, holistic view to teaching and learning is promoted via mind maps. The artificial distinction between disciplines as well as between theory and practice that characterises the conventional teaching approach is eliminated with this technique.

Another new feature of students' activity brought about because of mind mapping is evaluative learning. The student-directed and diagnostic mind mapping technique Unlike static, text- or print-based instructional tools, mind mapping recognises that there are a variety of learning

paths and knowledge articulations. Instead of only listening and remembering, learners can use mind maps to explore and discover. It helps them to follow up their own shortcomings and find the various lacunae in their own knowledge. A teacher is hardly required to be involved and does not have to play the role of a corrector. Self-learning can best be done through mind mapping strategy.

Mind mapping could be utilised at different periods throughout a lecture for different reasons in the classroom:

- *To begin a new lesson, the teacher will give students a theme and encourage them to brainstorm ideas for it.

- * For students to gain new information: The teacher can encourage students to create a mind map to study and summarise significant concepts they've just learned, which will enable them to remember what they've learned. The instructor can also integrate a mind map with topic-related questions to assist students understand and master knowledge more effectively.

1.8.2 Uses of mind mapping technique in teaching:

Except from orientating pupils with the speculation and apply of mind mapping, the instructor will exercise mind maps in a very variety of sensible ways that to form classroom instruction simple and additional gratifying. According to Tony Buzan (2000), the mind mapping technique can be used to teach in the following ways:

a) Making lecture materials:

As lesson notes, mind maps are the most effective tools. Organizing a presentation in mind map form is slightly quicker than writing it out, and it has the added benefit of allowing student to maintain track of both the instructor and the student at all times. A mind mapped lesson is simple to modify season to season without becoming untidy, and because of its mnemotechnic properties, a fast synopsis before the lecture rapidly pulls the subject into focus. If used season to season, the lecturer's own material can evolve into a comparable Mind map, which can trigger completely distinct courses. This eliminates the tedium of old lecture notes while also needing no additional effort. It makes lectures more enjoyable and attention-getting for both the presenter and the students/audience.

b) **Annual planning:**

The mind map can be used to provide a summary of the entire year's study schedule, illustrating term divisions and thus the number of lessons to learn. (For example, an environmental science teacher may gain an idea of the annual average basis of field trips and slide shows in relation to a typical session.)

c) **Long-Term planning:**

This is a part of the annual planning, that usually takes the shape of a smaller mind map that grows out of a stream or streams on the yearly plan. The term plan may indicate which topics of the curriculum topics of teacher plans to present and in what order.

d) **Everyday preparation:**

This assumes the same shape as the daily thought map diary. And would keep track of the specifics of the lesson, such as the start and end times, the classroom, and the topic to be addressed, among other things.

e) **Lecture and presentations:** The teacher can sketch the relevant part of the mind map as the lesson goes on a large chalkboard, whiteboard, flip chart, or overhead projector. This externalised reflection of the mental process will aid in the lesson's structure. It will also pique the students' interest and help them remember and comprehend the material. Students can also be given 'skeleton' mind maps to complete, or black and white images to colour themselves.

f) **Exams:** If the goal of an exam is to assess students' knowledge and comprehension instead of their writing skills, a mind map is the best option. It can tell the teacher whether the pupils have a general understanding of the subject, and also their primary strengths and shortcomings, at a look. The mind map also indicates locations in which the link of connection has gone awry for whatever reason.

g) **Projects:** Mind Maps are fantastic for planning, tracking, and presenting projects. They promote thorough and organized thoughts in the initial stages, allow both instructor and student to monitor and examine the increasing web of interconnected material, and provide an excellent foundation for either textual or spoken demonstrations at the end.

1.9 Definition of reading:

Reading is a versatile process. It is a combination of various abilities like word choice, comprehension, fluency and motivation. Different experts have given different definitions of reading which are discussed here. Reading is a process by which the author and the reader interact and communicate with each other. Hadley (2001) stated that, “as communication, as a

mental process, as the reader's active participation in the creation of meaning, as a manipulation of strategies, as a receptive rather than as passive skill.”

Silberstein (1994) defined that Reading is a process that deals with problem solving and helps in the development of meaningful language. Reading is an active skill that engages the reader in the reading process so that they can read their mind at the ultimate level. Reading is a complex task that helps to understand written texts using thought and perception. Grabe and Stoller (2002) defined Reading is an effective process that helps to grasp the meaning of a printed page and to interpret and apply that information in real life situation. Grabe and Stoller also mentioned the seven purpose of reading-

1. Search for all important information's,
2. learn from the books,
3. integrated all content,
4. write all text,
5. learn quickly,
6. Criticize,
7. understand the content.

1.10 Style of reading:

Just as we can strengthen our muscles through exercise, so we can develop our mental faculties through reading. There are different styles of reading books, here are some common styles discussed by the researchers. They broadly divide reading style into two parts. a. Oral b. Silent. Under silent style there have 4 types of reading i.e., Skimming, Scanning, Intensive reading, Extensive reading.

1. **Skimming:** This is called gist reading. We used skimming to quickly gather or gist information. The whole text is looked at and the important information is noted. Not all points are given importance in skimming. Difficult words are skipped. For example - reading newspaper, study of research article.
2. **Scanning:** Scanning is employed to find a specific part of information. The entire page is searched only to find the information that is needed. It removes irrelevant information such as – a conference guide, from a phonebook looking for a name.

3. **Intensive reading:** Intensive reading is a reading method where students have to read the short text carefully and deeply to get the most out of it. Its purpose is to understand the literal meaning of the lesson. It develops learners' reading skills, vocabulary and grammar knowledge. In this case, the teacher selected the reading material. This is where the reader understands every word meaning, it is a close reading process. The goal is to increase the validity of comprehension. Such as, reading text books.
4. **Extensive reading:** Extensive reading are a method of language learning where students read long texts and a lot of material for general understanding. Its main purpose is to achieve pleasure. It also enhances the reading fluency of the students. Reading material is selected by the person himself associated with activities outside the classroom. Such as, reading magazines, reading novels.

1.11 Definition reading comprehension:

Indrayani (2014) claimed that understanding of reading is a procedure of fully realizing the idea of a content. Murcia and Olshtain (2000) mentioned reading comprehension as an interactive procedure that helps the reciter to understand and interpret every idea of the written text. Smith (1997) defined reading comprehension as a complicated process where students explain the text after reading it and modify each content as they see fit. Reading comprehension combines knowledge with prior knowledge. Grellet (1995) stated that it is a process that helps to understand the meaning of each of the written texts and helps to figure out the main idea of the text. Lakshmi and Rao (2006) defined reading comprehension as the ability of the reader to understand the purpose of reading as well as to understand words and sentences, it helps the leader to acquire general information or information for fun. Reader uses past experience to understand the sense of the content for reading (Lipson & Wixson, 2009).

Al- Tal (1992) mentioned that reader uses more mental perception than sensory perception for reading comprehension. Reading first uses sensory perception, but reading comprehension requires a combination of attention, concentration, critical thinking, analytical thinking, etc. all of these processes.

1.11.1 Reading comprehension levels:

Reading comprehension is divided into several levels that are hierarchically located. According to Burns and Roe (2002) three levels of reading comprehension is:

1. **Reading lines:** This is the easiest level. This level acquired when the reciter perceives what the writer wants to convey in general, although the author does not comprehend exactly what he wants.
2. **Reading between the lines:** After reading the reader can understand what the writer specifically wants. Here the reader explains the relationship between the meaning and concept of a text and the information related to different themes.
3. **Reading behind the lines:** Here the reader understands the meaning after reading the lesson and uses it to similar situations to get new meanings and ideas.

Heilman, et. al. (1981) mentioned that there are four types of reading comprehension levels. These are 1. literal, 2. interpretative, 3. critical and 4. creative. Literal reading directly involves information. Interpreting is the 'reading between lines' which is inferred. Critical reading means evaluating written information. Creative comprehension means creating new ideas and thinking about them.

1. **Literal level of reading:** Literal reading is the easiest level because here the reader understands what the author wants to convey. So, the reader has to understand only what is in written form. This level usually focuses on reading passages, hearing sounds and seeing pictures. It is related with important and necessary information. With the help of students can choose the necessary information.
2. **Interpretative level of reading:** The important thing at the interpretative level is reading between the lines. The underlying meaning of the content of the information is important here. The writer's mind can be understood at this level.
3. **Critical level of reading:** It is a purpose-oriented activity that involves comprehending, questioning and evaluation. The writer's mind is intelligently understood by this kind of reading. It basically helps to find the reason for the writer's writing. It is called the highest level of comprehension as in this case external criteria supported by the reader's own experience are required to evaluate the quality, language used, author's judgment and intelligence etc. To do this, the reader records evidence of the author's bias, the author's qualifications, the writer's viewpoint, the intention, and the truth. Shortly, at this level, the reciter responds to the material both emotionally and intellectually.
4. **Creative level of reading:** Creative reading is the level of forming one's own ideas about a subject after reading it. Here the reader invents new ideas. It deals with reading for employed and inferred meaning. Readers of this level try to find answers to some questions - what will happen now? What would I do if I were a writer? What did the

character feel? Can I feel it at all? Through all these answers the reader finds the implied and inferred meaning about the text.

1.11.2 Reading comprehension process:

Some researchers have studied how the reading comprehension process is processed in the human brain. Grabe and Stoller (2002) stated that reading comprehension is processed at two levels.

“Lexical access (word recognition), syntactic parsing, symantec proposition formulation, and working memory activation are examples of lower-level processes. Text model of understanding, context model of reader interpretation, prior experience utilisation and inferencing, and executive control process are examples of higher-level processes.”

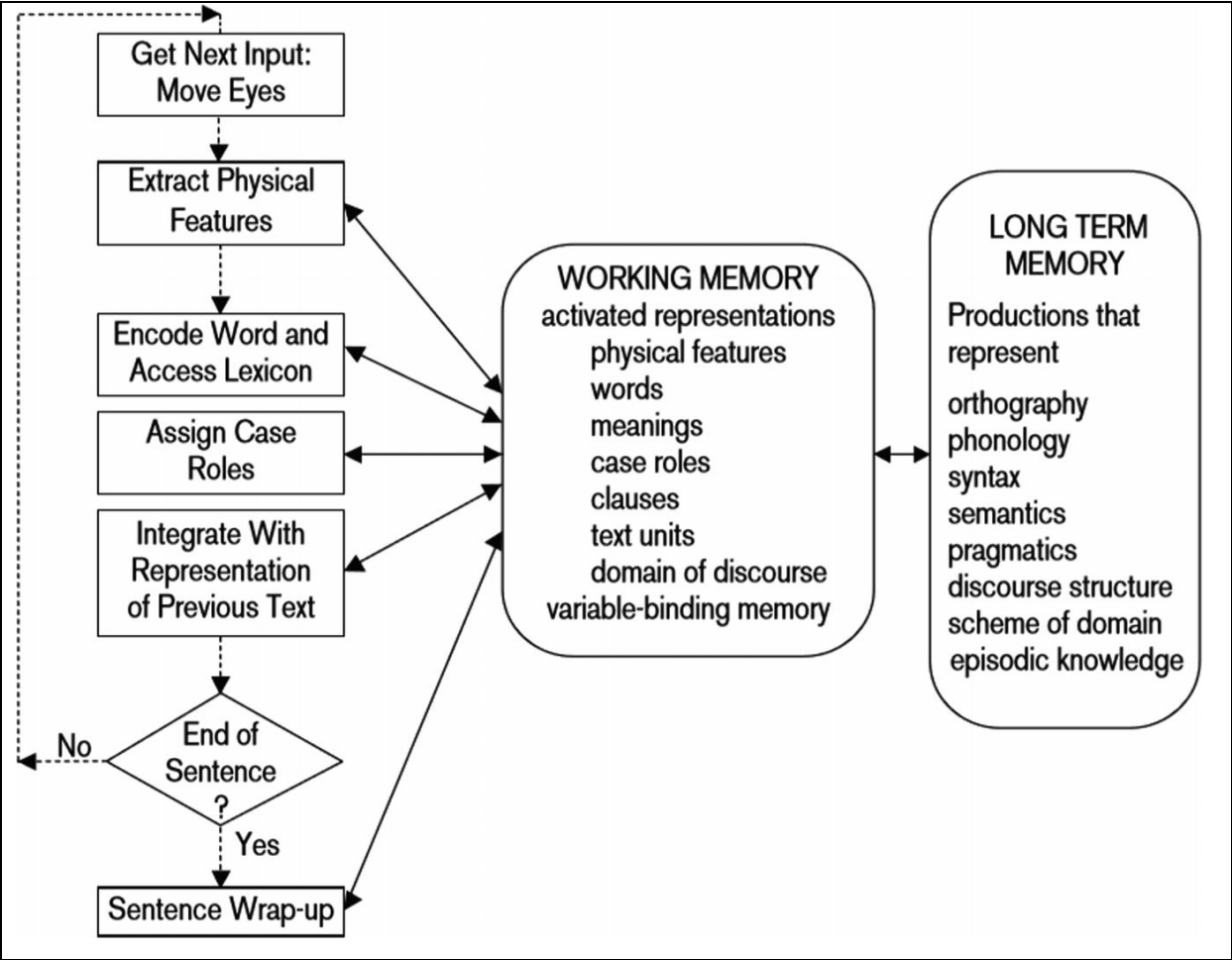


Figure 1.3 The Just and Carpenter (1987) model of Reading (cited in Stanovich, 1991)

1.11.3 Components of reading comprehension:

Each skill has its own components that help to understand the whole process of that skill. Similarly reading comprehension has many components as it helps in communication skill development and builds a good relationship between the reader and the book.

Durkin and Dolores (1995) noticed that, there are three components of reading comprehension.

1. Understanding vocabulary. 2. Understanding the sentence. 3. Understanding the paragraph.

The National Reading Panel Report (2000) classify 6 essential components, like-

- I. **Phonemic awareness:** Phonemes help with spoken language. English consists of 41 phonemes, which form syllables and words. For example, the word shop consists of 3 phonemes (sh-o-p) and the word stop means 4 phonemes (s-t-o-p). Phonemic awareness is a complex process by which we mean the ability to identify and manipulate the phonemes of the words we use. To understand this, we need to look at the words we utter, each word being uttered together or being uttered individually.
- II. **Phonics:** Phonics is used to understand the relationship between phonemes and graphemes. Phonemes means ‘sounds of spoken word’. Graphemes refers to the ‘letters and spellings used to express words in written language’. Phonics Instruction is essential for teaching reading where students are taught how to combine different letters to create sound. We use that knowledge in reading and speaking. CIERA (2001) mentioned that its main purpose is to help students understand the relationship between Word and Spoken Sound.
- III. **Vocabulary:** Most of the words need to be understood to understand any reading text. Each person has the key element of a strong vocabulary reading comprehension. The more books students read, the more their vocabulary will increase. Also, the instructions given by the teachers in the classroom will help to increase vocabulary. Vocabulary can also be enhanced through conversations, storytelling and word games. National reading panels defined that vocabulary can be strengthened by reading story books and listening to stories.
- IV. **Fluency:** Fluency is essential for reading comprehension because fluent readers are able to read quickly and accurately. Fluency in reading is used for comprehension as well as speaking. Fluency refers to the number of pauses for a word while reading and the correct decoding of each word. The National Reading Panel's mentioned

that repeatedly reading helps students to increase their reading fluency. Also helps to remember and recognize different words. We can say that reading improves comprehension in every way.

- V. **Text comprehension:** One of the purposes of reading is to understand. Increases comprehension with more strong vocabulary and background knowledge in the world. To strengthen comprehension, teachers reinforce the background knowledge by repeatedly reading on different subjects. Comprehension will increase when students ask questions, teachers will answer. And the teacher will encourage the discussion of the answer to this question. Properly instructed, the students can relate the previous knowledge with the current text subject which helps in understanding, so that they can easily remember the contents.
- VI. **Written expression:** Reading and writing are inextricably linked. Reading comprehension depends on quick comprehension and proper use of the language. After reading the book, when the meaning is properly transcribed, summarized and organized, then the comprehension of the text increases.

1.11.4 Problems of reading comprehension:

While students face different types of problems with reading comprehension, Shehu (2015) mentioned that students usually face four types of problems.

1. **Vocabulary:** The new words that students get when they read a new text are a big barrier to reading comprehension. Only if you fully understand a written text or print material students will be able to decode the message. It is critical to comprehend the meaning of each word. This requires strong vocabulary.
2. **Working memory or short-term memory:** Students often say I just read but can't remember anything about reading. Information needs to be processed over a long period of time in working memory so that it can be retained for a long time and transferred to long-term memory.
3. **Absence of extensive reading:** There is a lack of extended reading among the students. When they are confronted with a longer text, they get scared and cannot understand a general understanding. There is no interest, concentration and motivation to read large content. Here we can't gist unknown words.
4. **Type of text:** Type of text is a big barrier to reading comprehension. Some texts are very easy and some are difficult to understand for some students.

The researchers also noticed that

- I. students read two texts in a row, the effect of the first text falls on the other. Let's combine two text meanings creating confusion among themselves.
- II. The effect of listening is immense for developing reading comprehension. But in the present situation students do not have the ability or desire to listen attentively. As a result, vocabulary does not develop.
- III. When students are asked to read in loud voice sometimes, they do not read. It feels uncomfortable to read any new text all of a sudden. There is very little interest and motivation to read books.
- IV. Students who cannot read in English are always dominated by other students in the class can't express themselves in front of the whole class.
- V. Learners doesn't answer the question because their pronunciation would be wrong. They are in depression among themselves. He keeps himself wrapped up, sitting in the corner of the class and not participated in any program.
- VI. Most of the students want to use Mother Tongue. They are more interested in written text written in mother language.

1.11.5 Relationship between mind mapping and reading comprehension:

Ingemann (2008) mentioned that mind mapping technique develops a person's memory, creativity, brainstorming. Students need to have background knowledge for a text. Background knowledge can be separated into two parts, each language's background knowledge and each word's background knowledge (Stanovich, 1991; McNamara, 1991; Silberstein, 1994). We can say that mind mapping technique helps pupils to gain background information of any content. Brain can recall texts at any time and make connections between different topics using the brainstorming technique. Silberstein (1994) stated that background knowledge takes an important role for reading comprehension.

Virginia department of education, (2004) describes that a variety of strategies are used for reading comprehension skills. The KWL strategy being one of them. K denotes for known, W for want, L for Learn. 'Know' is the activity that helps to recall previous knowledge of the subject matter. This stage allows students to retrieve previous experience and background knowledge related to the subject. 'Want' indicates what the reader wants to learn from the text. Want to help students understand what they are reading. They think that when the question of what and why wakes up, they can better understand what is being read. 'Learn' by student

describes what the student has learnt by reading the subject. In other words, after reading the whole subject, its underlying significance is realized at this level. This technique can be used for all individuals. It can be used to read all subjects.

Know	Want	Learn
What a person knows before reading a book is measured and recorded.	Purpose of reading the book is to fix. What do you want to know after reading the book? Reading should be done on the basis of purpose.	When you read the book at the end of the reading, note or summarize it based on your reading.

Kaufman (2010) mentioned that mind mapping is an important technique for developing the reading process. It presents the main topic in the center and the sub-topics in the branch establishes associations within each topic. Buzan (2006) noticed that the mind-mapping technique involves two processes of reading comprehension, one is top-down and another is bottom-up process. The top-down reading process is an active process, in which pre-experiences related to a subject are incorporated into the schema of the current text when reading a subject. The bottom-up process occurs when a person understands the language of the text by looking at the meaning and grammatical features of each unit of written text.

The use of mind mapping technique organizes our brain knowledge, thinking, imagination, concentration and experience. This is a visualisation of the workings of the brain.

1.12 Rational of the study:

Reading is an important component of teaching-learning process, particularly for learners who must read to obtain information from school text books, research papers, and other sources. Furthermore, higher-level students must read a wider range of complex reference books. Poor students, according to Nupong (1998), are unable to comprehend the meaning of some texts, as well as the major idea and the story they read in the preceding section. This issue affects not only elementary levels of pupils, high school learners too and further education. Students who are less able to read and understand cannot read the current information and relate it to the previous knowledge. Many students have lack of motivation to read the books. One of the issues that pupils have faced in studying education is reading comprehension.

According to Buzan (2007), mind mapping is a creative brainstorming tool that reflects the way the brain works. It is the simplest way to organise information that comes from the brain. Mind mapping is a technique for writing that is both creative and effective. It will literally map out our thoughts. Instructors can use it to help students learn more and provide a foundation for learning, which would be particularly necessary for visual learners who need help organising their thoughts and forming relationships, Zheng (2009). They will create schemata on the topic, including structure, style, language, and context. To develop the internal knowledge structure, these schemas connect information symbols, language symbols, and readers' previous experience and knowledge around a certain theme.

As a result, by arranging and conveying the abstract meaning formation process in concrete representations, this visualised graphic representation can successfully increase readers' grasp of the text structure. According to a study conducted by an undergraduate English teacher from Taiwan, the use of mind maps in the learning of vocabulary and reading has a considerable impact on students' reading comprehension skills. Wong (2007) discovered that language instructors frequently employ because concept maps make the pattern of a book easier to understand, idea mapping is used in reading activities to increase reading comprehension.

Mind mapping, according to Murley (2007), is a non-linear graphic sketch of difficult fact that can help with creativity, organisation, productivity, and recall. Mind maps graphically depict concepts putting the principal topic at the centre of a relational framework, key subtopics spreading from the main issue, and sub-subtopics surrounding each subtopic, and so on. According to Woodrow (1991), a mind map is a visual that approves us to explore our brain's full potential for thinking and learning. According to Edward and Cooper (2010), mind mapping is the most appropriate means of entering, storing, and retrieving material from the brain. This technology is based on how our brains work naturally, thus it can maximise the human brain's potential and power. According to Durant (1993), mind maps aid in the development of pupils' ability to perceive and comprehend the content of the message.

Cain (2001) found that mind mapping improved concentration, kept students extended lengths of time on work, enhanced independence, and improved questioning and answering during class discussions. In addition, study of Toi (2009) showed that using mind maps instead of lists could help children remember words more efficiently. The study using mind map technique to discover can assist pupils develop their reading comprehension, especially those who are struggling. The process of mind mapping method to enhance reading capacity of weak readers

is effort to made explore for improving reading comprehension skill through mind mapping technique.

Many studies have examined the Mind mapping technique are used to help students enhance their reading comprehension skills at all levels of education, from basic to higher education. From the above discussion it was found that several studies were done in the areas of mind mapping as well as in the areas of reading comprehension independently. But in respect of mind mapping to improve reading comprehension skill sufficient research were either not held or are not available to the present researcher even after a long review of related literatures. The present investigator did not find any Indian research study in this particular topic. Therefore, the present researcher found a knowledge gap in the mentioned research area and formulated her present research title.

1.13 Statement of the study:

Keeping the above discussion in mind, the present researcher has proposed a title as “Promoting reading comprehension skill through mind mapping technique.”

1.14 Research questions of the study:

- I. How to apply mind mapping technique while reading?
- II. What are the benefits of using mind mapping technique to promote reading comprehension skill?
- III. What kind of problems have students faced while using mind mapping technique in reading comprehension skill development?
- IV. How to evaluate reading comprehension skill development processes using mind mapping?

1.15 Objectives of the study:

The following are the study's objectives:

- I. To determine the usefulness of mind mapping as a reading strategy.
- II. To find out the benefits of usage mind mapping technique for reading comprehension skill
- III. To find out the difficulties that learners experienced while using mind mapping technique in reading comprehension skill development.
- IV. To evaluate reading comprehension skill development processes using mind mapping.

1.16 Hypotheses:

Hypothesis is a tentative solution of the research problem. It is very important for quantitative research. The hypotheses of this research are formulated as follows:

H₀₁: There are no significant difference between students' performance while teaching in traditional method over mind mapping technique.

H₀₂: There are no significant difference between performance of students after teaching through mind mapping technique over traditional method of teaching on the basis of their gender.

1.17 Operational definitions of the key terms used

A. Mind Mapping Technique:

This term integrates of 2 words, 'mind' and 'mapping'. Oxford Dictionary (2015) define, "The element of a person that enables to be aware of the world and their experiences, to think, and to feel". Oxford Dictionary (2015) defined that mapping is a noun form. Derived from map, it means "A diagram of collection of data showing the spatial arrangement or distribution of something over an area". Mind mapping is a structural organising thinking tool which organise our ideas, concept, tasks and daily routine.

B. Reading Comprehension Skill: Comprehension is the understanding and interpretation of what is read. To be ready to accurately perceive written language, kids ought to be ready to (1) decipher what they scan; (2) build connections between what they read and what they already know; and (3) think deeply about what they have read".

C. Promoting: Support or actively encourage (a cause, venture, etc.); further the progress of some regulation is still required to promote.

1.18 Delimitations of the study:

- Only 90 samples were used for collection of data.
- The samples were selected from Medinipur District.
- Samples selection was done by using purposive sampling technique.
- Researcher only used semi-structured interview technique for qualitative data collection.

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CHAPTER -II

REVIEW OF RELATED LITERATURE

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CHAPTER-II

REVIEW OF RELATED LITERATURE

2.1 Review of related literature:

A survey of related literature is required in educational research in order to perform a study. The seek to situate the current study in both a temporal and theoretical framework. The intellectual support for the investigator is provided through a review of related literature. While reviewing all of the big studies from the past, the researcher is looking for any studies that may be linked to the current investigation. It is ideal to review any material that is directly or indirectly linked to the current subject.

2.2 Need of reviewing related literature:

The review of linked literature clades reviewing relevant research reports and papers, published research journals, and so on. The current researcher has to know what has been said and done in a certain area. The current investigator gathers numerous useful ideas regarding study designs, methods, research subjects, acceptable measuring tools and techniques, research procedure, and the outline for future research from prior studies. It gives the current investigator with researchable ideas, establishing and understanding the topic, valuable explanatory skills, objectives, hypotheses and report writing technique. It prepares investigators by informing them about previously ignored options. It also recommends an acceptable process for interpreting the results. The goal of the review of related literature is to analyse logical reasoning and give empirical data regarding the current inquiry

2.3 Studies related to the mind mapping software and other areas:

Cain, M.E. (2002) had conducted a study on “Using mind maps to raise standards in literacy, improve confidence and encourage positive attitudes towards learning.” The study main objective was to draw a conclusion from the review of literature and survey results to see how the mind mapping technique has improved the learning process of the students. The results show that ten out of fourteen people say that their mind mapping technique enables them to understand everything in an organised and consistent way, only 2 disagree. These 2 students were of the opinion that mind mapping technique enabled them to master subjects which they did not have enough notes for and which required further study to master.

Farrand, P., Hussain, F., & Hennessy, E. (2002) had conducted a study on “The efficacy of the ‘mind map’ study technique”. They took objectives as to find out the usefulness of employing the 'mind map' study technique to develop memory of facts from textual material. They found that learners’ who used the mind map technique had much excellent achievement than the learners who used the self- selected study technique. However, this result was understood a week later. The learning in the mind map group was 10% higher at week one (after correcting for baseline) (95 percent CI-1 percent to 22 percent).

Goodnough & Woods (2002) studied that participant in the study thought that Mind Mapping was a fun, fascinating, and inspiring way to learn. Some of the participants here have created mind maps using colours, keywords, symbols and they say that we have become much more creative while creating in this way and we are responsible for the fun aspect.

Mueller, A., Johnston, M., & Bligh, D. (2002) had studied on “Joining Mind Mapping and Care Planning to Enhance Student Critical Thinking and Achieve Holistic Nursing Care”. Discussion regarding the theoretical, philosophical, and sensible problems associated with nursing language and classification systems. The typically arguable views square measure supposed to stimulate readers' comments and views. He used mind mapping techniques to plan patient care. Explaining that using this technique has improved their critical thinking, whole brain thinking and comprehensive thinking.

Budd, J.W. (2004) had studies on “Mind maps as classroom exercises”. The author describes students create mind maps through small groups on a specific topic in the class. another cooperative and engaging learning approach that educators might utilise to transcend beyond "chalk and talk" is this practise. The practice can also aid in the integration of activities. There are different types of learning style of economic course, to activate one course in the middle semester and there are different types of economics courses. Each course provides students with ideas using mind map.

Holland, B., Holland, L., & Davis, J. (2004) had conducted a study on “An investigation into the concept of mind mapping and the use of mind mapping software to support and improve rstudent academic performance”. The concept of mind mapping as used in management development and executive education is demonstrated in this study. Because it tends to boost one's perception of expertise in understanding the allotted content, mind mapping provides a renewed sense of joy to the classroom. By reviewing a succession of mind maps, one can improve and merge work books and materials into one logical gathering of concepts that is

easily handled and grasped. Because an article or book chapter can only be conveyed on one page, it is necessary to be both efficient and attentive in picking the most important components to understand and keep.

Kaur, J. (2004) made study on “The effects of mind mapping strategies on the development of writing skills of selected form three students”. This study is based on a method that has been shown to improve pupils' thinking and writing abilities. This study utilised a nonrandomised control group; pre-test post-test quasi-experimental design on two classes of v pupils they were chosen based on their academic performance in the final year of form two (25 students in the control group and 25 students in the experimental group). The results also revealed that the experimental group's subjects responded more favourably to the mind mapping and brainstorming techniques. This study found that throughout the prewriting stage, the teaching approach, mind mapping, and brainstorming tactics had a good and balanced influence on the three pupils in this cohort

Paykoc, F., Mengi, B., Kamay, P. O., Onkol, P., Ozgur, B., Pilli, O. & Yildirim, H. (2004) had conducted research on the title, “What are the major curriculum issues? The use of mind mapping as a brainstorming exercise”. The study provides an example of group activity in elementary school and the goal is to present visually to the students so that they can easily understand and share the meaning of the subject. The authors discovered that a mind mapping exercise helped students organise their thoughts, present material clearly and beautifully, and communicate more effectively.

Al- Jarf, R. (2000) had conducted a study on “Enhancing freshman students’ writing skills with mind mapping software.” As a result of employing the mind mapping programme, he discovered notable changes between the treatment and control groups in post-test findings. The experimental group who utilised mind mapping software improved far more than the untrained control group.

Boyson (2009) had conducted a study used mind mapping techniques to create lesson plan for teachers and has seen trainers work according to a logic. They have found the teaching route and they can easily recall any subject. This can increase teacher confidence and make programmes function more smoothly.

D’Antoni, A.V., Zipp G.P., Olson, V.G., & Cahill, T. F. (2009) studied on “Does the mind map learning strategy facilitate information retrieval and critical thinking in medical students?” A brief 30-minute lesson on mind mapping allowed respondents who were unaware with the

approach to score comparably to those in the SNT group who utilised well-established procedures. This study shows that mind mapping may be simply explained to medical students who have no prior experience with it, and that it does not require the use of expensive equipment or the use of a traditional classroom teaching style.

Evrekli, E., Balim, A.G., & Inela, D. (2009) had conducted study on “Mind Mapping applications in special teaching methods courses for science teacher candidates and teacher candidates’ opinions concerning the applications”. The main objective of this study was how students can improve factual information from written information using mind mapping technique. Studies have shown that using mind map for writing skill development works as a useful technique. This technique improves 10% memory for participants to remember factual information. However, before using mind mapping technique as a study technique, one must make sure that it is able to inspire the users.

Toi, H. (2009) made study on “Research on how mind map improves memory”. To boost his writing skills, the researcher employed mind mapping as a pre-writing planning tool. Prior writing essays in English, students were taught how to apply mind mapping techniques. After using this technique, the students’ essays were checked by 3 experienced people. The results show that the writing skills of the students have improved a lot. He showed that the mind mapping improves children’s memory by 32% and also helps them to remember complex word.

Beel, J. (2010) conducted study on “Retrieving Data from Mind Maps to Enhance Search Applications”. He said that Web, academic, and expert search engines had trouble classifying and sorting things, as well as providing summaries for them. He proposed in this research that data gathered from mind maps could improve these search applications. Documents, such as online sites or academic publications, linked in a mind map, for example, could be categorised using the linking nodes, similar to reference text analysis. He discusses some preliminary ideas for using mind maps and the data gathered from them to improve search apps. There is other related work given. All of the concepts are founded on the notion that the content in a mind map can explain both the mind map's creator and the objects related to it.

Edwards, S., & Cooper, N. (2010) had studied on “Mind Mapping as a teaching resource”. They discovered that when used to written content, mind maps have really been considered as an efficient study strategy. This paper examined how a busy clinical teacher may put this strategy to practical use. This made teaching and learning more fun for pupils by making things more fascinating. They came to the conclusion that mind mapping was employed for a variety

of objectives, including problem-solving learning, small-group instruction, one-on-one conversation, examination preparation, and personal revision.

Beel, J., & Langer, S. (2011) had studied on “An Exploratory Analysis of Mind Maps”. The findings in this report are based on a preliminary analysis of 19,379 mind maps made by 11,179 individuals using the mind mapping apps 'Docear' and 'MindMeister.' There are few notes, if any, in 66.12 percent of cases, and the number of linkages is also minimal, depending on the mind mapping application. The majority of mind maps are only modified for one (60.76 percent) or two days (18.41 percent). A typical user makes 2.7 mind maps every year on average. One user made 243 mind maps, the largest of which had 52,182 nodes and each node had 7,497 words. On 142 days, one mind map was modified.

Diem, D. T. (2011) had made study on “Using Mind Maps and Diagrams to teach Vocabulary for First Year Mainstream Students at Division I”. Learning vocabulary is always mentioned in the four skill objectives (Reading, Writing, Speaking and Listening,). The study first intended to establish how mind mapping and graphical representations techniques are currently employed to language teaching to first-year conventional English majors in order to promote them at Division I. The pupils were then given paper-based questionnaires to investigate the scenario of their search difficulty. The true-experimental approach was then used in data gathering processes to achieve the research's second goal. The researcher found that, mind map and diagram is an effective teaching method for division I vocabulary learning. He advised the first-year students to use this technique more to increase their vocabulary.

Jones, B. D., Ruff, C., Snyder, D. J., Petrich, B., & Koonce, C. (2012) had made study on “The Effects of Mind Mapping Activities on Students’ Motivation”. We tested the students to take 3 different types of mind map drawing and what is the difference between their motivation for those 3 activities. One activity they completed out of class in a completely personal way. Another task was accomplished personally with the help of an instructor in the classroom and did another activity in the classroom with the help of him friends and instructors. Here the researcher used concurrent mixed method research design where both qualitative and quantitative are used simultaneously. Used as a researcher tool questionnaire were included open and close ended items. Researchers have found that the 3 activities have a similar effect on students’ motivation.

Merchie, E., & Keer, H.V. (2012) had studied on “Spontaneous Mind Map use and learning from texts: The role of instruction and student characteristics”. When the emphasis switches

'learning to read' has evolved into 'reading to learn.', independent processing and learning of informative study texts becomes increasingly vital. Students were used mind map for every text improvement in every stage of learning in school and research has shown that girls are more interested than boys.

Riswanto, & Putra P. P. (2012) had studied on “The Use of Mind Mapping Strategy in the Teaching of Writing at SMAN 3 Bengkulu, Indonesia”. The major focus of this research was to see if using the Mind Mapping approach helped students improve their writing skills. Researchers used non- equivalent groups pre-test-post-test experimental research design. Total population 234 students. They selected 66 students as a sample. There were 2 groups, each group has 33 students. Through written test data was collected then analysed using ‘t’-test formula. The result showed significant difference in the writing achievement of the two groups of students through the application of mind mapping techniques. So, they were concluded that mind mapping strategy helps students in writing achievement improvement.

Tee, T. K., Md Yunos, Hassan, R., Yee, M. H., Mhamad, M. M. Hussein, A., Mhamad, B., & Othman, W. (2014) had studied on “Buzan Mind Mapping: An Efficient Technique for Note-Taking”. Buzan mind mapping is a cost-effective way of note-taking that makes revision enjoyable for schoolchildren. For the past 30 years, Tony Buzan has been teaching students all around the world and has demonstrated that mind maps are the ideal solution for everybody in the school. The focus of this research was to evaluate the value of the Buzan mind mapping technique in secondary school note-taking. It has always explained the advantages and disadvantages of hand drawn mind mapping technique.

Liu, Y., Zhao, G., Ma, G., & Bo, Y. (2014) had studied on “The Effect of Mind Mapping on Teaching and Learning : A Meta-Analysis”. Improving learning and the teaching process through the use of this visualized tool. Considering the benefits of mind mapping, the researcher attempted to determine the impact of mind mapping on learning and teaching. There has been a lot of research done before where its benefits have been discussed, but they have not reached a definite conclusion. We use meta-analysis to confirm the effect by examining experimental and quasi-experimental research. According to this meta-analysis, mind mapping has a good impact on education. The overall result demonstrates that the kids' performance has improved.

Batdi, V. (2015) has studied on “A Meta-analysis Study of Mind Mapping Techniques and Traditional Learning Methods”. Using the meta-analysis method, this article tries to investigate

the effects of mind mapping on students' academic achievement, retention and attitudes scores. He gathered data from several international and national research work in the time period of 2005-2013 which have been used pre-test-post-test control group design. Researcher studied total 15 papers. Data analysed by using MetaWin statistical program. The results obtained after the meta-analysis showed that the mind mapping has a significant effect on academic achievement, retention and attitude.

Malekzadeh, B., & Bayat, A. (2015) had studied on “The Effect of Mind Mapping Strategy on Comprehending Implicit Information in EFL Reading Texts”. The main purpose of this study is to show that mind mapping has a significant impact on reading comprehension enhancement. They used quasi-experimental design. The researchers applied treatment as a mind mapping in the experimental group, while same treatment did not offer to the control group. Independent sample t-test was taken into account for analysing the data. Results showed that significant difference between two groups is important. So, this technique is improved reading comprehension skill of students.

2.4 Studies related to mind mapping and achievement in learning:

Rooda, L. A. (1994) had studied on “Effects of mind mapping on student achievement in a nursing research course”. Students are having difficulties memorising the breadth of the curriculum and the relationships between the topics, according to nurse educators. By contrasting conventional methods with the viability of mind mapping techniques, the researcher came up with a solution. Teaching through this technique increases the creativity of the students and makes it more interesting and fun for the students.

Edge, C. G. (2006) had conducted study on “Mind mapping: Its effects on student achievement in high school biology”. The goal of this study was to see if mind-mapping may help students perform better in secondary school science classes. The participants (n= 147) were mostly 9th and 10th graders from a secondary school of suburban South Texas. To find out how mind mapping affects students. accomplishment as assessed by a teacher-made, panel validated instrument, a pre-test-post-test control group design was chosen. To examine the teacher's perception of mind mapping and its effects on teaching and learning, follow-up interviews were conducted with a purposive sample of students (n=7). Mind mapping is a visual representation of enormous amounts of conceptual, hierarchical data in a clear, organised, and accessible style.

Orthan, A., & Zeynep, Y. (2007) had studied on “The effects of note taking in science education through the mind mapping technique on students’ attitudes, academic achievement

and concept learning.” Goal of this research work is to see how primary school kids' attitudes, academic achievement, and concept learning are affected by note taking in science classes through mind mapping. A mixed research design was used in this study. For quantitative data collection researchers used pre-test -post-test control group design and document analysis were used for analysis of qualitative data. The findings revealed that mind mapping has a considerable impact on learners' attitude and academic achievement, improvement of concept learning and elimination of any misconception's students may have towards the subject.

Fun, C. S., & Maskat, N. (2010) had conducted study on “Teacher-Centered Mind Mapping vs Student-Centered Mind Mapping in the Teaching of Accounting at Pre-U Level – An Action Research”. Mind mapping centred on the teacher and mind mapping centred on the students are drawn here and the relationship between these two types of mind mapping with student achievement is seen here. Researchers selected 50 students as a sample. Student test scores decreased when teacher-centered mind mapping was used, but student test scores increased significantly when student-centered mind mapping was used.

Mona, I., & Khalick, F. (2010) had studied on “The Influence of Mind Mapping on Eighth Graders' Science Achievement”. Purpose of this study was improved achievement on eighth graders' students using mind maps as a learning tool and established relationship between mind maps and conceptual understanding. Researchers used counterbalanced experimental research design method. Researchers creates 4 group. For data collection they used a multiple-choice test. Results found that central themes added main topic and topic are able to link between them. They are able to present each idea through the image and use the colour of each properly. Increases students' comprehension and thus increases their conceptual understanding as students map their minds.

Long, D., & Carlson, D. (2011) studied on “The Impact of Using the mind Map Strategy on The Ninth Grade Students Achievement in Science and Their Attitudes Toward Science in the Governmental Schools in Qalqilya.” The present study was associate action exploration style, conducted in associate eighth grade room. The experimenter developed how permitting charts may well be used by the students to broaden essential thinking chops and enhance their understanding of the content being conferred. The exploration information was gathered through anonymous pupil checks, educator observation notes and a post intervention assessment. students were schooled the operate and correct construction of all eight permitting charts and were inspired to use them on multiple occasions daily. Long's research showed that

when students constructed permission charts, they were more likely to have a poor-students who used traditional note-taking methods had worse understanding. Aim of this work was to see if using permitting charts will boost pupil participation.

Adodo, S.O. (2013) had studied on “Effect of Mind-Mapping as a Self-Regulated Learning Strategy on Students’ Achievement in Basic Science and Technology”. The study looks into the impact of using a on pupils' achievement in Basic Science and Technology, using a mind mapping approach as an inflection achievement strategy. The inquiry advocated for a quasi-experimental pre-test and post-test technique of planning. The survey included all inferior secondary school students in Ondo State's Akoko southwest Original Government Area. 120 pupils with basic knowledge were named using an easy absolute slice method and breaks into two teams of 60 pupils, with 30 manly and 30 unmanly scholars named per cluster using a stratified absolute slice method. ANCOVA and multiple bracket analysis statistics were used to dissect the exploration thesis. Finally, the study found that using a Because of its efficiency in polishing participants' critical thinking and imaginative capacities, the mind mapping method as an SRL students will be equipped' performance in BST and might be employed in this study as a more practical way to educate Basic Science and Technology (BST). Pupils should also be inspired to apply what they've learned and how they've learned to other Science subjects.

Balim, A.G. (2013) had studied on “The effect of mind-mapping applications on upper primary students’ success and inquiry-learning skills in science and environment education”. The goal of this research is to see how the mind mapping fashion affects students' comprehension of inquiry skills, instructional activity, and knowledge retention. The research was shared with the Science and Technology class. Study used a quasi-experimental exploratory approach with a pre-test and post-test management cluster named after seventh graders. During the 2010–2011 tutorial period in Smyrna, Turkey, this study included sixty-four seventh graders. The study's findings demonstrate that there is a significant difference between the experimental and management clusters in terms of tutorial activity, immeasurable retention of achievement on both psychological and emotional levels, and judgment of inquiry - based capacity scores

Ibrahim, M. A. J. (2013) had studied on “The Impact of Digital Mind Maps on Science Achievement among Sixth Grade Students in Saudi Arabia”. The aim of this research was to look at the effect of digital mind maps on knowledge action among sixth class learners in Asian nation. A mixture of unmanlike forty-four learners at the alternate semester of the tutorial time

2012/2013 shared within the research. The learners were without aim appointed to 2 experimental teams to admit completely different treatments. The primary cluster (Digital Mind Maps) used digital mind charts throughout their literacy method, whereas the alternate cluster (Paper Mind Maps) used paper mind charts. The findings disclosed that exploitation digital mind charts had a big result on scholars' knowledge action. Grounded on the earned findings, it was complete that the appliance of computer-based mind maps for Saudi sixth class learners may well be useful in perfecting their achievement.

Radix, C. A., & Abdool, A. (2013) had studied on "Using mind maps for the measurement and improvement of learning quality". In education, graphic organisers, particularly conceptual maps, are used to improve learning quality. The use of an associate degree substitute diagrams to check and evaluate learning quality is examined in this article. Here, interactive mind maps made by groups of learners in favour of specific creative individual learning activities are evaluated. The findings show that the mind map can be used in a similar way as the concept map for attentive creative person learning in a technical area. Furthermore, using an early spoke structure to create a collective mind map has a significant impact on learning quality among a group of learners.

Fung, H. P. (2014) had studied on "Impact of Mind Mapping Technique on Academic Achievement – An Experimental Study on Malaysia Form 4 Students". The present study give insight to academic policy makers/school authorities whether or not ought to incorporate mind mapping technique as a part of the academic/ co-curriculum for secondary schools' students, give chance for academic establishments to explore more what area unit the mind mapping syllabus/ contents & activity criteria area unit appropriate for secondary schools' students and conjointly give empirical proof whether or not mind mapping technique very helps students to boost their tutorial accomplishment of some subjective claims. If empirical proof shows mind mapping will improve students' tutorial accomplishment, the first they learn and use can give birth to the advantages earlier and a lot of.

Muhib, A., Dwi Anggani L. B., & Hartono, R. (2014) had studied on "Mind mapping and everybody writes techniques for students with high and low writing achievement". The usefulness of Mind Mapping and everyone draw approaches for college students with good and bad writing skills was studied in this study. The study's subjects were seventh students from Slawi Tegal's State Muslim secondary school staff in the 2013/2014 school year. Because the analysis samples, two of the fifteen divisions within the faculty were hand-picked. The

experiment was discovered after each team completed a pre-test and post-test. The mistreatment approach of multifactor analysis of variance was used in the experimental investigation using factorial style 2x2 (ANOVA). According to the conclusions of this study, Mind Mapping and everyone draws strategies are helpful and important for college pupils who write well and students who write poorly ability. For teaching writing, the Everyone Writes technique is easier than the Mind Mapping technique. There is an associate degree relationship between writing skill, techniques, and student achievement. This crucial analysis finding can be observed in the findings of the pre-test and post-test.

Olufunkel, B. T., & Blessing, O. O. (2014) had studied on “Achievement in Physics Using Mastery Learning and Mind Mapping Approaches: Implication on Gender and Attitude”. This study looked at how male and female students performed in Physics after being taught using the “Mastery Learning Approach” and “Mind Mapping Approach”. It also initiated the impact of “MLA and MMA” on improving learners' perceptions of Physics. These were done in the hopes of cultivating a favourable attitude toward Physics among students and thereby increasing their achievement in the discipline. The “non-equivalent pre-test, post-test control group design” was used in this study. Seventy-four senior school one Physics learners from 3 hand-picked secondary school in “Ikere government space in Ekiti state, Nigeria, were used in the study”. The study employed three complete categories. Every cluster of scholars in their intact categories was schooled field of force and force field. The instruments used for information assortment were “Physics accomplishment Test” and “Students’ perspective to Physics Questionnaire”. The study recommends that Physics academics ought to adopt mind mapping and different democratic ways throughout instruction in order that pupils would be target-hunting to be told meaningfully, and they would be aided in developing a favourable attitude toward Physics.

Sihombing, H. K. (2015) had studied on “The effect of mind maps on the student’s learning achievement and retention in cellular biology topic of grade xi ipa sma negeri 1 sidikalang academic year 2014/2015”. The objective of this study is to see how mind maps affect learning success and retention. There are two stages to this research. The first stage is to employ a mind map as a strategy, and the second stage is to put the strategy into action. Its goal is to determine the influence of mind maps on student learning and retention. The population is made up of scholars of various grades. There are eight categories in the XI Science SMA N one Sidikalang. The sample is divided into two categories: XI Science one as a management cluster (note-taking cluster) and XI Science two as an experimental group (mind map group). In each

category, there are twenty-five pupils per unit. Multiple alternative tests are used by the instruments to collect data (28 items). The findings show that mind maps have a significant impact on learning achievement and retention. It is obvious from this research that mind maps provide learning environments that are tailored to their own understanding and aspirations. It's also obvious that mind maps pique students' interest in data storage.

Parikh, N. D. (2016) had conducted a study on “Effectiveness of Teaching through Mind Mapping Technique”. The aim of this mind mapping analysis was to determine the effectiveness of instruction. The investigator employed “Tony Buzan's mind mapping technique” to assess the usefulness of mind mapping as a teaching tool. This is why the analysis' main goal - the usefulness of mind mapping technique - was assessed in linked to the learners' academic achievements and the class-8th scientific discipline. A case study for mind mapping was created for the subject. Pedagogics was used as a variable in this study, with tutorial achievement serving as a reliable variable and gender serving as a device variable. Aim of this research was to see how effective the Mind Mapping technique was; therefore, two teams were formed. Case criteria were devised to test the efficiency of the mind mapping approach. “Conclusions were drawn after calculating the T-ratio based on the average score of the legal action, variance, and standard error of the average score, and thus the advantages of the mind mapping technique were demonstrated by the completed questionnaires, and it was discovered that the Mind Mapping technique was easier than traditional methodology”.

2.5 Studies related to mind mapping as effective teaching-learning:

Rafik-Galea, S., & Kaur, J. (2005) had studied on “Teaching Literature Through Mind Maps”. When learning English literature, a great number of young children gain experience in areas such as thinking, memory, focus, motivation, idea organisation, design, and decision-making. This research looks at how mind maps might be used as visual aids in literature classes to help students build meaning while they scan and write. Maps of the mind are inextricably linked to mental performance and can be used in practically any task that involves cognition, remembering, design, or creativity. The research looks at how visual tools might help students organise their thoughts, develop and express links between ideas, and facts using colours, symbols, numbers, lines, and arrows. In thinking creatively regarding the way to and what to use to represent their comprehension, pupils' area unit mechanically thinking critically in addition as creatively within the literature schoolroom. Pupils can simply bear in mind what

they need bestowed diagrammatically and can face less problem in transferring graphic data to written texts.

Karin, S. L. (2008) had studied on “Scholarly research on mind maps in learning by mentally retarded children”. Educators, psychologists, and others have used mind maps for learning, group activity, visual thinking, and determining disadvantages for hundreds of years. For a few topics, people are misusing image-centered radial visual organisation systems known variously as mental or generic mind maps. Tony Buzan, a well-known British psychological science author, made the assertion that mind maps originated with him. He believes that "traditional" outlines assume the reader would scan the page from left to right and top to bottom, whereas in actuality, the brain can scan the entire page non-linearly. He also promoted the use of mind mapping solely over other methods of note-taking by relying on well-known ideas about the cerebral hemispheres. We have a tendency to analyse the educational behaviour of young people aged twelve to sixteen at specific colleges in our investigations. There was a check cluster and an impact cluster for all age groups. The academics taught the students at the check cluster how to use mind maps for instruction. These mind maps were decorated with a variety of colours, symbols, drawings, and keywords, the latter to help the students understand the hierarchies of the themes covered. The results revealed differences between the two teams in terms of the amounts of facts that could be remembered.

Spoorthi, B. R., Prashanthi, C., & Pandurangappa, R. (2013) had studied on “Mind Mapping- an effective learning adjunct to acquire a tsunami of information”. Aim and Need- The current generation of scholars is riding the knowledge wave. This means that the student's problem is less about gathering information and more about remembering and arranging all of the information that they must swallow both during their studies and thereafter to keep oneself current. Several pupils employ a variety of learning approaches to achieve this, including method, flow charts, abbreviations, maps, and so on. "Mind Mapping" is one such technique that can help students with this assignment. Unfortunately, this approach has gained almost no attention since its conception; however, the United States has launched a trial using this notion on dental undergrad students in order to teach and evaluate them. The outcomes were positive. We recommend this system to all teachers and students. This article discusses the benefits of mind mapping for learning, organising, and retrieving large amounts of information that students accumulate throughout their studies.

According to research by **Wai Ling, C. (2004)**, most students considered Mind Mapping to be very useful as a pre-writing planning approach. They stated that adopting the Mind Map's framework allowed them to write faster, generate greater orderly and organized points, generate more concepts, organise these ideas more readily, raise the clarity of thoughts, decide the number and layout of sentences to include, and develop more orderly and organized points. Overall, 10 of the 12 students said that using Mind Maps helped them improve their writing.

Polsen, K. (2003) investigated on “teachers and students’ perspectives on mind mapping in teaching and learning”. On the basis of teacher and student perceptions, the study provides a complete assessment of how mind mapping might be used as a teaching-learning technique. For improving History instruction, mind mapping was utilised as a pedagogical method. Teachers used it to convey historical ideas and concepts, while students used it to record data and deepen comprehension. Teachers were interviewed in order to explain their perspectives. The study's findings demonstrated that students thought mapping was a fun, intriguing, and inspiring way to learn. The majority of students said mind mapping helped them learn in a number of ways and that they enjoyed the creative parts of it.

Ambili, P. (2006) conducted “a study on the effectiveness of mind maps for teaching Biology in Standard IX”. The objectives of the research was to determine the impact of a mind map on developing psychomotor skill and artistic skill on students. The major finding emerged from the analysis of the rating of students on the comparative effectiveness of mind maps in realizing certain educational outcomes is that, mind map is superior in developing psychomotor skills and encourage the artistic skills of the students.

Raseena, S. (2006) conducted “a study on the effectiveness of mind map for learning Zoology at higher secondary level”. Conducted a study on the effectiveness of mind map for learning Zoology at higher secondary level. The investigator adopted two different methods (mind map and concept map) for teaching Zoology in Standard XII to assess the comparative effectiveness of both methods. Results of the research showed that mind map method of teaching is notably superior to concept map with regard to achievement in Zoology.

Ang, Moi & Lian (2007) assessed “a study on introducing mind map in comprehension”. The study's main goal was to assist students better understand and retain text passages, develop thinking abilities, and boost their confidence when answering comprehension questions. The findings expressed that introducing mind mapping into the teaching of comprehension skills improves pupils' comprehension and recollection of topics. The majority of kids were

enthusiastic and active in the classroom. Students also said that using a mind map is helpful for organising information and understanding the material more clearly.

Zampetakis, L. A., Tsironis, L., & Moustakis, V. (2007) explored “the effectiveness of introducing mind mapping technique to engineering students based on individual student performances”. Students' performance on mind mapping was collected using a survey instrument based on four important features. a) various types of mind maps; b) various potential applications of mind maps; c) various methods learners worked with mind maps; and d) various colour patterns. 100 students provided responses, which were then utilising conjoint analysis assessment to decide the impacts of each characteristic to the respondents' performance. According to the findings of the study, mind mapping is an excellent method for engineering students. The student favoured to work in groups with mind maps, allowing to be able to harness group data and stimulating the artistic method.

Mona, I. A.E. & Khalick, F. A. E. (2008) explored “the influence of mind mapping on VIII graders science achievement”. This study looked at the impact of the influence of mind maps as an instructional tool on eighth-grade science achievement, even if that effect was mediated by previous educational excellence, and the connection among participants' mind maps and overall conceptual understanding. 62 samples were randomly randomised to experimental and comparison conditions in four intact parts of a Grade VIII Science classroom. The pupils' progress was measured using a multiple-choice test that included two types and three levels of achievement. The experimental group demonstrated statistically significant differences from the control group. and significantly larger benefits than the comparison group, according to the analysis. The findings of this study back up the theoretical claims that mind mapping improves student learning in middle school science.

Beena, M. I. (2008) studied on the comparative effectiveness of conventional method and mind mapping method of teaching mathematics among VIII Standard students. Purpose of this study was to determine the efficiency of the mind map method. and to verify the advantages of using mind map as a memory enhancer. The sample consists of 50 VIII Standard students. Questionnaire for teachers and a rating scale for students was used, to assess the effectiveness of mind map for learning mathematics. The findings revealed that mind map is more effective than conventional method for teaching mathematics to VIII Standard students. It is also revealed that teaching through mind map enhances retention power, develop interest in studies,

improved visual sensation, and helps to summarize information and learning become more meaningful.

Thangarajathi, S. (2008) conducted a study on the effectiveness of mind mapping technique on teaching mathematics. The goal of the study was to see how successful mind mapping is in mathematics teaching at the high school level compared to traditional methods. 60 IX class students from Tuticorin district made up the study's sample. The investigator created mind maps and an achievement test (pre- and post-test). The study used two equivalent group pre-test post-test experimental designs. The mind mapping methodology was found to be more successful than the traditional method in the study.

Anchu, E. S. (2008) “investigated the impact of mind map as a learning tool in chemistry at higher secondary level in Kollam district.” The investigation's goal was to see how successful mind maps are as a learning tool in chemistry at the higher secondary level. The experimental and control groups are equated by random assignment in the post-test equivalent group design. The study's analysis revealed that the experimental and control groups scored significantly differently on their achievement tests. The mind mapping method was discovered to be more successful than the traditional way.

Beena (2009) studied comparative effectiveness of mind maps for learning Hindi grammar at secondary school level. Comparison of achievement scores of mind map group and lecture method group by analysis of co-variance revealed that the mind map group is significantly superior to lecture method with regard to achievement scores. It is concluded that mind maps method is more effective than lecture method group in learning Hindi at secondary level.

Cahill, T. & Anton, T. (2010) “conducted research on how the mind map learning technique helps medical students with information retrieval and critical thinking.” The goal of this research was to see if there was a link among mind mapping and critical thinking as judged by “health science reasoning exam (HSRI)” and if there was a link among mind maps and domain recall. When compared to short note taking, Mind mapping did not increase short-term recall of domain-specific material or crucial reasoning, according to the findings. This demonstrates that medical students who utilise mind maps may recover material quickly and are not at a level when competing to individuals who attended brief notes.

Ismail, M., Ngha, N. A., & Umnar, I. N. (2010) “compared the effects of mind mapping with cooperative learning on programming performance, problem solving skill and metacognitive knowledge among computer science students.” The goal of this study is to look at how “mind

mapping with cooperative learning (MMCL)” and “cooperative learning (CL)” affect programming skill, problem resolution capacity, and metacognitive data among Malaysian technology students. The impacts of MMCL and CL on the above-mentioned outcome variable among students with low- and high logical thinking were also explored. Students in the MMCL and CL groups had significant important impacts on programming performance, problem solving ability, and meta-cognitive understanding, according to the findings. In meta-cognitive knowledge, Students who were taught utilising the “MMCL method” outperformed students who were trained that used the “CL method”.

Pollard, E. L. (2010) conducted “a study on mind mapping in a professional doctoral physical therapy education programme.” The goal of the study was to see if the quiz results of physical therapy learners who used mind mapping in their learning techniques differed from those of learners who did not use mind mapping in their study styles in a lecture-based study program. For two units of a doctoral research course, 14 physical therapy students were educated in mind mapping and asked to build mind maps depending on lecture, class assignments, and instructors' notes. According to the results of the first unit assessment, the mind mapping group scored significantly lower than previous course participants. There was no notable change in between mind mapping group and preceding students on the second unit quiz.

Joylet, R. (2010) studied the effectiveness of mind mapping technique in teaching biology in Standard IX. Aim of the investigation was to investigate the usefulness of mind mapping strategy in teaching Biology and to compare the effectiveness of mind map technique with conventional method of teaching Biology. Non-equivalent pre-test, post-test parallel group design was used. The participant consists of hundred IX standard students. In standard IX, the data demonstrated that the mind mapping methodology was more effective than the traditional method of teaching Biology. The same result was also observed in the case of sub-samples of boys and girls.

Chitra, G. (2010) conducted “a study on the effectiveness of mind maps for teaching parts of speech in English at secondary level”. The research was attempted on a participation of 80 students of Standard IX, using experimental cum survey method. The study revealed that mind map method is more effective than activity method in teaching parts of speech in English. It also showed that mind map method is equally effective in teaching English for girls and boys. The study also indicated that a great majority of teachers are in need of training in the preparation and use of innovative methods of teaching English.

Mani, A. (2011) studied “the effectiveness of digital mind mapping over paper-based mind mapping on student’s achievement in environmental science”. The goal of this research is to see how e- mind mapping compares to hand-made mind mapping and the usual method in terms of student behaviour in biological science. The study used a pre-test post-test management cluster method. The experimental group, control group-I, and control group-II were chosen from a group of 120 B. Ed. students in Noida. The experimental group received digital mind mapping treatment, while control group-I received traditional treatment and control group-II received paper-based mind mapping treatment. The study's findings demonstrated that using a mind mapping technique considerably increased students' environmental science achievement and delivered the best results in activities such as brainstorming and group activities.

Deshhatty, D. D., & Mokashi, V. (2012) studied mind maps as a learning tool in anatomy. The goal of the study was to see if using mind mapping as a memo method may help medical students better grasp anatomy., as well as to assess the effectiveness of mind maps as a learning aid and determine whether there is a link between mind mapping and information recall. The sample is made up of fifty first-year medical graduates split into 2 groups of fifty. Standard note taking (SNT) was one group, while Mind Mapping was another (MM). Pupils in the mind map group outperformed who in the “SNT group”, according to the findings. The majority of students in the mind map group said that mind maps were a better learning tool for learning anatomy and that they helped them recall knowledge quickly. The students showed a desire to learn more about the mind map strategy and incorporate it into their upcoming tutorial activities.

Lago, L., & Seepha, S. (2012) conducted “a study on brain- compatible activities for EFL vocabulary learning and retention”. The goal of this study was to see how brain-compatible activities (BCA) affected the “vocabulary learning and retention of third-year undergraduate students” studying English for tourism after attending a BCA course. Pre-test, immediate post-test, two delayed post-tests, and a “semi-structured interview” were used to gather data. The study found that students learnt the target words significantly while taking a tourism course utilising BCA, and that the vocabulary taught by brain-compatible learning was remembered for at least six weeks following teaching.

Reshmy, R. (2012) studied on “the effectiveness of mind mapping technique for enhancing achievement in mathematics at secondary school level”. 270 students in Standard IX sample in the research work. A comparison of the means of the pre-test score for the entire sample

revealed a significant difference in achievement among the experiment and control groups. The mind mapping method of teaching mathematics was found to be more effective among secondary school students.

Sheela, P. P. (2013) conducted “a study on the impact of mind map teaching strategy on achievement in mathematics and certain select variables of high school students”. Aim of the research was to find out the effect of mind map teaching technique on achievement in mathematics over lecture method and the attitude towards mind map teaching strategy and problem-solving ability in mathematics. The study used a “pre-test, post-test equivalent group design”. 90 pupils of “Standard IX” were selected as a sample in Tiruchirapally district. Statistical techniques used were differential analysis, correlation analysis and regression analysis. The findings revealed that, mind map teaching strategy was effective in enhancing the achievement of students. Significant correlation was found between problem solving ability and achievement and the students having positive attitude towards mind mapping strategy are having better problem-solving ability.

Balim, A. G.S (2013) investigated on “the effect of mind mapping applications on upper primary student’s success and inquiry-learning skills in science and environment education”. The goal of the study is to see how the mind-mapping technique affects pupils' judgments of “inquiry learning skills,” academic accomplishment, and knowledge retention. This study used a quasi-experimental analysis style with a pre-test and post-test management cluster hand-picked from seventh graders. The study's findings demonstrate that there is a significant difference between the experimental and management clusters in terms of educational achievement, perseverance of learning, and perceptions of “inquiry learning” capacity scores, on both psychological and emotional levels.

Seyihoglu, A. (2013) analysed on the opinion of the geography teacher candidates toward mind maps. The goal of this study was to find out what teacher candidates thought about the mind mapping technique used in collegian earth science instruction. The qualitative analytic methodologies were applied in this study, and the study selected of fifty-five teacher candidates. As per the information, teacher candidates agree that mind mapping is a useful learning tool, learner, and content style. In terms of learning, the subject of this technique consists of the codes that paved the road for learning, ensured retentive learning, emphasised the basic concepts, summarised, organised, eye-catching, and its capacity to use a humorous language and demonstrate the relationships.

Ozturk, D., & Cagri. (2013) studied on “The perceptions of pre-service social sciences teachers regarding the concept of Geography by mind mapping technique”. The study's goal was to learn about pre-service science professors' perspectives on the concept of geography. There are 46 pre-service social science teachers in the study group. Pre-service instructors were expected to employ the concept of geography as the major topic, and mind maps were used as data gathering methods. The findings demonstrated that pre-service social science teachers used 245 topics related to geography in their mind maps. Pre-service social science teachers were found to have incorporated the idea of geography into Eighteen different graphic aspects on their mind maps. Pre-service teachers were found to strongly link the idea of geography with physical geography concepts.

Zipp, G., & Maher, C. (2013) explored “The prevalence of mind mapping as a teaching learning strategy in physical therapy curricula”. The goal of this research was to find out how common mind mapping is in health science specialist curriculum and what relationship there is between faculty understanding of mind maps and actual use of the technique. The findings of the study revealed that out of 55 completed responses of the physical therapist received, only 10.9 % reported that using mind mapping within their curriculum and 89.1% did not use mind map in class room. The outcomes of this exploratory research also suggest that many physiotherapist education programmes do not use mind mapping due to a lack of awareness and understanding among teachers.

Amitha, K. S. (2014) conducted a study on the effectiveness of instructional package based on economics and mind mapping to enhance students’ achievement in social science. The outcomes of the study revealed that mind map helps in developing creativity among students and it also helps to reduce the difficulty and boredom in social science classroom. Moreover, this instructional package increases retention power of the students.

Hallen, D., & Sangeetha, N. (2015) studied the effectiveness of mind mapping in teaching English in Standard VIII. The aim of the research was to search out the usefulness of mind mapping technique over the traditional methodology of teaching English at high-school level. The participants of the study consisted of sixty students of class eight in Tiruchendur Taluk in Tamilnadu. Mind Map was prepared by the investigator. The study employed a two-group equivalent “pre-test post-test experimental design”. The study's findings showed that mind mapping is more successful than traditional English teaching methods.

2.6 Studies related to mind mapping as a tool:

Goodnough, K. & Long, R. (2002) had studied on the topic, “Mind Mapping: A graphic organizer for the pedagogical toolbox”. In a sixth-grade classroom with 16 students, the use of mind mapping, a graphic technique developed by Buzan to assist note-taking, encourage creativity, organise thinking, and develop ideas and concepts, was explored as an educational and learning aid. A primary focus or visual depiction of the subject is placed at the centre of the paper, and key phrases are utilised to symbolise ideas, which are related to the core focus using lines. Students found mind mapping (MM) was an enjoyable and interesting strategy that helped them learn better. Individual metric linear units were preferred by the majority of students, while cluster MM was preferred by a few. The teacher liked the victimisation criterion linear unit as believed it helped students become more interested in science. MM will be a huge research project that will analyse individual learning and give people more options in how they accomplish assignments and projects.

Brinkmann, A. (2003) studied on “Mind Mapping as a tool in Mathematics Education” and found that mind mapping is a technique that it is simple to understand and that students find it to be a refreshing change in mathematics classes. Mind mapping's multiple good learning outcomes should lead to increased adoption of this technology in mathematics instruction.

D’Antoni & Pinto Zipp (2005) had studied on, “Applications of the Mind Map Learning Technique in Chiropractic Education”. Found that from a pool of fourteen physiatrist students, ten out of fourteen in agreement said the Mind Map strategy allowed them to reorganise and synthesize the content exposed in class

Wright, J. (2006) has studied on “Teaching and Assessing Mind Maps”. The goal of acquire initiatives in pedagogical is to improve students' skills so that they can meet the acquisitions requirements of their academic studies. Mind mapping is one such skill. The literature supports the idea that mind mapping presents pupils with useful organisational and heuristic tools, as well as instructions on how to build mind maps. However, the challenge of evaluating mind maps is frequently not present. This research investigates the characteristics of successful mind maps, their edges, and importance at the lowest levels of schooling, as well as the question of whether or not they should be evaluated. It appears that the value of mind mapping in university education has received little attention, and that the appraisal of mind maps requires more interaction among individuals with associate degrees interested in artistic instruction at the tertiary level.

Meier, P. S. (2007) had conducted study on “Mind-mapping: a tool for eliciting and representing knowledge held by diverse informants.” He discovered mind-mapping being a beneficial technique for exchanging ideas and information, organising and arranging literature reviews, and storing integrated stakeholder information in a readily accessible way.

Tattersall, C. et. al. (2007) had made study on “Mind mapping as a tool in qualitative research.” Although additional academic research is needed, mind mapping has the possibility of allowing researchers to generate speedy and accurate transcribed of interviews conducted without having to transcribe them verbatim. It may also help the researcher analyse qualitative data by assisting them in 'bracketing' their own prejudices, which is crucial in phenomenological research. This paper makes an attempt to explain, justification, and promote analysis, but its primary goal is to stimulate discussion in the qualitative analysis community on the usage of mind mapping as a technique in phenomenological studies. Endeavours in the field of qualitative analysis may see compelling reasons to avoid mind mapping, and many of these arguments may be correct. Mind mapping, on the other hand, may only be discovered through qualitative study through conversation and analysis.

Wickramasinghe, A., Widanapathirana, N., Widanapathirana, O., Liyanage, I., & Karunathilake, I. (2007) had made study on “Effectiveness of mind maps as a learning tool for medical students”. Their purpose was to assess the efficiency of mind maps as a self-learning tool for novice faculty members. There was no notable distinction between the marks of 2 teams. The average mark of the whole cluster was more than 34%. Majority (97.1%, N=34) from the mind map cluster felt that it's helpful to shorten info and more than 87% wish to check any regarding mind mapping.

D'Antoni, A.V., Zipp, G.P., & Olson, V.G. (2009) had done research work on “Inter rater reliability of the mind map assessment rubric in a cohort of medical students”. Mind mapping is a learning approach that is underutilised in medical education. Mind maps are multisensory tools that help medical students organise, integrating and retaining data. Present research reveals that using mind mapping like a note-taking approach can help you think more clearly. The goal of this study was to see if there was a link among mind mapping and important thinking, as judged mostly by “Health Sciences Reasoning Test (HSRT),” and whether there was a link among mind mapping and domain-based information recall. Though mind mapping

did not improve short-term recall of domain-based information or vital thinking when compared to SNT, beginner metric linear component participant underwent as well as SNT subjects after a brief introduction to the technique. This shows that medical students who use mind maps can retrieve information in the immediate term, and that they are not at a disadvantage when competing to SNT students. This shows that medical students who use mind maps can retrieve information in the immediate term, and that they are not at a disadvantage when competing to SNT students.

Nong, B. K., Pham, T. A., & Tran, T. N. M. (2009) had studied on “Integrate the Digital Mind Mapping into Teaching and Learning scientific discipline.” The purpose of this research is to investigate the impacts of electronic mind mapping versus hand-made mind mapping and traditional pedagogic on pupils' lesson achievement and attitudes toward learning and teaching scientific fields. Ninety students were chosen for the study. The participants were randomly assigned to one of three groups: experimental, control group one, or control group two. Electronic mind mapping, usual approach for control group one, and hand-made mind mapping technique for act as control group two were all used in the experimental cluster. The control group analysis style was employed both before and after the test. digital mind mapping learning and teaching method resulted in a significant improvement in students' tutorial pupils' achievement toward learning scientific disciplines, according to the findings.

Edwards, S., & Cooper, N. (2010) had studied on “Mind Mapping as a teaching resource”. They discovered that when applied to written content, mind maps have been considered as an efficient study strategy. This research examines how to employ mind mapping as a teaching resource. This paper examined how a working in clinical teacher may put this strategy to practical use. This made classroom instruction more fun for pupils by making things more fascinating. They discovered that Mind Mapping may be employed in a variety of circumstances, including problem-based learning, small-group instruction, one-on-one tutoring, and individual study.

Ren, G. (2011) had studied on the topic, “Evaluating effectiveness of Mind Mapping in Task Based Language Teaching and Learning (TBLT) in Chinese”. In this present study sixty-four boys were taken as the sample. They were all students in an independent K-12 boys' school where CSL (Citation Style Language) was offered as an elective. The following are the study's

major findings: According to 80 percent of the boys polled, mind mapping is more than successful during the TBLT Pre-Task Phase. In the During-Task Phase, Mind Mapping seems to be quite effective, as over 60% of the men examined have agreed to this statement. The study was also revealed that Mind Mapping is least impressive in the Post-Task Phase, as task rankings are low in this phase, and only roughly 34% of the boys agreed with this statement. In general, boys aged 13 to 17 prefer to employ Mind Mapping in TBLT in Chinese.

Keles, O. (2012) has studied on “Mind Maps and scoring Scale for Environmental Gains in Science Education”. Thus, the current study aims to develop sample mind maps which will be employed by academics whereas teaching environmental problems. The content of environmental themes included in the scientific and technical curriculums of sixth, seventh, and eighth graders was examined as part of the current study's framework. Mind maps for system, variety, and creatures, water pollution, acid rain, land pollution, lightweight pollution, utilisation, and warming were created among the themes covered in these curriculums. Furthermore, a sample "Mind Map grading Scale" was established and its stages of development were conferred in order to assess the students' capacity to use mind maps. Visual stimuli, group activity, nonlinear recording of information, appraisal, verifying comprehension, obstacle decision, elaboration, establishing analogies, note taking, summarising, depicting sequence of events, and other imaginative techniques of training are all possible with graphic organisers. As a result, any research into the use of mind maps in instructing various topics is thought to be necessary. Furthermore, any investigations and even the application of appropriate approaches to develop examples that academics can follow are required.

Pinto, G.Z., Catherine, M., & D'Antoni A.V. (2015) had studied on “Mind Mapping: Teaching and Learning Strategy for Physical Therapy Curricula”. Regardless of our profession, educators are requesting that environments be created that actively engage pupils in their journey of learning. Mind mapping is a new teaching and learning approach that has arisen in the classroom (MM). The goal of this exploratory study was to determine the frequency of measurement regular usage in a highly skilled health science curricula "physical therapy," as well as to determine whether there is a link between school information about mind maps and their usage approach. All certified North American nation therapist education programme chairs (191) from the Commission on Accreditation in Physical Therapy Education (CAPTE) were emailed and asked to participate in an online survey researching the use and information of mind maps. The survey link was anonymous and included into the message for immediate

access by the participants. Participants' open-ended replies reflect four primary themes related to the usage of metric linear units in schools, with limited awareness being the most significant impediment. The findings of this investigation show that the unit is not used in some therapist education programmes, owing to faculty ignorance. If schools grasped MM's tenets and relationship as a teaching - learning technique, it appears that they would be interested in investigating its utility.

2.7 Studies related to the mind mapping as constructivist/ collaborative approach:

Chen, Z. (2010) has studied on “The study of mind mapping with collaborative learning”. The purpose of this research is to look at the educational explanation, characteristics, and implementation of collaborative learning and mind mapping. This research investigates the use of mind mapping in conjunction with cooperative learning. Collaborative learning with mind mapping is a student-centered strategy that promotes active learning among students. It's an excellent means of self-expression, communication, and collaboration. It's a good way of mistreating whole-brain thinking, improving students' memory, implementing student engagement, promoting scholar cooperation, facilitating lecturer-student communication, enhancing students' critical thinking, and influencing student action. The current literature on the subject concludes that combining mind mapping with collaborative learning is an excellent way to improve student learning and instructor effectiveness.

Seyihoglu, A., & Kartal, A. (2010) had studied on “The views of the teachers about the mind mapping technique in the elementary life science and social studies lessons based on the constructivist method”. The purpose of this research is to discover out what instructors think about using mind mapping in biomedicine and social studies classes. 20 primary education lecturers made up the study area's participants. A semi-structured interview strategy was used in this investigation. Themes and codes were developed for content analysis, which supported the presenters' viewpoints. According to the results, the lecturers lacked expertise in the parts of the instruction that were delivered by misusing the creative person method, and as a result, they only employed the exposition and analytic stages in implementing the mind mapping strategy to the components of the lessons. Lecturers believe that using the mind mapping strategy to spoken lessons would be more acceptable. While the variables that provide length in students' acquisition and boosting exam achievement are commonly listed as positives of this approach, the potential problems with time constraints are frequently listed as negatives.

Balim, A. G. (2013) had studied on “Use of technology-assisted techniques of mind mapping and concept mapping in science education: a creative person study”. The goal of the study is to see how abuse of mind maps and brain maps affects students' understanding of ideas in scientific classes. Fifty-one students took part in this study, which employed a quasi-experimental analysis approach with pre-test/post-test control group. The constructivist approach study was conducted at an elementary school with two experimental group and one control group during a sixth-grade science course subject called 'Light and Sound.' The intervention was treatment digital technique of mind mapping in the experimental group one, treatment digital technique of mind mapping in the experimental group two, and old schoolroom teaching in the control group. Cognition tests and open-ended questions related to the section were being used as post-tests after the intervention among the experimental teams. Based on the results of thought tests, it was discovered that each group's knowledge of concepts was equal. learners in the experimental group had two positive reports, noting that learning using idea maps was beneficial and engaging.

2.8 Studies related to mind mapping and learners' attitude towards learning:

Gur, H., & Butuner, S.O. (2006) had studied on “Development of the attitude scale toward mind mapping technique which is used in mathematics class”. This study aimed toward developing Associate in Nursing perspective Scale toward mind mapping technique. it's believed that mind mapping uses each side of the brain, lease them work along will increase productivity and memory retention. Studies that have done regarding the mind mapping technique have usually supported this position. However, some negative results are found regarding mind mapping technique. Thus, it's vital to work out student's attitudes toward mind mapping technique.

Evrekli, E., Inel, D., & Balim, A.G. (2011) had studied on “A research the effects of using concept cartoons and mind maps in science education”. “One group pre-test post-test” look at style was employed throughout this study to see how the use of concept cartoons and mind maps impacted learners' success, motivation, attitudes, and opinions of “inquiry learning skills”. There were significant differences in students' achievements and motivations as a result of this study, but no significant differences in learners' attitudes and judgments of “inquiry learning skills”. After examining the examination of attitudes and views of “inquiry learning abilities”, post-test mensuration was discovered to be higher than pre-test measurement. Furthermore, throughout this study, the participants were divided into two teams based on their

degrees of achievement, as well as the outcomes of dependent variables, were examined. According to the findings, there were no significant differences across teams in terms of accomplishment, attitude, motivation, or views of inquiry learning skills.

Hariri, M. (2013) had studied on “The perspective of EFL learners towards using mind mapping software on their reading comprehension.” Aim of this research work was to examine the views of thirty-one EFL girl students concerning used of mind mapping software in reading comprehension activities. They were business management sophomores at “Hakiman University in Bojnourd, Iran”. The analysis was carried out from the perspective of an Associate in Nursing, and the knowledge was analysed by calculating the probabilities of the responses to the seventeen questions in the Likert scale. The findings revealed that the participants' attitudes regarding using mind mapping software to improve comprehension in their reading activities were overwhelmingly positive. The majority of them considered those stimulating, while they noted that creating a mind map through software package is more difficult than creating one at camp. They emphasised a number of the advantages of application e-mind maps, such as sharing or maybe creating mind maps with people via the internet.

Tungprapa, T. (2015) studied on “Effect of using the electronic mind map in the educational research methodology course for master-degree students in the faculty of education”. The purpose of this text is to use quantitative and qualitative research to examine the results of using an electronic mind map for teaching and learning in an educational analysis method course for Master's degree students at Ramkhamhaeng University in Thailand. One group of master's degree students is represented in the research samples. Associate in Nursing viewpoint evaluation – pre-study and post-study – type, a form, and Master in Nursing an interview kind are all part of the analysis tools. Quantitative knowledge was analysed using elementary statistics, such as the t-test (dependent) and hence the t-test (independent), while qualitative content was analysed using the content analysis method. According to the findings of a quantitative survey, the Free Mind programme is the most commonly used software package by students to create mind maps. At the $p < 0.05$ of applied mathematics significance, it was discovered that the students' post-study attitudes for the analysis study topic area were higher than their pre-study attitudes after using the electronic mind map. Furthermore, the researchers concluded that using a mind map is useful at the highest level. Meanwhile, the findings of a qualitative study revealed that students thought using a mind map in the analytical learning

activity was beneficial. However, teachers' own instruction and data transmission strategies are still seen as an important component in improving students' knowledge and developing favourable attitudes about research.

Ceng (2011) analysed that “mind mapping, as a psychological feature tool”. It has a clear visual manifestation, as well as the ability to construct a personal communications system that is responsible for information at the individual basis. As a result, it's critical to teach kids the subject of a course and to have them create a mind map that before they're assigned to a category. Reading is both a language and a mental activity. It's a technique in wherein readers apply their knowledge, linguistic skills, and critical thinking skills to actively engage with the author through the material format and create significant inventive creations all around paper's theme. Inside the studying category, using mind mapping to teach instructors English reading in an interactive fashion.

2.9 Studies related to the developing creative thinking by mind mapping technique:

Wen-Cheng, W., Chung-Chieh, L., & Ying-Chien, C. (2010) had studied on, “A Brief Review on Developing Creative Thinking in Young Children by Mind Mapping”. Mind mapping is a type of creative thinking that uses arcs, colours, symbols, figures, signs, images, photographs, or keywords, among other things, to correlate, integrate, and visualise taught concepts and elicit brain potential. Concentration, cooperation, logical, rationality, thought, analysing, originality, intuition, remember, ability to create and integrate, rapid reading, symbol, numerical, imagery, listening, kinesthetic learning sense, feeling, and so on are all greatly enhanced by mind maps. The finest tool for young children to investigate gain more knowledge is "picture," which is unrestricted by position or language. Because sketching ability is stronger than writing skills in youngsters and because representation is one of the most primitive human features, learning and articulating using mind mapping minimises challenges with writing, synchronic linguistics, and extended descriptions in children. As a result, this study examines related studies to see if young children may use mind mapping to improve their power.

Vijaykumari, K., & Kavithamole, M. G. (2014) conducted “a study on mind mapping: A tool for mathematical creativity”. The study's major goal is how mind mapping affects mathematical creativity. The study involved a hundred students divided into experimental and management teams, each with fifty individuals. This research work discovered that mind mapping can be a useful tool for improving mathematical creativity, which is across all stages

of mathematics instruction, a significant student outcome, and it's also quite helpful for higher secondary students. An in-depth examination of Their actions demonstrated that individuals are deeply committed in the process of generating new mind maps or changing existing ones after learning new knowledge or methods.

REVIEW MATRIX

Title	Author and year	Objectives	Journal/Book/ Link	Major Findings
“Using Mind Maps to raise standards in literacy, improve confidence and encourage positive attitudes towards learning.”	Cain, M.E. (2002)	The purpose of this article was to give a literature review as well as student satisfaction survey findings after applying mind map learning method.	<i>“Study conducted at New church Community Primary School, Warrington”.</i>	They were able to structure and complete task offered in the class using mind map supervised learning.
“The efficacy of the ‘mind map’ study technique.”	Farrand, P., Hussain, F. & Hennessy, E. (2002)	They set out to see how effective it was to use the 'mind map' study strategy to increase factual memory from written material.	<i>“Medical Education.”</i>	At the immediate exam, mind map and identity study approach groups improved their retention of facts and information when compared to baseline.
“Student and Teacher Perceptions of Mind Mapping: A Middle School Case Study.”	Goodnough & Woods. (2002)	Mind Mapping as an enjoyable, fascinating, and stimulating technique to learning was the study's goal.	“Paper presented at the Annual Meeting of American Educational Research Association, New Orleans.”	Learning with Mind Mapping is a fun, fascinating, and stimulating experience.

“Joining Mind Mapping and Care Planning to Enhance Student Critical Thinking and Achieve Holistic Nursing Care.”	Mueller, et.al. (2002)	Mind Mapping and Treatment Plan to Improve pupils analytical Thought and Develop Comprehensive Nursing Care were the goals of this study.	“ <i>Nursing Diagnosis</i> ”	Mind Map enhanced thought talents such as critical thinking comprehensive thinking and whole-brain thinking.
“Mind Maps as Classroom Exercises.”	Budd, J.W. (2003)	Aim of the study was enhancing exercise skill.	“ <i>The Journal of Economic Education</i> ”	Activities that cater to a variety of learning styles can help re-energize economics classes.
“An investigation into the concept of Mind Mapping and the use of Mind Mapping software to support and improve student academic performance.”	Holland, B., Holland, L., & Davis, J. (2004)	The goal of mind mapping is to increase self-motivation (Those components of job that we enjoy doing solely for the purpose of doing it).	“ <i>Learning and Teaching Projects.</i> ”	Since it tends to boost one's perception of expertise in understanding the allotted content, mind mapping provides a refreshed sense of joy to the classroom.
“The effects of mind mapping strategies on the development of writing skills of selected form three students.”	Kaur, J. (2004)	The goal of this study was to find a mind mapping strategy that would help students improve their thinking and writing skills.	“ http://www.pasir.upm.edu.my/316/ ”	Conclusion: When compared to a control group, the teaching style, mind mapping, and brainstorming tactics used during pre - writing following treatment, this group of

				three students' compositional writing abilities improved significantly and consistently.
“What are the Major Curriculum Issues?: The Use of Mind Mapping as a Brainstorming Exercise.”	Paykoc , F., Mengi, B., Kamay, P.O., Onkol, P., Ozgur, B., Pilli, O., & Yildirim, H. (2004)	The goal is to find out how visual material might aid children establish shared meanings.	“Paper presented at the First Int. Conference on Concept Mapping, Spain.”	Students found that using mind mapping software helped them organise their thoughts, present material clearly and beautifully, and communicate more effectively.
“Enhancing Freshman students’ Writing Skills with a Mind Mapping software.”	AI-Jarf, R. (2009)	The purpose of this study was to see if Mind Mapping software could help with writing skills.	“ <i>E-learning and Software for Education.</i> ”	Pupils who utilised digital mind map improved their writing skills more than pupils who did not.
“The Use of Mind Mapping in Teaching and Learning.”	Boyson (2009)	Mind Mapping for classroom instruction can assist instructors and trainers in identifying a reasonable plan or	“ <i>The Learning Institute,</i> ”	Mind Mapping was discovered to increase prominent and successful and facilitate effective operation of programmes.

		teaching path while also increasing content knowledge retention.		
“Does the mind map learning strategy facilitate information retrieval and critical thinking in medical students.”	D’Antoni, A.V., Zipp G. P., Olson, V. G. & Cahill, T. F. (2009)	The goal of this research was to see if using a mind map learning technique could help medical students with knowledge discovery and critical thinking.	“ <i>BMC Med Educ.</i> ”	Using a mind map learning technique did not result in a significant improvement in very brief, domain-based knowledge in medical students (as measured by multiple-choice quizzes).
“Mind Mapping applications in special teaching methods courses for science teacher candidates and teacher candidates’ opinions concerning the applications.”	Evrekli, E., Balim, A. G., & Inela, D. (2009)	The goal of this study was to see if employing mind map study plan to enhance factual retention from written material was successful.	“ <i>Procedia – Social and Behavioral Sciences.</i> ”	Mind maps are commonly used as a learning strategy; nevertheless, methods for increasing user motivation must be considered.
“Research on how Mind Map improves Memory.”	Toi, H. (2009)	The value of applying mind mapping abilities as a pre - writing planning method for improving writing quality.	“Paper presented at the <i>International Conference on</i>	Planning with mind maps is a great writing method that can help students enhance their writing. He demonstrated how Mind Mapping

			<i>Thinking</i> , Kuala Lumpur.”	can assist children in better recalling words.
“Retrieving Data from Mind Maps to Enhance Search Applications.”	Beel, J. (2010)	It was suggested that data gathered from mind maps could be used to improve these search apps.	“ www.docear.org .”	These search applications can benefit from data collected from mind maps.
“Mind Mapping as a teaching resource.”	Edwards, S., & Cooper, N. (2010)	The goal of this research was to examine how a working in clinical teacher may use mind mapping in a practical and usable way.	“ http://use links.cdlib.org .”	Mind mapping can be utilised for a variety of purposes, includes problem-based learning, small-group instruction, one-on-one instruction, test preparation, and personal revision.
“An Exploratory Analysis of Mind Maps.”	Beel, J., & Langer, S. (2011)	The goal was to figure see how mind maps work and what information they carry.	“ www.docear.org .”	They discovered that a typical mind map had 31 branches on average (median), with each node containing between one and 3 words. There are few notes, if any, in 66.12 percent of cases, and the number of linkages is also minimal, depending on the mind mapping application.

“Using Mind Maps and Diagrams to teach Vocabulary for First Year Mainstream Students at Division I.”	Diem, D. T. (2011)	Learning vocabulary is always mentioned in the four skill objectives (Speaking, Listening, Reading and Writing).	“Vietnam National University, Hanoi university of Languages and International Studies.”	To teach vocabulary, mind maps and visualisations were useful and successful.
“The Effects of Mind Mapping Activities on Students’ Motivation.”	Jones, B.D., Ruff, C., Snyder, D. J., Petrich, B, & Koonce, C. (2012)	Increasing motivation of the students by mind mapping technique.	<i>“International Journal for the Scholarship of teaching and Learning”</i> .	Whereas the 3 groups had equal effects on students' motivational views, there were some variances in their mind mapping preferences. Instructions are available.
“Spontaneous Mind Map use and learning from texts: The role of instruction and student characteristics.”	Merchie, E. A., & Keer, H. V. (2012)	Purpose of this study was to encourage generative study practises that promote active knowledge transformation by assisting students in engaging with study texts.	<i>“Procedia-Social and Behavioural Sciences”</i> .	During the intervention period, pupils who automatically generated Mind Maps while learning from texts were mostly girls, and they mostly used author-provided Mind Maps.
“The Use of Mind Mapping Strategy in the Teaching of Writing at	Riswanto, Putra, P. P. (2012)	The major focus of this research was to see if using the Mind Mapping approach helped	<i>“International Journal of</i>	Students who were taught utilising the Mind Mapping Strategy had significantly higher writing

SMAN 3 Bengkulu, Indonesia.”		pupils develop their writing skills.	<i>Humanities and Social Sciences.”</i>	achievement. As a result, the Mind Mapping Strategy can be said to have aided pupils in improving their writing abilities.
“Introducing the mind map technique to promote lesson summarizing in EFL instruction.”	Amine, N. M. (2013)	This research aims to promote knowledge of one of the most cutting-edge educational tools: the mind map.	“Dissertation submitted in partial fulfilment of the requirement for the post-graduate Degree in Language Sciences at Mohamed Khieder University of Biskra.”	The participants' achievement scores improved as the proportion of information retained increased. As a result, mind map approach has been discovered to be a effective tool for summarising lessons.
“Manipulating Mind Mapping Software to develop Essay Writing.”	Dadour, E., & El-Esery, A. (2014)	The goal of the study was to see if using digital mind mapping can be used to predict outlining skill and writing competency.	<i>“Research Journal of English Language and Literature (RJELAL).”</i>	The level of intelligence outline and writing proficiency can be determined using mind mapping software.

“Buzan Mind Mapping: An Efficient Technique for Note-Taking.”	Tee, T. K., Md Yunos, Hassan, R., Yee, M. H., Mhamad, M. M., Hussein, A., Mhamad, B., & Othman, W. (2014)	The purpose of this paper is to discuss the value as a note-taking tool, Buzan mind mapping method for secondary school pupils.	<i>“International Journal of Social, Education, Economics and Management Engineering.”</i>	Buzan mind mapping is an effective note-taking approach that makes revision enjoyable for students.
“The Effect of Mind Mapping on Teaching and Learning : A Meta-Analysis.”	Liu, Y., Zhao, G., Ma, G., & Bo, Y. (2014)	Using graphical study aids to assist teaching and learning has grown increasingly common.	<i>“Standard Journal of Education and Essay.”</i>	To determine the impact of mind mapping on classroom instruction while taking into account the benefits of mind mapping.
“A Meta-analysis Study of Mind Mapping Techniques and Traditional Learning Methods.”	Batdi, V. (2015)	Using the meta-analysis method, this article tries to analyse the influence of mind mapping strategies educational outcomes, behaviours, and engagement scores of students.	“Ministry of Education”	Academic achievement, attitude, and retention all benefit from mind mapping.

“The Effect of Mind Mapping Strategy on Comprehending Implicit Information in EFL Reading Texts.”	Malekzadeh, B., & Bayat, A. (2015)	The goal of this research was to see how effective a leading mind mapping approach was at improving students' comprehension of instruction text.	www.ijeionline.com ”	The mind mapping approach improves pupils' reading comprehension, and the null hypothesis will be refuted.
“Effects of mind mapping on student achievement in a nursing research course.”	Rooda, L. A. (1994)	Purpose of this study was to in a clinical research course, the impact of mind mapping on pupil performance was studied.	“ <i>Nurse Educator</i> ”	Mind Mapping as Mind mapping and other creative teaching tactics can create a lesson not only more engaging, but also more enjoyable.
“Mind mapping: Its effects on student achievement in high school biology.”	Edge, C. G. (2006)	The goal of this research was to see if mind-mapping may help students perform better in introductory science classes.	“The university of Texas at Austin.”	Achievement in high school course enhanced utilizing mind mapping.
“The effects of note taking in science education through the mind mapping technique on students' attitudes, academic achievement and concept learning.”	Orthan, A., & Zeynep, Y. (2007)	The purpose of this study is to see how primary school kids' attitudes, academic achievement, and concept acquisition are affected by taking notes in their science	“ <i>Journal of Baltic Science Education.</i> ”	It was discovered that using the mind-mapping method to take notes made a substantial effect in students prepared for future, eliminating misconceptions, academic accomplishment, and attitudes toward science courses.

		classes using the mind mapping approach.		
“Teacher-Centered Mind Mapping vs Student-Centered Mind Mapping in the Teaching of Accounting at Pre-U Level – An Action Research.”	Fun, C. S., & Maskat, N. (2010)	The purpose of this study is to compare Teacher-Centered Mind Mapping to Pupil Mind Mapping in an economics course, as well as the association between the two ways of mind mapping and students' exam scores.	<i>Elsevier</i>	The results demonstrated that (1) teacher-centered mind mapping resulted in a decrease in student test scores, (2) Student test scores improved significantly after using student-centered mind mapping.
“The Influence of Mind Mapping on Eighth Graders' Science Achievement”	Mona, I., & Khalick, F. (2010)	The impact of employing mind maps as a training tool on eighth-grade scientific achievement was investigated in this study.	<i>“School Science and Mathematics”</i>	pupils in the experimental group increased statistically significantly and significantly more than students in the control group.
“The Impact of Using the mind Map Strategy on The Ninth Grade Students Achievement in Science and Their Attitudes Toward Science In the	Long, D., & Carlson, D. (2011)	The researcher investigated how thinking maps could be utilized by the students to broaden they will improve their critical thinking skills and have	“ https://hdl.handle.net/20.500.11888/7357 .”	Students that employed standard note-taking procedures were able to gain a better knowledge of the material.

Governmental Schools in Qalqilya.”		a better knowledge of the material given.		
“Effect of Mind-Mapping as a Self-Regulated Learning Strategy on Students’ Achievement in Basic Science and Technology.”	Adobo, S. O. (2013)	The study looks into the impact of mind-mapping as a self-regulated learning approach on students' performance in Basic Science and Technology (BST).	<i>“Mediterranean Journal of Social Science”</i>	Students' performance was improved by using the mind mapping approach as an identity learning strategy.
“The effect of mind-mapping applications on upper primary students’ success and inquiry-learning skills in science and environment education.”	Balim, A. G. (2013)	The goal of this study is to see how the mind-mapping technique affects students' judgments of interesting observation, academic achievement, and knowledge retention.	<i>“International Research in Geographical and Environmental Education”</i>	On both cognitive and affective levels, there is a great disparity in favour of the experimental group in terms of academic accomplishment, retention of learning scores, and impression of inquiry-learning skill scores.
“The Impact of Digital Mind Maps on Science Achievement among Sixth Grade Students in Saudi Arabia.”	Ibrahim, M. A. J. (2013)	The goal of this study was to see how digital mind maps affected science achievement among Saudi Arabian sixth graders.	<i>“Procedia –Social and Behavioral Sciences”</i>	The use of digital mind maps by Saudi sixth grade pupils could help them attain better results.

“Using mind maps for the measurement and improvement of learning quality.”	Radix, C. A. & Abdool, A. (2013)	This research looks at how an alternative graphic organiser might be used to evaluate and enhance learning quality.	“Caribbean Teaching Scholar”	For studying constructivist learning inside a technical area, a mind map is a good alternative to a concept map.
“Impact of Mind Mapping Technique on Academic Achievement – An Experimental Study on Malaysia Form 4 Students.”	Fung, H. P. (2014)	Objective of this study was to mind mapping technique really helps students to improve their academic achievement of some subjective claims.	“ http://www.researchgate.net/publication/266201770 .”	Mind mapping can improve students’ academic achievement.
“Mind mapping and everybody writes techniques for students with high and low writing achievement.”	Muhib, A., Dwi Anggani L. B., & Hartono, R. (2014)	The usefulness of Mind Mapping so Everyone Writes for children with maximum and minimum writing achievement was studied in this study.	“ http://journal.unnes.ac.id/sju/index.php/eej/view/662 .”	This study's findings show that Mind Mapping so Everyone Writes are useful and significant for children with maximum and minimum writing achievement. For teaching writing, the Everyone Writes approach is more beneficial than Mind Mapping. There is a relationship between writing ability, techniques, and student achievement.

“Achievement in Physics Using Mastery Learning and Mind Mapping Approaches: Implication on Gender and Attitude.”	Olufunkel, B. T. & Blessing, O. O. (2014)	This study looked at how male and female students performed in Physics when taught using the Mastery Learning Approach (MLA) and Mind Mapping Approach (MMA).	<i>“International Journal of Humanities Social Sciences and Education (IJHSSE)”</i>	Students that received MMA had a more favourable attitude toward physics. MLA, MMA and the conventional method.
“The Effect of Mind Maps on the Student’s Learning Achievement and Retention in Cellular Biology Topic of Grade Xi Ipa Sma Negeri 1 Sidikalang Academic Year 2014/2015.”	Sihombing, H. K. (2015)	The goal of this study is to see how mind maps affect educational performance and memorization.	“ http://digilib.unimed.ac.id/12221/6/4103342008%20ABS TRAK.pdf ”	The findings show that mind maps have a major impact on learning success and retention. According to this study, mind maps create a learning environment that is tailored to the individual's understanding and needs. It is also obvious that using a mind map encourages students to retain material.
“Effectiveness of Teaching through Mind Mapping Technique.”	Parikh, N. D. (2016)	The research's major goal was to determine the usefulness of mind mapping techniques in connection to the students' academic achievements, for which a case study for mind	<i>“The International Journal of Indian Psychology”</i>	The Mind Mapping methodology was proven to be more successful than the traditional way.

		mapping in class 8th Social Science was created.		
“Teaching Literature Through Mind Maps.”	Rafik-Galea, S., & Kaur, J. (2005)	This research looks at how mind maps can be used in the classroom to assist learners make sense of what they're reading and writing.	<i>“Mobile Learning: Malaysian Initiative & Research Findings,”</i>	Students will have an easier time remembering what they have conveyed visually and converting visual data to printed texts.
“Scholarly research on mind maps in learning by mentally retarded children.”	Karin, S. L. (2008)	Educators, psychologists, and people in general have used mind maps (or related concepts) for teaching, brainstorming, visual thinking, and problem solving for millennia.	“Paper presented at the European Conference on Educational Research, University of Goteborg”	The ability to recall was affected by mind mapping techniques.
“Mind Mapping- an effective learning adjunct to acquire a tsunami of information.”	Spoorthi, B.R., Prashanthi, C., & Pandurangappa, R. (2013)	The current generation of students’ lives in a tsunami of information.	<i>“International Journal of Scientific and Research Publications.”</i>	Mind mapping's potential for learning, organising, and retrieving massive amounts of knowledge that students gain during their course.

“The Effectiveness of Using Mind Mapping Skills in Enhancing Secondary One and Secondary Four Students’ Writing in a CMI School.”	Wai Ling, C. (2004)	The goal of this review was to see how effective it was to use mind mapping abilities in a CMI school to improve intermediate one and secondary 4 students' writing.	“University of Hong Kong, Masters dissertation.”	Mind Mapping has proven to be an effective pre-writing approach.
“How Do Pupils and Teachers View the Use of Mind Mapping in Learning and Teaching? G.T.C Scotland Teacher Researcher Programme.”	Polsen, K. (2003)	Investigated on teachers and students’ perspectives on mind mapping in teaching and learning.	“G.T.C Scotland teacher researcher programme”	Mind mapping as enjoyable, interesting and motivating approach in learning. The majority of students said mind mapping helped them learn in a number of ways and that they enjoyed the creative parts of it.
“The effectiveness of mind maps for teaching Biology in standard IX.”	Ambili, P. (2006)	To study the effectiveness of mind map on developing psychomotor skill and artistic skill on students.	“Unpublished master’s thesis, Mahatma Gandhi University, Kottayam.”	Mind map is superior in developing psychomotor skills and encourage the artistic skills of the students.

“Effectiveness of mind maps for learning Zoology at higher secondary level.”	Raseena, S (2006)	Aim of the study was effectiveness of mind map for learning Zoology at higher secondary level.	“Unpublished master’s thesis, University of Kerala.”	Mind map method of teaching is significantly superior to concept map with regard to achievement in Zoology
“Introducing mind map in comprehension.”	Ang, Moi, & Lian (2007)	The study's main goal was to assist students better understand and retain text passages, develop thinking abilities, and boost their confidence when answering comprehension questions.	<i>“Educational Research Association”</i>	When teaching comprehension skills, students' understanding and retention of comprehension passages improves.
“Creativity development in engineering education: The case of mind mapping.”	Zampetakis, L. A., Tsironis, L., & Moustakis, V. (2007)	Explored the effectiveness of introducing mind mapping technique to engineering students based on individual student performances.	<i>“Journal of Management Development”</i>	Mind mapping is an effective strategy to engineering students. The pupil prefers to work in groups with mind maps, which allowed them to pool their knowledge and encourage the creative process.
“The influence of mind mapping on VIII graders science achievement.”	Mona, I. A. E., &	The impact of mind maps as an instructional platform on eighth-grade Science	“School Science and Mathematics Association”	Mind mapping has positive impact on the framework of middle school science, students are learning.

	Khalick, F. A. E. (2008)	achievement was investigated in this study.		
“Conventional method of teaching and mind map method of teaching Mathematics among VIII standard students.”	Beena, M. I. (2008)	The study's goal was to see how effective the mind map method was. and to verify the advantages of using mind map as a memory enhancer.	“Unpublished master’s thesis, Manonmaniam Sundaranar University, Tirunelveli.”	Mind map enhances retention power, develop interest in studies, improved visual sensation, and helps to summarize information and learning become more meaningful.
“Effectiveness of mind mapping technique in teaching Mathematics”.	Thankarajathi, S. (2008)	The study's goal was to see how successful mind mapping is in mathematics teaching at the high school level compared to traditional methods.	<i>“Edutracks”</i>	The mind mapping method is more efficient than the traditional way.
“An investigation into the impact of mind map as a learning tool in Chemistry at higher secondary level in Kollam district.”	Anchu, E. S. (2008)	The purpose of the investigation was to study the effectiveness of mind maps as a learning tool in chemistry at higher secondary level.	“Unpublished master’s thesis, Mahatma Gandhi University, Kottayam.”	Mind mapping technique was found to be more efficient than the conventional method.

“Effectiveness of mind map for learning Hindi grammar at secondary school level.”	Beena. (2009)	The purpose of the study was to learn Hindi grammar using mind mapping strategy.	“Unpublished master’s thesis. University of Kerala, Thiruvananthapuram.”	Mind maps method is more effective than lecture method group in learning Hindi at secondary level.
“Does the mind map learning strategy facilitate information retrieval and critical thinking in medical students?”	Cahill, T., & Anton. (2010)	The goal of this study was to see if there was a link among the health science reasoning test was used to assess mind mapping and rational reasoning, as well as to see if there was a connection among mind maps and area recall.	“ <i>BMC Medical Education</i> ”	Mind mapping did not increase short-term recollection of context data or critical thinking when compared to brief note taking.
“The effects of mind mapping with cooperative learning on programming performance, problem solving skill and meta-cognitive knowledge	Ismail, M., Ngah, N. A., & Ummar, I. N. (2010)	The goal of this study is to see how mind mapping combined with cooperative learning (MMCL) and cooperative learning (CL) affect program efficiency, problem solving ability, and metacognitive	“ <i>Journal of Educational Computing Research.</i> ”	The students in mind mapping with co-operative learning (MMCL) and co-operative learning (CL) groups have a considerable favourable impact on programming ability, problem-solving ability, and metacognitive understanding

among computer science students.”		knowledge within Malaysian computer science students.		
“Meeting the needs of professional education: A study of mind mapping in a professional doctoral physical therapy education programme.”	Pollard, E. L. (2010)	The goal of the study was to see if the question scores of athletic trainers who used mind mapping in respective learning techniques differed from those of pupils who did not use mind mapping in respective learning strategies in a lecture-based research study.	<i>ERIC</i>	The mind mapping group performed much worse than previous course participants. The mind mapping class and preceding students did not differ much on the second unit quiz.
“Effectiveness of mind map technique in teaching IX standard Biology.”	Joylet, R. (2010)	Aim of the goal of the study was to determine the usefulness of mind mapping as a teaching tool. Biology and to compare the effectiveness of mind map technique with conventional method of teaching Biology.	“Unpublished master’s thesis, Tamilnadu Teachers Education University”.	In standard IX, the mind mapping methodology was proven to be more effective than the traditional method of teaching Biology.

“Effectiveness of mind map for teaching parts of speech in English at secondary level.”	Chitra, G. (2010)	To see if using a mind map to teach words and phrases in English at the secondary level is beneficial.	“Unpublished master’s thesis, Mahatma Gandhi University”.	Mind map method is more effective than activity method in teaching parts of speech in English.
“Effectiveness of digital mind mapping over paper-based mind mapping on students’ academic achievement in environmental science.”	Mani, A. (2011)	The goal of this study is to see how digital mind mapping compares to hand-made mind mapping and traditional teaching methods in terms of student accomplishment in environmental science.	“ http://editlib.org/p/38011 ”	Mind mapping strategy significantly improved student’s achievement in environmental science and generate the best results in the functions likely brain storming and group activities.
Mind maps as a learning tool in anatomy.	Deshhatty, D. D., & Mokashi, V. (2012)	The goal of the study was to see how mind mapping as a note-taking approach helps medical students understand anatomy better, as well as to assess the usefulness of mind maps as a learning aid and determine whether there is a link between	“ <i>International Journal of Anatomy and Research</i> ,”	A mind map is a better learning tool for learning anatomy and for recalling facts quickly. The students indicated an interest in learning more about mind mapping and applying it to their future academic endeavours.

		mind mapping and information recall.		
“Brain-compatible activities for EFL vocabulary learning and retention”.	Lago, L., & Seepha, S. (2012)	The goal of this study was to see how brain-compatible activities (BCA) affected the After taking a BCA course, 3rd-year graduate pupils studying English for tourism improved their vocabulary learning and retention.	<i>“International Journal of Scientific and Research Publications,”</i>	While taking a tourism course using Brain- Compatible Activities (BCA), the students significantly learnt the target words, and the terminology they acquired through brain-compatible learning was remembered for at least six weeks after teaching.
“Effectiveness of mind mapping technique for enhancing achievement in Mathematics at secondary school Level”.	Reshmy, R. (2012)	To determine the usefulness of the mind mapping technique in improving secondary school mathematics achievement.	“Unpublished master’s thesis. University of Kerala.”	Mind mapping technique of teaching mathematics was more effective among the secondary school students.
“The impact of mind map teaching strategy on achievement in Mathematics and select variables of high school students”.	Sheela, P. P. (2013)	The purpose of the study was to measure the effects of mind map teaching strategy on mathematics accomplishment versus lecture technique, as well as attitudes regarding mind	“Unpublished Ph D Thesis, Manonmaniam Sundaranar University.”	Mind map teaching strategy was effective in enhancing the achievement of students. Mind mapping strategy are having better problem-solving ability.

		map teaching strategy and mathematical problem-solving skills.		
“The effect of mind-mapping applications on upper primary students' success and inquiry-learning skills in science and environment education”.	Balim, & Günay, A. (2013)	The goal of the study is to see how the mind-mapping technique affects students' judgments of inquiry - based learning skills, academic accomplishment, and knowledge retention.	<i>“International Research in Geographical and Environmental Education,”</i>	On both cognitive and affective levels, the study finds a substantial difference in experiment group over the control group in terms of academic accomplishment scores of retentions of learning and perception of inquiry learning skill scores.
“Opinions of the Geography teacher candidates toward mind maps”.	Seyihoglu, A. (2013)	The focus of this research was to find out what teacher candidates thought about the mind mapping approach utilised in undergraduate geography classes.	<i>“Educational Research and Reviews,”</i>	In terms of learning, mind mapping techniques include codes such as paving the path for learning, ensuring retentive learning, stressing basic concepts, summarising, organising, eye-catching, the capacity to use humoristic language, and the ability to illustrate relationships.

“Perceptions of pre-service Social Sciences teachers regarding the concept of Geography by mind mapping technique”.	Ozturk, D., & Cagri. (2013)	The goal of the study was to give pre-service social science teachers' perspectives on the idea of geography.	<i>“Educational Research and Reviews,”</i>	Pre-service social science teachers were found to have incorporated the idea of geography into 18 different graphic aspects on their mind maps. Pre-service teachers were found to strongly link the idea of geography with physical geography concepts.
“Prevalence of mind mapping as a teaching and learning strategy in physical therapy curricula”.	Zipp, G., & Maber, C. (2013)	The goal of this study was to see how common mind mapping is in health science professional curriculum and what relationship there is between faculty awareness of mind maps and their use of the technique.	<i>“Journal of Scholarship of Teaching and Learning,”</i>	Many health science education programmes do not use mind mapping due to a lack of information and competence among teachers.
“Effectiveness of instructional package based on economics and mind mapping to enhance achievement of the	Amitha, K. S. (2014)	To discover the effectiveness of instructional package based on economics and mind mapping to enhance	“Unpublished master’s thesis. University of Kerala,	Mind map helps in developing creativity among students and it also helps to reduce the difficulty and boredom in social science classroom.

students in Social Science”.		achievement of the students in Social Science.	Thiruvananthapuram.”	
“Effectiveness of mind mapping in English teaching among VIII standard students”.	Hallen, D., & Sangeetha, N. (2015)	The study's goal is to see how successful mind mapping is in comparison to traditional English teaching methods in high school.	<i>“Journal on English Language Teaching”</i>	The mind mapping methodology is more efficient than the traditional English teaching method.
“Mind Mapping: A Graphic Organizer for the Pedagogical Toolbox”.	Goodnough, K., & Long, R. (2002)	To discover the effectiveness of mind mapping on fostering students’ motivation in learning science.	<i>“Science Scope,”</i>	They found mind mapping (MM) to be a fun and interesting approach, and they believed it helped them learn better. Individual MM was chosen by most students, however some favoured group mind mapping. The teacher liked utilising MM and found it helped students become more interested in science.
“Mind Mapping as a tool in Mathematics Education”.	Brinkmann, A. (2003)	Purpose of the study was improving knowledge of	“The mathematics teacher”	Mind Mapping various positive learning effects

		mathematics using as a tool mind map.		
“Applications of the Mind Map Learning Technique in Chiropractic Education”.	D’Antoni & Pinto Zipp. (2005)	The study's main goal was to look at the Mind Map Learning Technique's applications in chiropractic education.	<i>“Journal of Chiropractic Education,”</i>	They were able to more effectively arrange and synthesize the material offered in their course using the Mind Map technique.
“Teaching and Assessing Mind Maps”.	Wright, J. (2006)	Literacy interventions in university education are designed to improve students' abilities to coping with the literacy requirements of their academic studies.	<i>“Per Linguam,”</i>	The benefits and importance of excellent mind maps throughout all levels of education were investigated.
“Mind-mapping: a tool for eliciting and representing	Meier, P. S. (2007)	Its objective was to sharing ideas and documents using mind mapping as a tool.	<i>“Social research UPDATE”</i>	Mind mapping to be a useful tool for sharing ideas and documents.

knowledge held by diverse informants”.				
“Mind mapping as a tool in qualitative research”.	<i>Tattersall, C. Et.al (2007)</i>	Its goal is to spark debate in the qualitative research community over the usage of mind mapping as a technique in phenomenological studies.	<i>“Nursing Times,”</i>	In the qualitative research world, the use of mind mapping more as merely a technique in phenomenological studies has stirred dispute.
“Effectiveness of mind maps as a learning tool for medical students.”	Wickramasinghe, A., Widanapathirana, N., Widanapathirana, O., Liyanage, I., & Karunathilake, I. (2007)	Their goal was to determine the usefulness of employing mind maps as an auto tool for new faculty members.	<i>“South East Asian Journal of Medical Education,”</i>	Found mind map useful way of memorizing information, summarizing information.

“Inter rater reliability of the mind map assessment rubric in a cohort of medical students.”	D’Antoni, A.V., Zipp, G.P., & Olson, V.G. (2009)	The researchers wanted to see if there was a link between mind mapping and critical thinking, as judged by the Health Sciences Reasoning Test (HSRT), and if there was a link between mind mapping and domain-based information recall.	“ <i>BMC Medical Education</i> ,”	Mind mapping was found to have no effect on domain-based information recall or critical thinking., but it can successfully retrieve information in the short term.
“Integrate the Digital Mind Mapping into Teaching and Learning Psychology.”	Nong, B. K. Pham, T. A. & Tran, T.N.M. (2009)	The aim of this research is to find out the impact of digital mind mapping on learners' academic accomplishment and attitudes in classroom instruction psychology as compared to hand-made mind mapping and traditional teaching methods.	“Unescobkk.org.”	digital mind mapping teaching - learning method resulted in a considerable favourable effect in students' academic progress and attitudes about learning Psychology, according to the findings.

“Mind Mapping as a teaching resource.”	Edwards, S. & Cooper, N. (2010)	This paper examined that a therapeutic manner teacher may put this strategy to practical use.	Elsevier	Mind mapping can be applied in a variety of settings, including problem-based learning, small-group teaching, one-on-one tutoring, and personal revision.
“Evaluating effectiveness of Mind Mapping in Task Based Language Teaching and Learning (TBLT) in Chinese.”	Ren, G. (2011)	To see how successful Mind Mapping is in Chinese Task Based Language Teaching and Learning (TBLT).	“gr@cgs.vic.edu.au”	Mind Mapping is particularly effective during the TBLT Pre-Task Phase. During the task phase, mind mapping is quite useful. When used as a thinking technique, Mind Mapping is least successful in the Post-Task Phase.
“Mind Maps and Scoring Scale for Environmental Gains in Science Education.”	Keles, O. (2012)	As a result, the current study intends to create sample mind maps that teachers can use when teaching environmental topics.	“ <i>International Online Journal New Perspectives in Science Education.</i> ”	Teachers are said to find mind maps helpful for teaching environmental issues.

“Mind Mapping: Teaching and Learning Strategy for Physical Therapy Curricula.”	Pinto, G. Z., Catherine, M., & D’Antoni A.V. (2015)	The goal of that kind of exploratory study would be to see how often mind maps are in a health science instructors called "physical therapy," and if there is a link between faculty understanding of mind maps and its usage approach.	<i>“Journal of Physical Therapy Education,”</i>	This research can help physical therapist training institutions investigate mind mapping as an instructional approach.
“The study of mind mapping with collaborative learning.”	Chen, Z. (2010)	The educational rationale, characteristics, and implementation of collaborative learning and mind mapping are examined in this work.	“A seminar paper presented to the Graduate Faculty, University of Wisconsin-Platteville.”	Mind mapping combined of collaborative learning is a powerful tool for increasing student learning quality and teacher effectiveness.
“The views of the teachers about the mind mapping technique in the elementary life science and social studies lessons	Seyihoglu, A., & Kartal, A. (2010)	The goal of this study is to find out what teachers think about using mind mapping in Bioscience and Social Studies classes.	<i>“Educational Sciences: Theory & Practice,”</i>	When employing the mind mapping methodology to organise the sections of the class, the teachers only used the presentation and appraisal steps since they lacked proficiency in the areas of the

based on the constructivist method.”				lecture that were presented using the constructivist method.
“Use of technology-assisted techniques of mind mapping and concept mapping in science education: a constructivist study.”	Balim, A. G. (2013)	The purpose of this study is to see how employing mind maps and concept maps affects students' learning of topics in scientific classes.	<i>“Irish Educational Studies”</i>	The experimental group's students had pleasant feelings. Learning with idea maps was both practical and enjoyable.
“Development of the attitude scale toward mind mapping technique which is used in mathematics class.”	Gur, H., & Butuner, S.O. (2006)	This study aimed at developing an attitude Scale toward mind mapping technique.	<i>“Elementary Education Online,”</i>	Studies which have done about the mind mapping technique have generally supported this position.
“A research study on the effects of using concept cartoons and mind maps in science education.”	Evrekli, E. Inel, D., & Balim, A.G. (2011)	To see how concept Students' accomplishments, motives, attitudes, and opinions of inquiry learning skills are influenced by cartoons and mind maps.	<i>“Journal of Science and Mathematics Education”</i>	Significant disparities in students' achievements and motives were discovered as a result of this research.

“The attitude of EFL learners towards using mind mapping software on their reading comprehension.”	Hariri, M. (2013)	The goal of this study was to see how 31 EFL girl pupils felt about using mind mapping software for reading comprehension assignments.	<i>“Journal of Language Learning and Applied Limquistic World (IJLLALM”),”</i>	The findings revealed that the participants' attitudes toward using mind mapping software in their reading activities to improve comprehension were significantly positive.
“Effect of using the electronic mind map in the educational research methodology course for master-degree students in the faculty of education.”	Tungprapa, T. (2015)	The aim of this article is to use quantitative and qualitative research to examine the results of employing an e- mind map for instruction an educational research course for post-graduate pupils at Ramkhamhaeng University in Thailand.	<i>“International Journal of Information and Education Technology,”</i>	After using the electronic mind map, students' post-study attitudes about the research research subjects were found to be greater than their pre-study views, indicating that the electronic mind map increases students' understanding and creates good attitudes toward research.
“A Brief Review on Developing Creative Thinking in Young Children by Mind Mapping.”	Wen-Cheng, W., Chung-Chieh, L., & Ying-Chien, C. (2010)	Mind mapping is a type of radiant thinking that uses patterns, coloring, figures, digits, signs, images, photographs, or keywords, among other things, to	<i>“Canadian Center of Science and Education,”</i>	Young children can use mind mapping to help them improve their creative thinking skills.

		correlate, integrate, and visualise a learnt concept and elicit brain potential.		
“Mind mapping: A tool for mathematical creativity.”	Vijaykumari, K., & Kavithamole, M. G. (2014)	The purpose of this research is to identify the effect of mind mapping upon mathematics inventiveness.	“ <i>Guru Journal of Behavioural and Social Sciences</i> ,”	Mind mapping is an excellent tool for enhancing mathematical creativity, that is an influential outcome at all levels of mathematics education, but especially in the higher secondary grades.

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CHAPTER III

RESEARCH METHODOLOGY

3.1 Introduction

3.2 Method of the study

3.3 Population and Sample

3.4 Participants of the Study

3.5 Research Design

3.6 Data Collection Procedure

3.7 Research Variables Used in the Present Study

3.8 Research Instruments

3.9 Data Analysis

References

CHAPTER-III

RESEARCH METHODOLOGY

3.1 Introduction:

Methodology is the plan and procedure of any research. It is also known in research ground as design of the study. It is the framework and technique of inquiry that is envisioned in order to achieve appropriate answers to research questions and to manage dissimilarity. In any quantitative investigation, study design and procedure play an ideal role to select the proper way of investigation according to the purpose of the study. Research methodology enables the investigator to provide appropriate answers of research questions in validity, objectivity, reliability as far as possible and accurately. It is a pre-plan or blueprint of status for collection, nature of analysis of data. Different types of study design are obtainable to conduct research but the choice of accurate direction in particular research depends on the nature of problems, variables, sample, measuring tools and the restraints on the manipulation of variable involved.

This chapter deals with method, population, sample and sampling technique, sample size, tools or instruments, data collection, tabulation and scoring of data, statistical analysis used etc.

3.2 Method of the study:

Method of research is a basic plan for research. After selecting a research problem, the investigator finds out the proper scientific way before the situation areas in which the decisions are to be carried out about the study. It is a procedure of well-planned presentiment guided towards bringing expected situation under control. It helps the researcher to construct the logical pillar about the process of study accurately and economically. A proper research method is very essential to complete the research work, it depends on the nature of study. The present study uses an experimental research approach.

3.3 Population and Sample:

For the present research the researcher has to determine the population for data collection. According to Creswell (2008) population is “a group of individuals who have the same characteristics”. The study's population was determined by the researcher from the secondary level learners of West Bengal. The researcher has taken some part of the population and the result was generalized on the whole population. Arikunto (2010) observed that sample is a confined number of units taken from a population that represents the population. In the recent

study, the researcher followed the purposive sampling method and the class 8th standard students from Bhagwanchak Patiram Sikshaniketan was purposively selected for the experiment. In this study 90 students were included in the sampling group. Samples are chosen based on teacher's recommendation and breaks into two groups: the Experimental Group named as Group I, and the Control Group named as Group II. Each group has 45 students. The experimental group received instruction using the mind mapping technique, while the control group received instruction using the usual way. The brief description is given below in the table: 3.1

Name of the Group	Class	Number of samples	Name of the group	Instruction
Group I	VIII	45	Experimental group	Mind mapping technique
Group II	VIII	45	Control group	Traditional method of teaching

Table – 3.1

3.4 Participants of the study:

The present study was conducted in secondary level of Bhagwanchak Patiram Sikshaniketan for her experiment. The subjects were having different socio-economic status, caste and tribe categories. The total population of the students in this school was 1000.

3.5 Research design:

The aim of this study is to promote students’ reading comprehension skill and how to improve students' ability to read English using mind mapping as a technique. Researcher used Sequential Explanatory Mixed Method Research Design which is a combination of Qualitative and Quantitative Method. Cresswell (2007) defined that sequential explanatory is a type of mixed method where the researcher collected quantitative data first. Then collected qualitative data. The purpose of this two- phase explanatory mixed method study will be to obtain statistical, quantitative results from a sample and then follow- up with a few individuals to probe or explore those results in more depth. In this study the researcher used quasi-experimental study for quantitative data collection and used interview technique for qualitative data collection.

Quantitative method is a method that analyses through statistical analysis using research instruments to collect data on a specific population and sample. Researcher have used experimental research design to determine if mind mapping techniques promote students' reading comprehension skills. Experimental designs are quantitative research processes where the researcher determines whether any activity or material differs from the results of the participants.

Here the researcher used Pre-Test Post-Test Non- Equivalent Quasi Experimental Research Design. Borg. et. al. (1993) stated that quasi-experimental research participants are not assigned a random condition. The term “non-equivalent” means that assignment to group purposively. The groups were not equivalent, so this design was named the non-equivalent groups design.

Before treatment two groups were given the same pre-test, then instruction to experimental group by mind mapping strategy and control group to traditional method of teaching. Finally, the researcher applied the post - test on the respondents. Researcher will determine based on the result of post -test whether students have developed reading comprehension skills or not.

To find out how mind mapping technique promotes reading comprehension skill of students, the researcher used interview. She conducted an interview for collection of data from the experimental group.

To understand above the paradigm of the design is given below in the table -3.2.

Groups	Pre-test	Treatment	Post-test
Experimental group	T1	X1(Mind mapping technique)	T2
Control group	T1	X2 (Traditional method of teaching)	T2

Table – 3.2

3.6 Data collection procedure:

The researcher performed a pre-test before starting treatment and a post-test afterward. She was conducted the quasi- experimental teaching in six meeting for treatment group and control group. Then the researcher uses interviews to gather information on how improving students' comprehension of reading skills builds the mind mapping. For gathering data, the investigator applied the following procedures:

1. **Pre - test:** The work is started with pre-test before the experimental research. It is conducted before treatment. This shows how the reading comprehension skills of the students were before the treatment. Here the researcher explains to the participants, for the purpose of pre- test.
2. **Treatment:** Students must be given treatment before doing post- test. Treatment means that the researcher has applied the method chosen by her for this study and the technique used by the investigator in this study was mind mapping technique. Mind mapping technique helps learners remember and recall when they read subjects.

Six meetings in the study were used for treatment.

a. The first meeting (6th April, 2019)

The researcher first enters the classroom and introduced her to the students. She explained what the purpose of his research was and why they would read and understand English better. After 5 minutes of self-introduction, he checks the attendance list of the students and calls them by their names to make them more closed. She wants to know the ability in reading of students. Allow them to read one chapter of the English book and give them 5 minutes.

b. The second meeting (3rd May, 2019)

In the second meeting, the researcher came to the class, checked the attendance list of the students and gave the students some general concepts on the mind map. Then show some examples on mind map to the students. Then teach the students the process of creating mind map. The researcher then tells the learners to create an easy mind map on any one theme and the researcher guided to each student. Next, students present mind map in front of class.

c. The third meeting (6th May, 2019)

The researcher continued to do what she was doing in the second meeting.

d. The fourth meeting (9th May, 2019)

The researcher began the lesson by going over the register. The researchers began to illustrate to the learners how to form a concept, she instructs learners how to express ideas structurally through mind map.

Researchers have taught students how to use the Mind Mapping technique to develop their reading comprehension skills. At the end, the researcher asks the learners if they have any questions.

e. The fifth meeting (16th may, 2019)

Here the researcher explains to the students how they will use colours, symbols, images and keywords when creating a mind map. The colour use will increase their interest in reading and capable them to remember for a long duration, what the researcher explained to them. Ending of the class, the researcher tells the learners that they will bring home a mind map drawing on daily life activity.

f. The sixth meeting (20th May, 2019)

In this meeting the researcher explained to the students how they will use the mind map in reading and establish association between different topics. When they read a textbook, the researcher taught them how to express it with a keyword in each para and as they read, the researcher asked them to highlight the important lines with different colours.

Here the researcher will discuss about two meetings held on the control group.

a. The first meeting (6th April, 2019)

The researcher walked into the lesson and introduced himself to the pupils. She described the objective of her study and the importance of knowing English. How much English language is needed in the future? After 5 minutes of self-introduction, she checked the attendance list of the students.

She applied pre-test to the students to know their reading skill. She asked the students to read from one chapter and gave each of them five minutes.

b. The second meeting (4th May, 2019)

The researcher started the class for the second meeting in the control group by checking the register. She then clarified why the second meeting was needed. She taught by using traditional method.

c. The third meeting (6th May, 2019), The fourth meeting (9th May, 2019), The fifth meeting (16th May, 2019)

Researcher has used the traditional method in these three consecutive meetings.

d. The sixth meeting (20th May, 2019)

In this meeting the researcher applied post- test on the learners to check their reading skill and compared the results in the experiment class.

- 3. Post-test:** The researcher gave the students a post-test after the treatment and described the aim of the post-test previously. The researcher used the same instrument as post- test and pre- test. Here the researcher calls the students one by one, using the mind map to check how they have read the book. Check how much fluency has increased, whether the subject they are reading can be applied in other fields. The researcher gave each student five minutes to present what he or she understands in front of the class.

3.7 Research variables used in the present study:

In the present study three important types of variables were identified, these were:

- A. Independent variable:** Independent variable was Traditional Method of Teaching and Mind mapping technique.
- B. Dependent variable:** Dependent variable was reading comprehension skill.
- C. Intervening variables and their controlling:** Some variables act directly upon dependent variables, like nature of the study, teacher's competencies, physical and academic environment, long time period etc, which are not measured directly. The researcher has tried to her best to keep away such variables and their influence on dependent variables in experimental situation. These were statistically controlled by the researcher.

3.7.1 Controlling Experimental Situation:

The researcher has followed the following attempt to control the experimental situation. She has requested all the subjects of group to come regularly in the experimental period. To control the mortality the researcher has maintained equivalent group and the pre-test result provided information for determining who walked out of 1 group and eliminating a similar member from the other group in order to sustain equivalent groups and keep touch with both the experimental and control groups. Including these, the experimental process was controlled by keeping the smooth classroom environment, well management modes of testing and time duration of the experiment properly. The researcher has maintained the systematic classroom situation by motivating, facilitating and encouraging students in a friendly climate in the experimental situation in order to reduce personal differences among the subjects.

3.7.2 Threats to experimental validity:

Internal validity as well as external validity are the two types of validity used in experimental research. The extent to which differences in the predictor variables are because of the experimental manipulation rather than some other variable is known as internal validity. External validity is that the degree to that the results area unit generalizable on the far side the participants used for research. In this study internal validity threats by mortality, instrumentation and statistical regression were controlled by the researcher, has showed in the table 3.3 and the treatment diffusion, Hawthorne effect, novelty effect are the threats to external validity has controlled by the researcher which has showed in the given below table 3.4

Table 3.3 Shows the way of controlling the internal validity by the researcher in the study

Threats	Definition	Controlled by the researcher
Mortality	Dropping act in the study.	Pre-test has obtained the information for testing who walked out of one group and extract a similar subject from another group to sustain equal group; by means of contact with both treatment and controlled groups.
Instrumentation	Instruments used in the study have reliability, validity.	The researcher has used reliable and valid instruments to observe the treatment effect.
Statistical regression	The propensity for scores to regress near the mean, with higher scores rising and lower scores falling.	Control group was selected randomly like experimental group.

Table :3.3

Table 3.4 Depicts threats to external validity were controlled by the researcher

Threats	Definition	Controlled by the researcher
Treatment diffusion	The treatment group communicates with the control group, informing them of the experimental treatment.	By carrying out the study at separate locations, such as schools, the investigator has limited contact and has asked respondents not to discuss what happens until the experiment is over.
Reactive arrangement	The study can affect ones feeling, behaviour and attitude	During the study the researcher has encouraged and motivated the participants as much as possible.
Hawthorne effect	The treatment has no effect on the participants' behaviour because of their increased participation in the study.	To prevent participants from guessing the study's goal, the researcher has supplied information.
Novelty effect	A treatment is only successful when it is fresh or novel, and the effectiveness of the treatment does not extend beyond this first phase.	The researcher has extended the period of study up to long time, so that any novelty effect has worn off.

Table: 3.4

3.8 Research instrument:

3.8.1 Rubric:

Rubrics used in a variety of ways to assess students' reading comprehension. The Rubrics, as they are understood to be readable, help to facilitate instructional design and distribution. Rubric adapted from David P. Harris (2007) book of ' Testing English as A Second Language'. Researcher modified rubric based on research goals in collaboration with guide. The rubric has been used to assess pupils' performance. Researchers have used this tool to learn their reading skills in both pre-test and post-test. Students who can decipher English effectively received a maximum 100-point score, while those who can decipher English poorly receive a 40-point score.

3.8.2 Interview: Borg and Gall (1983) mentioned that the interview technique can be divided into three parts such as structured, semi-structured and unstructured interview. Here the researcher uses semi-structured interview technique to get information from the interviewee. Extensive opening questions used in this study to provide more relevant information about research question (Creswell, 2008). Basit (2010) stated that one of the advantages of the semi – structured interview technique is that it does not have to answer the same questions as the structured interview technique. Interview is a technique that allows direct interaction between the researcher and the participants. The researcher collected in-depth data from the participants through interviews. The whole interview process was recorded.

3.9 Data Analysis

3.9.1 Analysis of quantitative data: The researcher analysed the data gained from pre-test and post test scores to analyse the achievement. Researcher used mean, standard deviation and ‘t’- test to carry out quantitative data analysis.

3.9.2 Analysis of qualitative data: Collected data in the form of keynotes and audio recordings, usually transcribed into written form for closure study, reading the transcript again one by one and very carefully in line by line. Researcher uses thematic analysis method for qualitative data analysis. Erden (2017) explained that “in qualitative researches the process performed basically is to gather similar data within the frame of certain concepts (codes) and themes and to interpret them by organizing them in a form that reader can comprehend.” Codes and themes for this purpose are determined based on student feedback when researching content is analysed. After transcribing the data obtained through interviews to verify study reliability, it was coded independently by another researcher and matched to see if the coding created by both was consistent.

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CHAPTER IV

DATA ANALYSIS AND INTERPRETATION

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56 57 58 59 60 61 62 63 64 65 66 67 68 69 70 71 72 73 74 75 76 77 78 79 80 81 82 83 84 85 86 87 88 89 90 91 92 93 94 95 96 97 98 99 100 101 102 103 104 105 106 107 108 109 110 111 112 113 114 115 116 117 118 119 120 121 122 123 124 125 126 127 128 129 130 131 132 133 134 135 136 137 138 139 140 141 142 143 144 145 146 147 148 149 150 151 152 153 154 155 156 157 158 159 160 161 162 163 164 165 166 167 168 169 170 171 172 173 174 175 176 177 178 179 180 181 182 183 184 185 186 187 188 189 190 191 192 193 194 195 196 197 198 199 200 201 202 203 204 205 206 207 208 209 210 211 212 213 214 215 216 217 218 219 220 221 222 223 224 225 226 227 228 229 230 231 232 233 234 235 236 237 238 239 240 241 242 243 244 245 246 247 248 249 250 251 252 253 254 255 256 257 258 259 260 261 262 263 264 265 266 267 268 269 270 271 272 273 274 275 276 277 278 279 280 281 282 283 284 285 286 287 288 289 290 291 292 293 294 295 296 297 298 299 300 301 302 303 304 305 306 307 308 309 310 311 312 313 314 315 316 317 318 319 320 321 322 323 324 325 326 327 328 329 330 331 332 333 334 335 336 337 338 339 340 341 342 343 344 345 346 347 348 349 350 351 352 353 354 355 356 357 358 359 360 361 362 363 364 365 366 367 368 369 370 371 372 373 374 375 376 377 378 379 380 381 382 383 384 385 386 387 388 389 390 391 392 393 394 395 396 397 398 399 400 401 402 403 404 405 406 407 408 409 410 411 412 413 414 415 416 417 418 419 420 421 422 423 424 425 426 427 428 429 430 431 432 433 434 435 436 437 438 439 440 441 442 443 444 445 446 447 448 449 450 451 452 453 454 455 456 457 458 459 460 461 462 463 464 465 466 467 468 469 470 471 472 473 474 475 476 477 478 479 480 481 482 483 484 485 486 487 488 489 490 491 492 493 494 495 496 497 498 499 500 501 502 503 504 505 506 507 508 509 510 511 512 513 514 515 516 517 518 519 520 521 522 523 524 525 526 527 528 529 530 531 532 533 534 535 536 537 538 539 540 541 542 543 544 545 546 547 548 549 550 551 552 553 554 555 556 557 558 559 560 561 562 563 564 565 566 567 568 569 570 571 572 573 574 575 576 577 578 579 580 581 582 583 584 585 586 587 588 589 590 591 592 593 594 595 596 597 598 599 600 601 602 603 604 605 606 607 608 609 610 611 612 613 614 615 616 617 618 619 620 621 622 623 624 625 626 627 628 629 630 631 632 633 634 635 636 637 638 639 640 641 642 643 644 645 646 647 648 649 650 651 652 653 654 655 656 657 658 659 660 661 662 663 664 665 666 667 668 669 670 671 672 673 674 675 676 677 678 679 680 681 682 683 684 685 686 687 688 689 690 691 692 693 694 695 696 697 698 699 700 701 702 703 704 705 706 707 708 709 710 711 712 713 714 715 716 717 718 719 720 721 722 723 724 725 726 727 728 729 730 731 732 733 734 735 736 737 738 739 740 741 742 743 744 745 746 747 748 749 750 751 752 753 754 755 756 757 758 759 760 761 762 763 764 765 766 767 768 769 770 771 772 773 774 775 776 777 778 779 780 781 782 783 784 785 786 787 788 789 790 791 792 793 794 795 796 797 798 799 800 801 802 803 804 805 806 807 808 809 810 811 812 813 814 815 816 817 818 819 820 821 822 823 824 825 826 827 828 829 830 831 832 833 834 835 836 837 838 839 840 841 842 843 844 845 846 847 848 849 850 851 852 853 854 855 856 857 858 859 860 861 862 863 864 865 866 867 868 869 870 871 872 873 874 875 876 877 878 879 880 881 882 883 884 885 886 887 888 889 890 891 892 893 894 895 896 897 898 899 900 901 902 903 904 905 906 907 908 909 910 911 912 913 914 915 916 917 918 919 920 921 922 923 924 925 926 927 928 929 930 931 932 933 934 935 936 937 938 939 940 941 942 943 944 945 946 947 948 949 950 951 952 953 954 955 956 957 958 959 960 961 962 963 964 965 966 967 968 969 970 971 972 973 974 975 976 977 978 979 980 981 982 983 984 985 986 987 988 989 990 991 992 993 994 995 996 997 998 999 1000 1001 1002 1003 1004 1005 1006 1007 1008 1009 1010 1011 1012 1013 1014 1015 1016 1017 1018 1019 1020 1021 1022 1023 1024 1025 1026 1027 1028 1029 1030 1031 1032 1033 1034 1035 1036 1037 1038 1039 104

4.1 The Analysis of Quantitative Data

4.2 The Analysis of Qualitative Data

4.3 Major Findings

CHAPTER-IV

DATA ANALYSIS AND INTERPRETATION

4.1 The analysis of quantitative data:

H₀₁: There are no significant difference between students’ performance while teaching in traditional method over mind mapping technique.

The pre-test scores

Descriptive Statistics:

Descriptive statistics of experimental group and control group in pre-test

Table 4.1.1 The results of pre-test score

	Group	N	Mean	SD	SEM	Min	Max
Pre-test	Control group	45	55.33	9.68	1.443	40	75
	Experimental group	45	55.67	10.31	1.537	40	75

Table 4.1.1

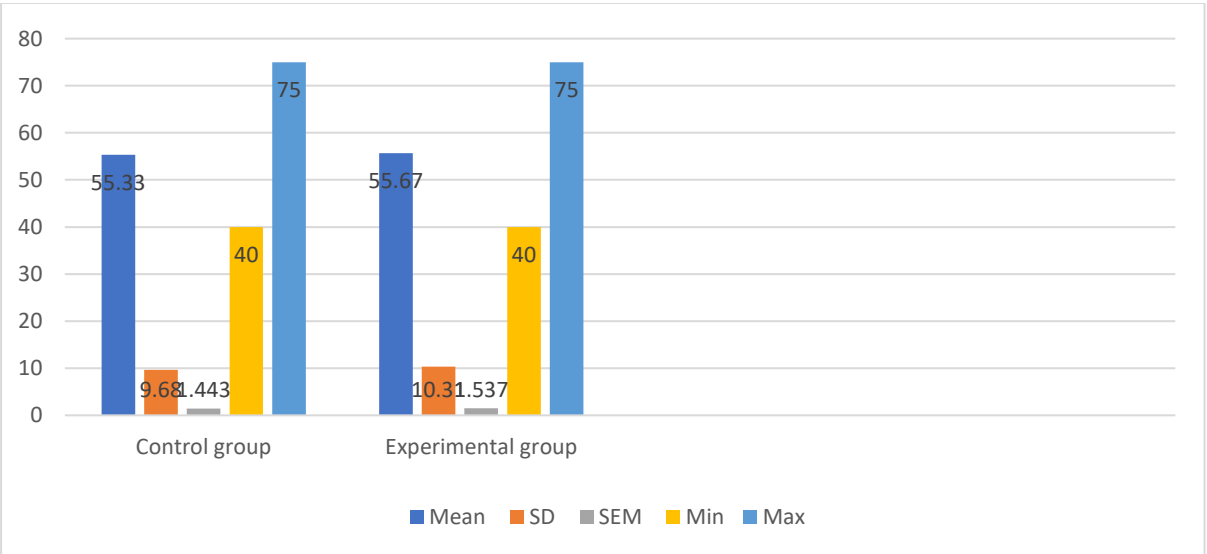


Figure 4.1.1 Showing pre-test score of control group and experimental group

Description:

It is seen from above table and graph, that there are two groups in the pre-test, one is control group consist of 45 participants and another is experimental group consist of 45 participants.

- The mean score of control group (55.33) is approximately same as the mean of the scores of the experimental group (55.67).
- Standard Error of Mean (SEM) of control group is 1.443 and experimental group is 1.537. So, real mean of control group lies between $55.33-1.443= 53.887$ to $55.33+1.443 = 56.773$ and real mean of experimental group lies between $55.67-1.537= 54.113$ to $55.67+1.537= 57.207$.
- Since the difference between minimum scores (40) and maximum scores (75) of control group pre-test (i.e., Range = $75-40= 35$) is same as the difference between minimum scores (40) and maximum scores (75) of experimental group pre-test (i.e., Range = $75-40= 35$). So, the mean of control group pre-test is approximately same influenced by the extreme scores of the experimental group pre-test.
- Since SD of control group pre-test (9.68) is approximately same as SD of experimental group pre-test (10.31). So, approximately same scores are concentrated the mean of control group and experimental group pre-test.

So, the researcher concludes that the control group in pre-test is shown approximately same performance on test in English reading comprehension ability as experimental group pre-test.

Inferential Statistics

Table 4.1.2 Showing t-test between control group and experimental group

	Group	N	Mean	SD	t-value (Independent Samples t- test)	Probability Level(sig.2- tailed)
Pre -test	Control group	45	55.33	9.68	- 0.16	.875(not significant at .05 level)
	Experimental group	45	55.67	10.31		

Table 4.1.2

Description:

Mean difference is $(55.67-55.33) = 0.34$ (very low) & t-value is -0.16 and also sig. (2-tailed) i.e., **P** value is $.875>.05$ i.e., chosen α level of .05. So, at a 5% level of significance, the null hypothesis is not rejected.

As a result, there is no statistically significant difference in the means of the values (pre-test) in the Experimental and Control groups.

The post-test scores

Descriptive Statistics:

Descriptive statistics of control group and experimental group in post-test

Table 4.1.3 The results of post-test score

	Group	N	Mean	SD	SEM	Min	Max
Post-test	Control group	45	55.67	8.09	1.206	45	70
	Experimental group	45	71.22	11.44	1.705	50	95

Table 4.1.3

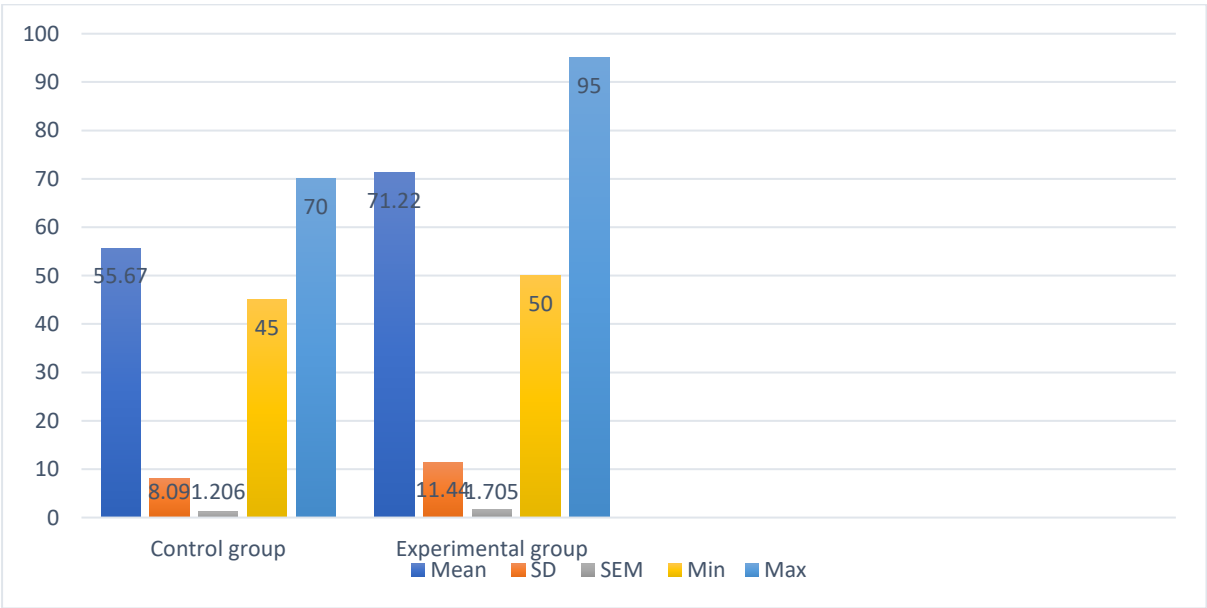


Figure 4.1.2 Showing post-test score of control group and experimental group

Description:

It is seen from above table and graph, that there are two groups in the post-test, one is control group consist of 45 participants and another is experimental group consist of 45 participants.

- The mean score of control group is 55.67 and the mean scores of the experimental group is 71.22.
- Standard Error of Mean (SEM) of control group is 1.206 and experimental group is 1.705. So, real mean of control group lies between $55.67-1.206= 54.464$ to $55.67+1.206 = 56.876$ and real mean of experimental group lies between $71.22-1.206= 70.014$ to $71.22+1.206= 72.426$.
- Since the difference between minimum scores (45) and maximum scores (70) of control group post-test (i.e., Range = $70-45= 25$) and the difference between minimum scores (50) and maximum scores (95) of experimental group post-test (i.e., Range = $95-50= 45$). So, the mean of control group post-test is approximately same influenced by the extreme scores of the experimental group post-test.
- Since SD of control group post-test (8.09) is approximately same as SD of experimental group post-test (11.44) so, approximately same scores are concentrated the mean of control group and experimental group post-test.

So, the researcher concludes that the experimental group post-test is shown better performance on test in English reading comprehension ability as control group post-test.

Inferential Statistics

Table 4.1.4 Showing t-test between control group and experimental group

	Group	N	Mean	SD	t-value (Independent Samples t- test)	Probability Level(sig.2- tailed)
Post -test	Control group	45	55.67	8.09	- 7.448	.000(highly significant)
	Experimental group	45	71.22	11.44		

Table 4.1.4

Description:

Mean difference is $(71.22-55.67) = 15.55$ (high) & t-value is -7.448 and also sig. (2-tailed) i.e., **P** value is $.000 < .05$ i.e., chosen α level of $.05$. So, the null hypothesis is rejected at 5% level of significance.

As a result, it may be stated that the means of the scores (post-test) in the Experimental and Control groups differ significantly.

A one-way analysis of covariance (ANCOVA) was used because the pre-test scores could have influenced the experimental effect. The covariate was the pre-test scores, and the dependent variable was the post-test scores.

Table 4.1.5 ANCOVA of pre-test score as covariate and post test score as dependent variable

Tests of Between-Subjects Effects

Dependent Variable: Achievement Post- test

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	6177.253 ^a	2	3088.627	30.495	.000
Intercept	9539.152	1	9539.152	94.183	.000
Achievement Pre-test (covariate)	92.809	1	92.809	.916	.341
GRE1 C2 (main effect)	6084.444	1	6084.444	60.074	.000
Error	8811.636	87	101.283		
Total	382350.000	90			
Corrected Total	14988.889	89			

a. R Squared = $.412$ (Adjusted R Squared = $.399$)

The prime effect for post-test scores became statistically significant after adjusting for the covariate.

The results show that such experimental group which was taught using mind mapping performed much better than the control group which was taught using traditional methods.

H₀₂: There are no significant difference between performance of students after teaching through mind mapping technique over traditional method of teaching on the basis of their gender.

For pre-test:

Here the required null statistical hypothesis be

H₀: There are no significant difference between the means of the scores (pre-test) of girls and boys in Control group.

Table-4.1.6 Analysis mean, SD, SEM, Minimum score and maximum score of control group pre -test score of girls and boys.

Variable	Group	Gender	N	Mean	SD	SEM	Min	Max
Traditional method	Control group	Girls	18	55.83	10.33	2.434	45	75
		Boys	27	55.00	9.405	1.810	40	75

Table-4.1.6

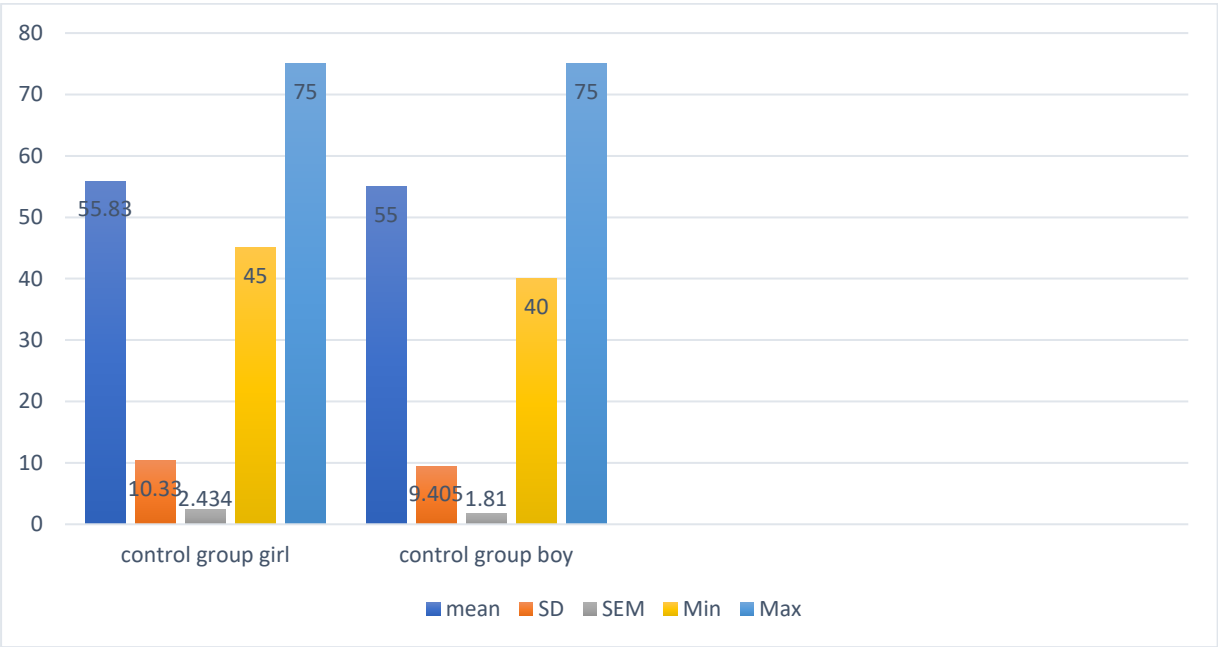


Figure – 4.1.3 Showing pre- test score of control group girls and boys

Description:

It is seen from above table and graph, that there are two groups in the pre-test, one is control group girls consist of 18 participants and another is control group boys consist of 27 participants.

- The mean score of the control group girls (55.83) is approximately same as the mean of the control group boys' scores (55.00).
- Standard Error of Mean (SEM) of control group girls (2.434) and control group boys (1.810). So, real mean of control group girls lies between $55.83 - 2.434 = 53.396$ to $55.83 + 2.434 = 58.264$ and real mean of control group boys lies between $55.00 - 1.810 = 53.19$ to $55.00 + 1.810 = 56.81$.
- Since the difference between minimum scores (45) and maximum scores (75) of control group girls pre-test (i.e., Range = $75 - 45 = 30$) is same as the difference between minimum scores (40) and maximum scores (75) of control group boys pre-test (i.e. Range = $75 - 40 = 35$). So, the mean of control group girls' pre-test is approximately same influenced by the extreme scores of the control group boys' pre-test.
- Since SD of control group girls' pre-test (10.33) is approximately same as SD of control group boys' pre-test (9.405). So, approximately same scores are concentrated the mean of control group girls and control group boys' pre-test.

So, the researcher concludes that the control group girls in pre-test is shown approximately same performance on test in English reading comprehension ability as control group boys' pre-test.

Table-4.1.7 Showing t-test between control group pre- test scores girls and boys Inferential Statistics:

Group	Gender	N	Mean	SD	t-value (Independent Samples t-test)	Probability Level(sig.2- tailed)
Control group	Girls	18	55.83	10.33	0.280	.781 (not significant at .05 level)
	Boys	27	55.00	9.405		

Table-4.1.7

Description:

Mean difference is $(55.83-55.00) = 0.83$ (very low or null) & t-value is 0.280 and also sig. (2tailed) i.e., **P** value is $.781 > .05$ i.e., chosen α level of .05. So, the null hypothesis is accepted at 5% level of significance.

As a result, there is no statistically significant difference between the mean of the girls' and boys' pre-test scores in the Control group.

Here the required null hypothesis be

H₀: There are no difference between the means of the scores (pre-test) of girls and boys in Experimental group.

Descriptive statistics

Table-4.1.8 Analysis Mean, SD, SEM, Minimum score and maximum score of Experimental group pre-test score of girls and boys.

Variable	Group	Gender	N	Mean	SD	SEM	Min	Max
Mind mapping technique	Experimental group	Girls	23	56.30	10.79	2.250	45	75
		Boys	22	55.00	10.00	2.132	40	60

Table-4.1.8

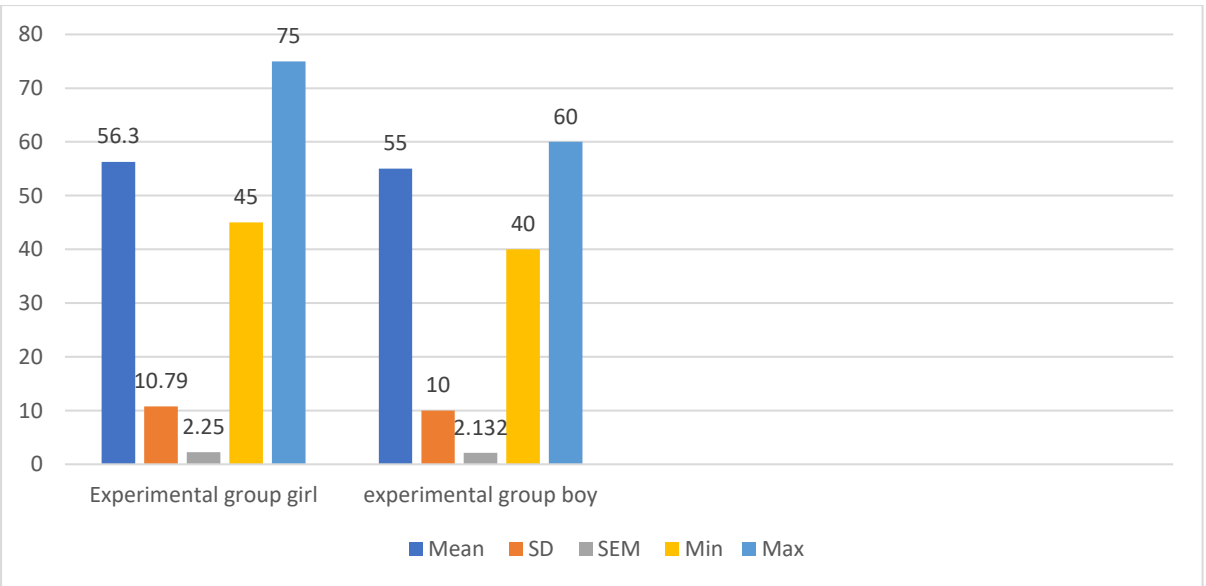


Figure – 4.1.4 Showing pre- test score of experimental group girls and boys

Description:

It is seen, from above table and graph, that there are two groups in the pre-test, one is Experimental group girls consist of 23 participants and another is Experimental group boys consist of 22 participants.

- The mean score of treatment group girls (56.30) is approximately same as the mean of the scores of the Experimental group boys (55.00).
- Standard Error of Mean (SEM) of Experimental group girls (2.250) and Experimental group boys (2.132). So, real mean of Experimental group girls lies between $55.30 - 2.250 = 53.05$ to $55.30 + 2.250 = 57.55$ and real mean of Experimental group boys lies between $55.00 - 2.132 = 52.868$ to $55.00 + 2.132 = 57.132$
- Since the difference between minimum scores (45) and maximum scores (75) of Experimental group girls pre-test (i.e., Range = $75 - 45 = 30$) is same as the difference between minimum scores (40) and maximum scores (60) of Experimental group boys pre-test (i.e., Range = $60 - 40 = 20$). So, the mean of Experimental group girls' pre-test is approximately same influenced by the extreme scores of the Experimental group boys' pre-test.
- Since SD of Experimental group girls' pre-test (10.79) is approximately same as SD of Experimental group boys' pre-test (10.00) so, approximately same scores are concentrated the mean of Experimental group girls and Experimental group boys' pre-test.

So, the researcher concludes that the Experimental group girls in pre-test is shown approximately same performance on test in English reading comprehension ability as Experimental group boys' pre-test.

Table-4.1.9 Showing t-test between control group pre- test scores girls and boys Inferential Statistics:

Group	Gender	N	Mean	SD	t-value (Independent Samples t-test)	Probability Level(sig.2- tailed)
Experimental group	Girls	23	56.30	10.79	0.420	.676((not significant at .05 level))
	Boys	22	55.00	10.00		

Table-4.1.9

Description:

Mean difference is $(56.30-55.00) = 1.3$ (very low) & t-value is 0.420 and also sig. (2tailed) i.e., **P** value is $.676 > .05$ i.e., chosen α level of .05. So, the null hypothesis is accepted at 5% level of significance.

As a result, there is no significant difference in mean of the girls' and boys' scores (pre-test) in the Experimental group.

For Post-test:

Here the required null hypothesis be

H₀: There are no significant difference between the means of the scores (post-test) of girls and boys in Control group.

Table- 4.1.10 Analysis Mean, SD, SEM, Minimum score and maximum score of control group post-test score of girls and boys.

Variable	Group	Gender	N	Mean	SD	SEM	Min	Max
Traditional method	Control group	Girls	18	56.67	7.86	1.852	40	75
		Boys	27	55.00	8.32	1.601	40	70

Table-4.1.10

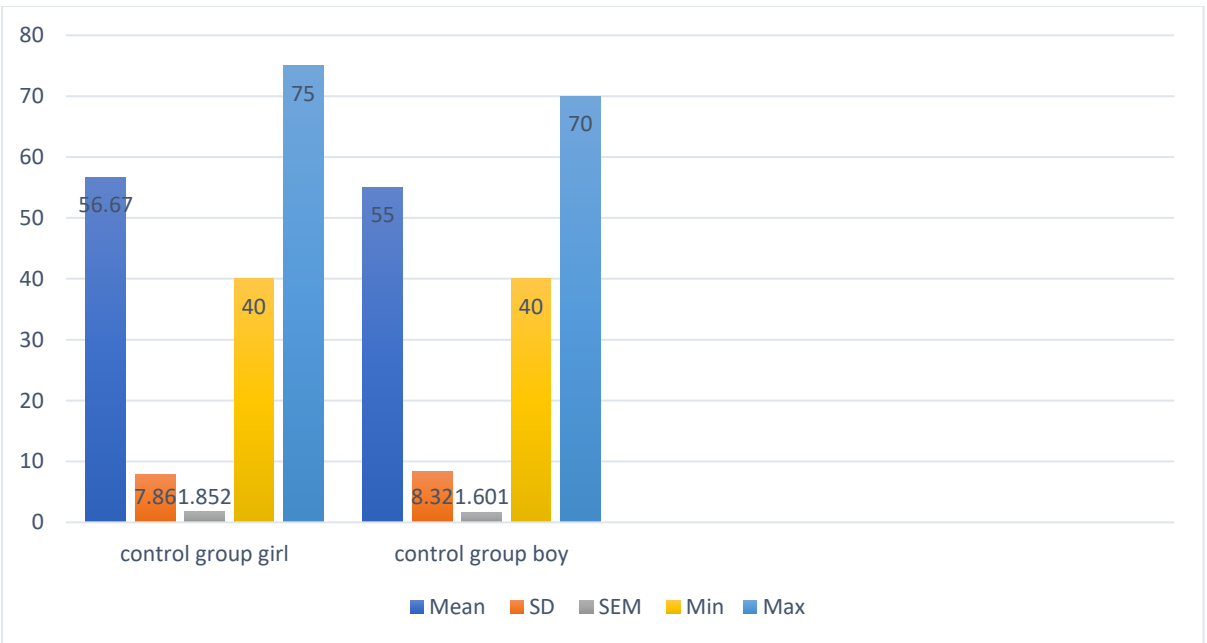


Figure – 4.1.5 Showing post- test score of control group girls and boys

Description:

It is seen from above table and graph, that there are two groups in the post-test, one is control group girls consist of 18 participants and another is control group boys consist of 27 participants.

- The mean score of control group girls (56.67) is approximately same as the mean scores of control group boys (55.00).
- Standard Error of Mean (SEM) of control group girls (1.852) and control group boys (1.601). So, real mean of control group girls lies between $56.67 - 1.852 = 54.82$ to $56.67 + 1.852 = 58.522$ and real mean of control group boys lies between $55.00 - 1.601 = 53.399$ to $55.00 + 1.601 = 56.601$
- Since the difference between minimum scores (40) and maximum scores (75) of control group girls post-test (i.e. Range = $75 - 40 = 35$) is same as the difference between minimum scores (40) and maximum scores (70) of control group boys post-test (i.e. Range = $70 - 40 = 30$). So, the mean of control group girls' post-test is approximately same influenced by the extreme scores of the control group boys' post-test.
- Since SD of control group girls' post-test (7.86) is approximately same as SD of control group boys' post-test (8.32) so, approximately same scores are concentrated the mean of control group girls and control group boys' post-test.

So, the researcher concludes that the control group girls in post-test is shown approximately same performance on test in English reading comprehension ability as control group boys' post-test.

Table-4.1.11 Showing t-test between control group post-test scores girls and boys
Inferential Statistics:

Group	Gender	N	Mean	SD	t-value (Independent Samples t-test)	Probability Level (sig.2- tailed)
Control group	Girls	18	56.67	7.86	0.673	.505 (not significant at .05 level)
	Boys	27	55.00	8.321		

Table-4.1.11

Description:

Mean difference is $(56.67-55.00) = 1.67$ (low) & t-value is 0.673 and also sig. (2tailed) i.e., P value is $.505 > .05$ i.e., chosen α level of .05. So, the null hypothesis is accepted at 5% level of significance.

As a result, there is no statistically significant difference between means of the girls' and boys' scores (post-test) in the Control group.

Here the required null hypothesis be

H₀: There are no significant difference between the means of the scores (post-test) of girls and boys in Experimental group.

Table- 4.1.12 Analysis Mean, SD, SEM, Minimum score and maximum score of Experimental group post-test score of girls and boys.

Variable	Group	Gender	N	Mean	SD	SEM	Min	Max
Mind mapping technique	Experimental group	Girls	23	74.78	11.02	2.299	50	90
		Boys	22	67.50	10.88	2.320	45	95

Table-4.1.12

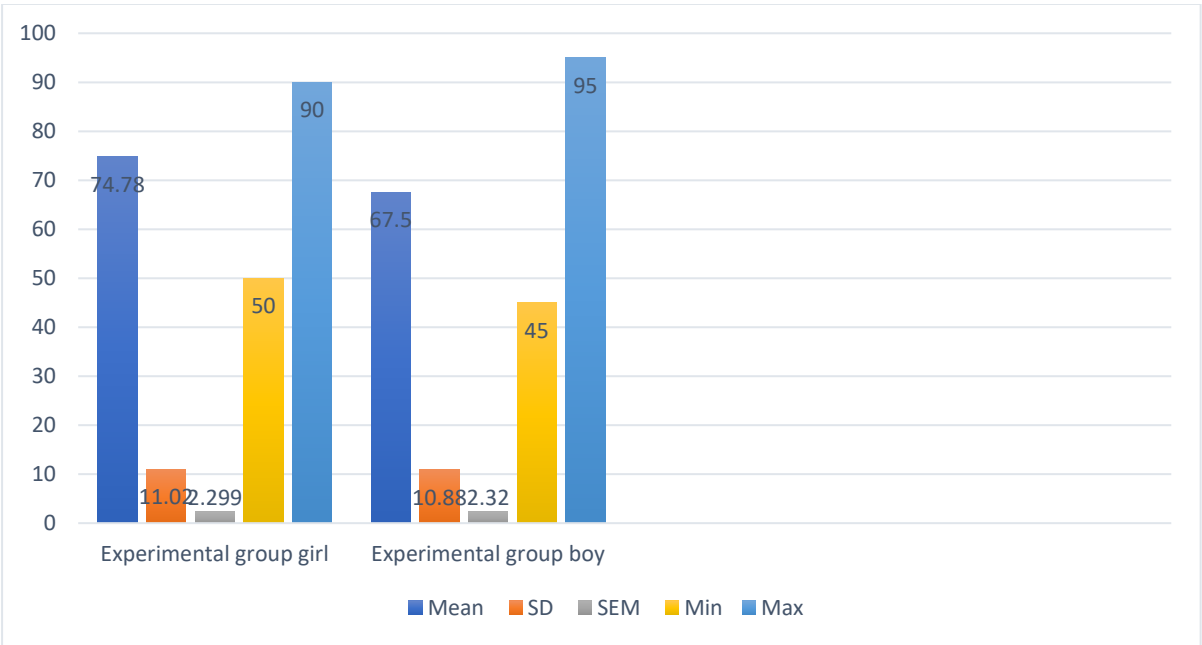


Figure – 4.1.6 Showing post- test score of experimental group girls and boys

Description:

It is seen, from above table and graph, that there are two groups in the post-test, one is Experimental group girls consist of 23 participants and another is Experimental group boys consist of 22 participants.

- The mean score of Experimental group girls (74.78) is approximately same as the mean of the scores of the Experimental group boys (67.50).
- Standard Error of Mean (SEM) of Experimental group girls (2.299) and Experimental group boys (2.320). So, real mean of Experimental group girls lies between $74.78 - 2.299 = 72.481$ to $74.78 + 2.299 = 77.079$ and real mean of Experimental group boys lies between $67.50 - 2.320 = 65.18$ to $67.50 + 2.320 = 69.82$
- Since the difference between minimum scores (50) and maximum scores (90) of Experimental group girls post-test (i.e., Range = $90 - 50 = 40$) is same as the difference between minimum scores (45) and maximum scores (95) of Experimental group boys post-test (i.e., Range = $95 - 45 = 50$). So, the mean of Experimental group girls' post-test is approximately same influenced by the extreme scores of the Experimental group boys' post-test.
- Since SD of Experimental group girls' post-test (11.02) is approximately same as SD of Experimental group boys' post-test (10.88) so, approximately same scores are concentrated the mean of Experimental group girls and Experimental group boys' post-test.

So, the researcher concludes that the Experimental group girls in post-test is shown approximately same performance on test in English reading comprehension ability as Experimental group boys' post-test.

Table-4.1.13 Showing t-test between Experimental group post-test scores girls and boys Inferential Statistics:

Group	Gender	N	Mean	SD	t-value (Independent Samples t-test)	Probability Level (sig. 2- tailed)
Experimental group	Girls	23	74.78	11.02	2.229	.031(significant at .05 level)
	Boys	22	67.50	10.88		

Table-4.1.13

Description:

Mean difference is $(74.78-67.50) = 7.28$ (high) & t-value is 2.229 and also sig. (2tailed) i.e., **P** value is $.031 < .05$ i.e., chosen α level of .05. So, the null hypothesis rejected at 5% level of significance.

As a result, it can be inferred that the means of the girls' and boys' scores (post-test) in the Experimental group are significantly different.

4.2 The analysis of qualitative data:

Among the study opportunities, the data gathered at the end of the interview with the students in the experimental group in the presented following the table:

Table 4.2.1 The way students answered the question of “How to apply mind mapping technique while reading?” was analyzed.

Themes	Codes	f	%	Respondent expressions
Planning	Determining target for future	18	40%	When we plan our future, we can set targets using mind mapping techniques.
	Planning for routine	34	76%	Mind mapping techniques help to create a routine of when to read a subject.
	Planning for project	29	64%	When we prepare a project, we can make it easier by using mind mapping techniques.
	Planning for presentation	24	53%	We use mind mapping techniques to memorize each point accurately during the presentation.
	Brain storming	12	27%	We use this technique to discuss and think about a subject in different ways.
	Planning for exam	23	51%	We plan to appear in examination using this technique in advance.
	Time planning	22	49%	Using this technique, we can read in each subject in time. Uses time correctly while reading.

Learning	Note taking	34	76%	We can draw mind maps on course topics and we can present a long note in one page.
	Providing the concentration	32	71%	While reading each subject, we create a mind map on each topic, which increases my concentration and we can remember for a long time.
	Preparation for exam	28	62%	We create mind maps on topics that seem hard or complicated for any competitive exam and class exam, which helps in my exam.
	Makes the abstract subject concrete.	29	64%	Using this technique, any abstract subject can easily become tangible to us.
	Decoding	33	73%	From the day we learned to use this technique, we were able to decode it properly in the classroom.
	Content summarizes	30	67%	We can summarize long detailed content using this technique.
	Strengthen what was learned and increase durability.	34	76%	We use a variety of symbols and pictures when creating mind maps, which makes the hard subject permanent and colorful to us. For this we use right and left hemisphere of the brain.
	Explain what I have learned	38	84%	When we find something hard, we create a mind map on it, which helps us to explain later.

Table 4.2.1

Interpretation:

According to table 4, two themes have been created based on the answers given by the students in this question such as, learning and planning. From the ‘planning’ theme researcher can see how the students have used mind map to read them determining target for future, planning for routine, planning for project, planning for presentation, brainstorming, planning for exam, and time planning. It is determined which respondents use for mind map in the theme of ‘learning’ for note taking, providing the concentration, preparing for exam, makes the abstract subject

concrete, decoding, content summarizes, strengthen what was learned and increase durability and explain what I have learned.

Table 4.2.2 The way students answered the question of “What are the benefits of using mind mapping technique to promote reading comprehension skill?” was analyzed.

Themes	Codes	f	%	Respondent expressions
Personal opinion	It's personal.	11	24%	One we can use in our personal daily lives. The task at hand can be done very easily by mapping it in your mind before doing any work in daily life.
	It develops creativity.	22	49%	Mind map we create using our own creativity. Everyone's map is created in a unique way. Different types of images, symbols are used here which develops creativity.
	It improves imagination.	27	60%	A strong keyword and image are used for each context. Using the image will develop our imagination power.
	Improves our visual perception.	18	40%	We employ graphic elements more than words here, and we use images to communicate what we've learnt.
	It can present practically in less time.	14	31%	Using color images and keywords can present anything in a very short time and learning has become fun for me.
Affective	It is funny.	38	84%	Taking notes sometimes we didn't know how to use mind maps was annoying to us. Thanks to mind map it has increased my interest in reading and it helps my brain to do multifaceted work.
	Increases interest	25	56%	Mind mapping is a new technique, every step of this technique is interesting to us and using the steps while reading increases our interest in reading.

	Increases attention	23	51%	Using this technique has greatly increased my focus on reading books.
	Improvements intrinsic motivation	35	78%	It has increased my motivation towards reading.
Cognitive	Ensures divergent thinking.	42	93%	Using this technique, we can read a subject in different ways and after reading it we can think of that subject in different ways.
	Use of right and left hemisphere for brain function.	38	84%	Mind map is a method where the right and left hemisphere of the brain is imprinted instead of memorizing information.
	Ensures for long-term memory.	45	100%	Page layout, thicker line and multicolor pen helps to transmit learning to long term memory. It ensures our permanent learning.
	Learning becomes meaningful.	45	100%	Reading became meaningful to us as a result of using the whole process. When we encounter mind maps, they are similar to traffic laws that we can grasp.
	Helps to remember.	36	80%	Mind map acts as a key when recalling. It opens the door to knowledge.
	Consider the content as a whole.	33	73%	It prevents us from creating 15-20 pages notes because with a mind map, we can present 15–20pages notes.
	Ensures associative learning.	31	69%	When creating a mind map, an association is established between the main topic, the sub topic and the other small topics that ensure our associated learning.
	Apply what was learned.	28	62%	Since we codify every piece of information in a way that is easy to remember and can be applied in the right place.

Table 4.2.2

Interpretation:

The researcher created 17 codes based on the information she got from this question. She created 3 themes based on those 17 codes, such as personal opinion, affective, cognitive. Student stated in the theme of ‘personal opinion’, benefit usage mind mapping technique for reading comprehension skill, such as improve imagination, it develops creativity, improves our visual perception, it can present practically in less time and it is personal. When researcher focus on ‘affective’ theme, she noticed how the mind map helps them in reading comprehension skill development, such as, increase interest, increase attention, it is funny activity and improvements of intrinsic motivation. ‘Cognitive’ theme helps them reading comprehension skill development like, ensures divergent thinking, use of right and left hemisphere for brain function, ensures for long-term memory, learning becomes meaningful, helps to remember, consider the content as a whole, ensures associative learning and apply what was learned.

Table 4.2.3 The way students answered the question of “What kind of problems have students faced while using mind mapping technique in reading comprehension skill development?” was analyzed.

Themes	Codes	f	%	Respondent expressions
Personal	Very difficult for brain.	3	7%	When I use my right and left hemisphere correctly to create a mind map, pressure falls on my brain.
	Difficult to understand.	5	11%	I don’t easily understand when you are saying how to make a mind map and teaching the process.
	Meaning of symbols is forgotten.	4	9%	The symbols that I used to create the mind map; I forget when I read the next time.
	Difficult to relate the subject.	2	4%	I can’t easily relate every point with mind map when I’m reading content.
	Not a good technique for reading.	2	4%	I think this technique is not a good technique for reading skill development.

	Difficult to create mind map.	8	18%	It is very difficult for me to create this map because I can't remember the exact number of processes to follow when creating a mind map.
Material	Every time pen, color pencil not available.	6	13%	I can't create a mind map even if I want to, when I don't have a color pen or pencil.
	Every time A4 page not available.	4	9%	A4 paper is not always available.

Table 4.2.3

Interpretation:

The researcher has divided the 2 themes that are encountered in using mind map in developing reading comprehension skill, they are 'personal' and 'material'. The problems that the students have personally faced, based on the data analysis that the researcher has found are discussed below.

Very difficult for brain, difficult to understand, meaning of symbols is forgotten, difficult to relate the subject, not a good technique for reading and difficult to create mind map. Material problems are like, every time pen, color, pencil not available and every time A4 page not available.

Table 4.2.4 The way students answered the question of "How to evaluate reading comprehension skill development processes using mind mapping?" was analyzed.

No.	Expressions	f
1.	I love to learn English subject using mind map.	23
2.	For me mind map is easiest method to read English.	34
3.	I prefer to study English using mind maps.	32
4.	A mind map makes me enjoy English subjects.	43
5.	To prepare a study review, each learner can use a mind map.	22
6.	I love to use mind maps to conduct lessons review.	24
7.	I prepare a mind map earlier reading English subject.	30
8.	I use a mind map to remember what the teachers are teaching.	29
9.	For the learning process, mind maps are more beneficial.	33

10.	Mind map makes learning simple and enjoyable.	31
11.	When I use mind maps, I can better my understanding of concepts and facts.	43
12.	It is more effective for teachers to educate utilising a mind map.	42
13.	I use a mind map to recall English grammar.	41
14.	When I use the mind map, I can easily recall the notes that the teachers teach.	34
15.	Mind map makes English subjects appealing to me.	37
16.	I use the mind map to assist me revise it.	35
17.	Multidimensional and structural thinking has improved.	43
18.	At first creating mind nap is difficult for me, then it became funny.	31
19.	My drawing skill has improved.	37
20.	At first it took me a long time to create a mind map, but gradually it took much less time.	45
21.	At first it took me a long time to use each topic related symbols of the subject, later it took much less time.	42
22.	At first the mind map was very small in size, later I was able to draw large size and I drew mind map across a page.	40
23.	When I had to write a lot, I would present this subject in mind map.	41
24.	While first considering the limited pattern, later more different image, symbols and keywords I can choose for the map.	34

Table 4.2.4

Interpretation:

When assessing the process of their development in terms of creating mind maps, learners indicate that while first they consider the limited pattern, later they use more different image, symbols and keywords they choose for the map, at first the mind map was very small in size, later they were able to draw large size and also drew mind map across a page, their drawing skill has improved. At first creating mind nap was difficult for them, then it became funny, multidimensional and structural thinking has improved, mind map helps them to revise it, when using a mind map, they can quickly remember the notes that teacher teach. They enjoy using mind maps to review lessons and at first it took them a long time to use each topic related symbols of the subject, later it took much less time etc.

4.3 Major findings

1. Mind mapping technique has significant effect over traditional method of teaching on reading comprehension skill in English language among class 8th students. It refers to mind mapping technique was useful method for acquiring reading comprehension skill in English language.
2. After adopting mind mapping as a tool for enhancing reading comprehension skills in English language, there is a substantial difference in results between girls and boys. Therefore, present investigator estimated that mind mapping technique is more effective in developing reading comprehension skill for girls' than boys' students in English language.
3. Mind mapping techniques would be used by 40% of learners to set their future goals.
4. 76% students said that they would use this technique to create a study routine.
5. 64% students answered that when they prepare a project, they want to make it easier by using mind mapping technique.
6. 53% students reported that they would use this technique when planning a presentation.
7. 27% students said that this technique helps brainstorming.
8. 51% of students opine that they would use this technique when planning about their exams.
9. 49% of students respond that they would use mind mapping techniques to plan what they would read at what time.
10. 76% students answered that they use this technique to receive notes.
11. 71% students said that when they create mind mapping on each topic while reading, it increases their concentration.
12. 62% students said that this technique helps them prepare for examination.
13. 64% students said that using this technique they can embody abstract matter.
14. 73% students said that using this technique they can easily decode any subject.
15. 67% students said that mind mapping technique help them to summarize content.
16. 76% students said that by using this technique they can remember anything for a long time.
17. 84% students opined that if they use mind mapping techniques while learning the subject, they can easily explain the subject.
18. 24% of students believe that this technique is completely personal as they use it for themselves.

19. 49% students said that this technique develops their creativity.
20. 60% students said that this technique can enhance students' imagination.
21. 40% students said that mind mapping techniques increased their ability to see.
22. 31% students opine that this technique was easy to use and take much less time to use.
23. 84% students respond that this technique was much more enjoyable.
24. 56% students believe that mind mapping increase their interest in reading.
25. 51% students said that this technique increased their concentration in reading and work.
26. 78% students respond that it helps to increase their inherent motivation.
27. 93% students reported that this mind mapping technique enhanced their divergent thinking.
28. 84% students said that by using mind mapping technique they can use their right and left side brains correctly.
29. 100% students reported that using this technique will increase their long- term memory.
30. 100% students said that learning has become meaningful with this technique.
31. 80% of students said that this technique helps them remember.
32. 73 % students answered that by using this technique they can remember the whole thing as a whole.
33. 69% students said that this technique helps them to increase associative learning.
34. 62% students responded that by using this technique they can put their learning into practice.
35. 7% students answered that this technique is very difficult for the brain.
36. 11% students reported that they did not understand this technique properly for using.
37. 9% students opined that they forgot all the symbols used in this technique.
38. 4% students responded that it is very difficult for them to relate to this technique.
39. 4% students said this technique is not a good technique to study.
40. 18% students answered that it was very difficult to create this technique.

CHAPTER V

DISCUSSION AND CONCLUSION

5.1 Discussion and Conclusion

5.2 Educational Implications of the Study

5.3 Limitations of the Study

5.4 Suggestions for Further Research

References

CHAPTER-V

DISCUSSION AND CONCLUSION

5.1 Discussion and conclusion

Present researcher concluded that the means of the scores (post-test) in the Experimental and Control groups are significantly different. The mean of the scores of the experimental group (71.22) is much higher than the mean score of control group (55.67). Similar to this conclusion, Phi and Nhan (2020) concluded that, “there was a significant difference between the two classes.” In addition, the post-test mean score of experimental class (66.67) is much higher than the mean score of control group (59.68). It implies that mind maps technique has a significant effect on students reading skill that help them achieved higher scores on the post-test. According to Cahyani (2012), mind mapping improves pupils' reading comprehension skill. Students could simply determine the implicit and express details information about the text, determine the text's meaning, determine the text's reference and determine the most plan of the text.

The findings of this study are consistent with prior research, indicating that mind mapping can improve pupils' reading abilities (Maestas & Croll, 1985; Deesri, 2002; Singtui, 2008). However, it was noted that only 60 percent of the participants in this study increased their reading comprehension skills while other 22.8 percent did not improve created it attention-grabbing to unfold why it had been the case. It is frequently said that pupils weak reading abilities made they find it challenging to engage in higher-level reading activities such as summarizing reading passages. Students' deficiencies in a variety of areas, such as vocabularies, grammatical data, and locating major concepts, will all cause problems. Siriphanich and Laohawiriyanon (2010) determined that "The English reading comprehension post-test mean score of students was higher than the pre-test mean score at the 0.05 level of significance".

Studies made by Rizqiya (2013), Saori (2020), and Mohaidat (2018) supported the findings that mind mapping technique improved students reading comprehension skill. Phantharakphong & Pothitha (2014) also noted that “the use of concept maps could enhance the students’ English reading comprehension”.

The findings of the present study were supported by Yetkiner (2011), Aydin (2009) and Aslan (2006). They noticed that using mind mapping technique, students can gain a lot of information and they can maintain it permanently. This finding of the study partially supported by the study

of Buzan and Buzan (2007) that “Mind mapping ensures you to remember by integrating what was told in books and courses to your brain friendly.”

Methods of learning and recording information must become effective in order for learning to become efficient and lasting. Apart from the fact that the way of recording data varies, the fact that mind maps are personal, it will boost their usefulness. Individuals who create a mind map based on their own preliminary information, interests, and wishes become active participants in the process of learning by generating their own fact.

Learners cite the benefits of mind maps as increasing long-term memory, activating two sides of the brain, assuring retention and skilled learning, enabling contemplation, becoming a effective variation of presentation that can be completed in a very short time, being personal, and being a humorous way of stimulating benefit, concentration, and motivation.

These findings similar to the statement of Öztürk (2005), who stated that in this way the information can be completely converted into visual content and since a variety of colour pens are used here, the information becomes more permanent and students can remember faster. Colours, images and keywords have basic components of mind map. These help our brain to quickly collect and store any information.

According to Goodnough and Woods (2002), students have a positive attitude toward mind mapping as they find it amusing and engaging, and enjoy using it. Steyn and Boer (1998) concluded that students use mind mapping techniques with great pleasure and they can easily remember any concept they have learned.

Students in the present study mentioned that creating a mind map is difficult for the brain, difficult for others to grasp because it's subjective, forgetting the meanings given to some signs, not having an actual capacity to draw, and not always being able to obtain coloured pens and thus the needed images.

Students in the present study stated that they began to usage graphics more, they began to distinguish two symbols and presentation structures, their drawing, invention, and artistic thinking ability has increased. They began to utilise a variety of colours and prepared in an abnormally short period of time. They made it easier to set symbols and branch out the information evaluating their development processes while preparing mind maps.

People construct what they need to learn in their thoughts while creating a mind map by using words and symbols and connecting them together. This confirm that learning becomes

personal, skilled, and memorised, allowing what has been taught to be remembered. As observed in the study's conclusion, there are a huge number of student achievement that Create a mind map guarantee. In this regard, students are taught mind maps at various levels, and it is possible to ensure that they use them in class for a number of purposes, including taking notes, summarising, evaluating, establishing their goals, and expressing themselves. As a result, attributes like creative thinking, expanded imagination, and holistic reading are developed while ensuring that students use each hemisphere of their brain actively. Furthermore, studying with a system that is radically distinct from traditional learning methods would make learning more enjoyable. On the other hand, with today's modern technology, a mind map can easily be created using a laptop.

5.2 Educational implications of the study

Students used learning methods such linking, developing, related, producing, meaning schemes, and building knowledge bases to represent their learning process in addition to using mind mapping to understand their own learning processes.

Because mind mapping is the portfolio of assessment, even when summative evaluation is intended to determine final grade, it fits perfectly within the philosophy of perpetual evaluation.

One result is that teachers should mix up their mapping exercises to better match students' preferred learning styles. Although we do not encourage teachers to cater to specific learning "styles," research does show that using a variety of instructional strategies helps increase student interest and engagement, therefore we advise using a variety of activities whenever possible.

Teachers should give pupils a choice of mapping activity options. Instructors would give students control over their learning by giving them the option to complete the map alone outside of class, alone in class, or as a group in class. This in turn should increase engagement, as anticipated by the empowerment component of the MUSIC model. Our knowledge gained from being both students and instructors leads us to believe that sometimes students may choose activities that are not the most conducive to their learning since they are preoccupied with other academic objectives.

5.2.1 Designing a curriculum

Mind mapping are useful tools for highlighting the organisation of knowledge so that students can access and assimilate it more readily. The curriculum should be specified, based on

constructivist concepts, and encourage problem- and student-centered, as well as holistic style of learning techniques, according to mind mapping. The creation of mind maps for all subjects in the classroom should be encouraged by policymakers and educators. In order to challenge their methods of thinking, students will uncover the themes they wish to emphasise and organise their information in new ways than in a standard course plan.

Students can find ideas from the mapping curriculum that are crucial to more than one field, which aids in breaking down traditional disciplinary barriers. Teachers can build a map that includes teaching strategies, time and task allocations for different parts of the course, and visually explains the conceptual relationships used for the objectives in any course. Mind maps curriculum aid students and teachers in choosing appropriate instructional materials. The curriculum designer may support attempts to re-conceptualize the course material to serve as a starting point for student debate and to summarise key course concepts, which improves the potential to give students meaningful learning experiences by combining concepts. Such a curriculum can assist in the development of courses that are rationally scheduled, well-integrated, and have continuity between old and new knowledge. As a result, educators may create lessons that are instructive, pedagogically sound, and engaging for students. Mind maps assist teachers in illustrating the value of a particular topic and how it links to theoretical and practical problems that are present both within and outside of the field.

5.2.2 Instructional Design

The researcher has isolated the following principles of instructional design for knowledge construction.

1. It will provide multiple representations of reality;
2. It represents the natural complexity of the real world;
3. Focus on knowledge construction, not reproduction;
4. Present authentic tasks (contextualizing rather than abstracting instruction):
5. Provide real-world, case-based learning environments, rather than pre-determined instructional sequences;
6. Foster reflective practice;
7. Enable context and content dependent knowledge construction:

8. Support collaborative construction of knowledge through social negotiation.

5.2.3 Mind Mapping in Teacher Education Programme

The introduction of idea maps into formal education is the biggest obstacle. Before using mind mapping tools in typical classroom settings, teachers must become comfortable with their use. As a result, it must involve teachers and administrators in training programmes to comprehend new educational paradigms. Before the New Model can be implemented in schools, there is a massive amount of teacher education work that needs to be done. The idea behind mind maps should be studied by teacher educators, and such a model should be used in teacher education programmes. Teachers' ought to collaborate to improve some of the basic mind maps addressing educational concepts. The status of technology and pedagogical understanding at the moment is mind mapping. This is beneficial for education in schools, colleges, and universities.

5.2.4 Mind Mapping Lesson Plan

The maps were very helpful to the study's researcher in creating course schedules. By employing a lesson plan, the researcher found teaching mind maps to be easier and encountered students who had a more thorough comprehension of the material he had prepared to teach, which reduced the chance of sequencing mistakes. The mind mapping lesson plan uses the following set of elements, which is helpful for regular classroom instruction.

5.2.5 Open Learning Distance Education

Mind mapping is a new technology that is gaining popularity in academic settings all around the world. The researcher came to the conclusion that open correspondence and distance learning should be designed with the goal of educating students who are not physically "on site" in a traditional classroom or campus. This realisation led to the development of open correspondence and distance learning's pedagogy, technology, and instructional system. When the information source and the learners are separated by time, distance, or both, it has been described as a process to establish and offer access to learning. In other words, remote learning is the process of designing a similar educational experience for the student outside of the classroom that best suits their needs. A hybrid or blended course of study is one that combines open, correspondence, and distance learning with online presence requirements for any purpose (including taking exams). Through the use of mind mapping software, remote learning will get

more recognition for its capacity to offer students worldwide individualised attention and communication.

5.2.6 Online Mind Mapping Software

Online mind mapping is especially important for correspondence and distance learning. The programme will be used to produce diagrams showing the connections between concepts, ideas, and other pieces of data. Even though many publishers have created online mind maps, it is still challenging to visualise, edit, and collaborate on ideas online. The current study will assist software developers in re-evaluating the best ways to visualise, edit, and collaborate in real time with students throughout the globe.

5.2.7 Mind Mapping for Evaluation

While changing assessment procedures is a problem, the researcher found that the learners themselves evaluated their maps as a type of formative and diagnostic evaluation in this study. Currently, students and teachers place a lot of emphasis on multiple-choice exams that primarily assess rote memorization and information recall, but in performance-based exams, students are required to show their understanding by applying concepts to solve novel problems, as well as to revise and learn new concepts. There is plenty of opportunity for learning specific facts and procedures under the New Model, but these should now be taught in the context of strong conceptual frameworks. With the help of the compare mind maps tool, it is possible to compare student-made mind maps to expert mind maps for a certain subject. All conceptual similarities and differences are highlighted in colour. The score in this assessment method represents the students' real comprehension and subsequent knowledge organisation. Because it is the portfolio of assessment, the mind map fits perfectly within the philosophy of permanent evaluation, even when summative evaluation is intended to determine final grade.

5.3 Limitations of the study

- The research work is restricted to 90 students of class VIII only.
- From various ICT based techniques, only mind mapping technique has taken for investigation.
- Out of many mind mapping techniques, only one technique (hand- made mind maps) has undertaken for the study.

- The researcher has selected only English reading comprehension as experimental subject from class VIII.
- Out of many CBSE, ICSE, WBBSE and other state Boards run schools, only one WBBSE affiliated secondary school of Medinipur West district has taken for experiment.

5.4 Suggestions for further research:

The present researcher recommends the following investigations:

- Effect of mind maps as constructivist/collaborative approach for social thinking on inclusive education may be conducted for investigation. Effect of creativity on long term knowledge movement, and reflective thinking of learners on map construction is a useful study for the present time.
- Field based collaboration and cooperation for effective preparation of in-service and pre-service teachers through mind map instructions.
- Mind map as a constructivist approach to study students' qualitative aspects like: attitude, perception and achievement during and at the end of the instructions.
- Problems and concerns with assessment by mind map are a new topic to look into in the current circumstances.
- Effect of mind map on students' critical thinking skills can be compared with method of instruction needs further studies for investigation. Studies may be conducted to explore the effect of mind map on achievement and retention among learning disabled students. It also needs to observe the effect of mind mapping technique on different age level, intelligence level, creativity process, and process skill of the learners.
- The effect of mind mapping on open, distance and correspondence education activities can be investigated. Different staff development programmes starting from elementary to university levels should explore by mind map programmes and their result should be investigated for welfare purposes.
- A study may be performed to introduce a mind map for organised conceptual framework for groups to explain language of the participants; this produces a graphic or pictorial product that simultaneously shows all key ideas and their interconnections; this frequently improves group or organisational cohesiveness and morale.
- Using collaborative mind mapping software on learning goals, objectives and assessment process is a problem needs investigation.

- Mind mapping is a fantastically simple, easy-to-use, and effective approach to engage kids in the learning process. It's especially beneficial for teachers who work with pupils from various language backgrounds.
- Future studies should allow participants to build many mind maps in order to gain competency with the technique. This would allow them to progress from novice to master in the production of mind maps, allowing them to emphasis critical thinking at the end.

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SUMMARY

Introduction:

To make the learning process successful, four types of important skills are required: reading, writing, speaking and listening skills. Reading skills are involved with the entire learning process. Reading is a must for successful learning. An in-depth study of the students who dropped out of school shows that they fail in reading first. So, reading is an important part of the whole educational process.

Reading is a process that helps to understand the meaning of written text. Reading skills create a good communication between the reader and the writer. Reading and comprehension are two sides of the same coin. There are various problems in reading comprehension among students. This problem is more common when students read an English Textbook, Bengali speaking students do not understand the meaning of the text. Students get more hindrances when they find a difficult word or new word to read. As the text is too big, therefore, sometimes they cannot understand the meaning of the text. Teaching English as a second language is a complex task. To learn English, one has to create a creative environment, increase the motivation and interest of the students towards reading.

Researchers have found that mind mapping techniques help students to read, learn and understand English. Reading comprehension levels can be improved using this technique (Kim & Kim, 2012). Ausubel (1968) noticed that learning depends on the relationship between the different content, the prior knowledge of the content, the relationship between the stimulus and the response and the meaning of the subject matter to the students. Nashwati (2003) observed that presenting any content in an organized way will make it understandable, significant to the learners and will be in a position to link to different topics.

Buzan and Buzan (1996) observed mind mapping as a visual organizing method by which a large amount of information can be stored together in the brain. It is an effective learning technique that helps students to organize note taking in an organized way and remember them easily (Tucker, Armstrong, & Massad, 2010). Holzman (2004) mentioned that this technique speeds up the learning of slow learners and increases their achievement. Buzan (2006) observed that this technique allows students to accurately sequence different content, which enhances their decision-making, problem-solving ability, and improves reading skills.

Rational of the study:

Reading is an important component of teaching-learning process, particularly for learners who must read to obtain information from school text books, research papers, and other sources. Furthermore, higher-level students must read a wider range of complex reference books. Poor students, according to Nupong (1998), are unable to comprehend the meaning of some texts, as well as the major idea and the story they read in the preceding section. Toi (2009) showed that using mind maps instead of lists could help children remember words more efficiently. Cain (2001) found that mind mapping improved concentration, kept students extended lengths of time on work, enhanced independence, and improved questioning and answering during class discussions. According to Durant (1993), mind maps aid in the development of pupils' ability to perceive and comprehend the content of the message. Edward and Cooper (2010), mind mapping is the most appropriate means of entering, storing, and retrieving material from the brain.

Many studies have examined the Mind mapping technique are used to help students enhance their reading comprehension skills at all levels of education, from basic to higher education. From the above discussion it was found that several studies were done in the areas of mind mapping as well as in the areas of reading comprehension independently. But in respect of mind mapping to improve reading comprehension skill sufficient research were either not held or are not available to the present researcher even after a long review of related literatures. The present investigator did not find any Indian research study in this particular topic. Therefore, the present researcher found a knowledge gap in the mentioned research area and formulated her present research title.

Statement of the study:

Keeping the above discussion in mind, the present researcher has proposed a title as “Promoting reading comprehension skill through mind mapping technique”.

Research questions of the study:

- I. How to apply mind mapping technique while reading?
- II. What are the benefits of using mind mapping technique to promote reading comprehension skill?

III. What kind of problems have students faced while using mind mapping technique in reading comprehension skill development?

IV. How to evaluate reading comprehension skill development processes using mind mapping?

Objectives of the study:

The following are the study's objectives:

- I. To determine the usefulness of mind mapping as a reading strategy.
- II. To find out the benefits of usage mind mapping technique for reading comprehension skill
- III. To find out the difficulties that learners experienced while using mind mapping technique in reading comprehension skill development.
- IV. To evaluate reading comprehension skill development processes using mind mapping.

Hypotheses:

Hypothesis is a tentative solution of the research problem. It is very important for quantitative research. The hypotheses of this research are formulated as follows:

- I. **H₀₁:** There are no significant difference between students' performance while teaching in traditional method over mind mapping technique.
- II. **H₀₂:** There are no significant difference between performance of students after teaching through mind mapping technique over traditional method of teaching on the basis of their gender.

Operational definitions of the key terms used

A. Mind Mapping Technique:

This term integrates of 2 words, 'mind' and 'mapping'. Oxford Dictionary (2015) define, "The element of a person that enables to be aware of the world and their experiences, to think, and to feel". Oxford Dictionary (2015) defined that mapping is a noun form. Derived from map, it means "A diagram of collection of data showing the spatial arrangement or distribution of something over an area". Mind mapping is a structural organising thinking tool which organise our ideas, concept, tasks and daily routine.

B. Reading Comprehension Skill: Comprehension is the understanding and interpretation of what is read. To be ready to accurately perceive written language, kids ought to be ready to (1) decipher what they scan; (2) build connections between what they read and what they already know; and (3) think deeply about what they have read”.

C. Promoting: Support or actively encourage (a cause, venture, etc.); further the progress of some regulation is still required to promote.

Delimitations of the study:

- Only 90 samples were used for collection of data.
- The samples were selected from Medinipur District.
- Samples selection was done by using purposive sampling technique.
- Researcher only used semi-structured interview technique for qualitative data collection.

Population and Sample:

For the present research the researcher has to determine the population for data collection. The study's population was determined by the researcher from the secondary level learners of West Bengal. In the recent study, the researcher followed the purposive sampling method and the class 8th standard students from Bhagwanchak Patiram Sikshaniketan was purposively selected for the experiment. In this study 90 students were included in the sampling group. Samples are chosen based on teacher's recommendation and breaks into two groups: the Experimental Group named as Group I, and the Control Group named as Group II. Each group has 45 students. The experimental group received instruction using the mind mapping technique, while the control group received instruction using the usual way.

Research design:

The aim of this study is to promote students' reading comprehension skill and how to improve students' ability to read English using mind mapping as a technique. Researcher used Sequential Explanatory Mixed Method Research Design which is a combination of Qualitative and Quantitative Method. The purpose of this two- phase explanatory mixed method study will be to obtain statistical, quantitative results from a sample and then follow- up with a few individuals to probe or explore those results in more depth. In this study the researcher used quasi-experimental study for quantitative data collection and used interview technique for qualitative data collection.

Here the researcher used Pre-Test Post-Test Non- Equivalent Quasi Experimental Research Design.

Research variables used in the present study:

In the present study three important types of variables were identified, these were:

- D. Independent variable:** Independent variable was Traditional Method of Teaching and Mind mapping technique.
- E. Dependent variable:** Dependent variable was reading comprehension skill.
- F. Intervening variables and their controlling:** Some variables act directly upon dependent variables, like nature of the study, teacher's competencies, physical and academic environment, long time period etc, which are not measured directly. The researcher has tried to her best to keep away such variables and their influence on dependent variables in experimental situation. These were statistically controlled by the researcher.

Research instrument:

A. Rubric:

Rubrics used in a variety of ways to assess students' reading comprehension. The Rubrics, as they are understood to be readable, help to facilitate instructional design and distribution. Rubric adapted from David P. Harris (2007) book of ' Testing English as A Second Language'. Researcher modified rubric based on research goals in collaboration with guide. The rubric has been used to assess pupils' performance. Researchers have used this tool to learn their reading skills in both pre-test and post-test. Students who can decipher English effectively received a maximum 100-point score, while those who can decipher English poorly receive a 40-point score.

- B. Interview:** Here the researcher uses semi-structured interview technique to get information from the interviewee. Extensive opening questions used in this study to provide more relevant information about research question (Creswell, 2008). The researcher collected in-depth data from the participants through interviews. The whole interview process was recorded.

Data Analysis

- A. **Analysis of quantitative data:** The researcher analysed the data gained from pre-test and post test scores to analyse the achievement. Researcher used mean, standard deviation and 't'- test to carry out quantitative data analysis.
- B. **Analysis of qualitative data:** Collected data in the form of keynotes and audio recordings, usually transcribed into written form for closure study, reading the transcript again one by one and very carefully in line by line. Researcher uses thematic analysis method for qualitative data analysis. Erden (2017) explained that "in qualitative researches the process performed basically is to gather similar data within the frame of certain concepts (codes) and themes and to interpret them by organizing them in a form that reader can comprehend." Codes and themes for this purpose are determined based on student feedback when researching content is analysed. After transcribing the data obtained through interviews to verify study reliability, it was coded independently by another researcher and matched to see if the coding created by both was consistent.

Major findings:

1. Mind mapping technique has significant effect over traditional method of teaching on reading comprehension skill in English language among class 8th students. It refers to mind mapping technique was useful method for acquiring reading comprehension skill in English language.
2. After adopting mind mapping as a tool for enhancing reading comprehension skills in English language, there is a substantial difference in results between girls and boys. Therefore, present investigator estimated that mind mapping technique is more effective in developing reading comprehension skill for girls' than boys' students in English language.
3. Mind mapping techniques would be used by 40% of learners to set their future goals.
4. 76% students said that they would use this technique to create a study routine.
5. 64% students answered that when they prepare a project, they want to make it easier by using mind mapping technique.
6. 53% students reported that they would use this technique when planning a presentation.
7. 27% students said that this technique helps brainstorming.

8. 51% of students opine that they would use this technique when planning about their exams.
9. 49% of students respond that they would use mind mapping techniques to plan what they would read at what time.
10. 76% students answered that they use this technique to receive notes.
11. 71% students said that when they create mind mapping on each topic while reading, it increases their concentration.
12. 62% students said that this technique helps them prepare for examination.
13. 64% students said that using this technique they can embody abstract matter.
14. 73% students said that using this technique they can easily decode any subject.
15. 67% students said that mind mapping technique help them to summarize content.
16. 76% students said that by using this technique they can remember anything for a long time.
17. 84% students opined that if they use mind mapping techniques while learning the subject, they can easily explain the subject.
18. 24% of students believe that this technique is completely personal as they use it for themselves.
19. 49% students said that this technique develops their creativity.
20. 60% students said that this technique can enhance students' imagination.
21. 40% students said that mind mapping techniques increased their ability to see.
22. 31% students opine that this technique was easy to use and take much less time to use.
23. 84% students respond that this technique was much more enjoyable.
24. 56% students believe that mind mapping increase their interest in reading.
25. 51% students said that this technique increased their concentration in reading and work.
26. 78% students respond that it helps to increase their inherent motivation.
27. 93% students reported that this mind mapping technique enhanced their divergent thinking.
28. 84% students said that by using mind mapping technique they can use their right and left side brains correctly.
29. 100% students reported that using this technique will increase their long- term memory.
30. 100% students said that learning has become meaningful with this technique.

31. 80% of students said that this technique helps them remember.
32. 73 % students answered that by using this technique they can remember the whole thing as a whole.
33. 69% students said that this technique helps them to increase associative learning.
34. 62% students responded that by using this technique they can put their learning into practice.
35. 7% students answered that this technique is very difficult for the brain.
36. 11% students reported that they did not understand this technique properly for using.
37. 9% students opined that they forgot all the symbols used in this technique.
38. 4% students responded that it is very difficult for them to relate to this technique.
39. 4% students said this technique is not a good technique to study.
40. 18% students answered that it was very difficult to create this technique.

Discussion and conclusion:

Present researcher concluded that the means of the scores (post-test) in the Experimental and Control groups are significantly different. The mean of the scores of the experimental group (71.22) is much higher than the mean score of control group (55.67). Similar to this conclusion, Phi and Nhan (2020) concluded that, “there was a significant difference between the two classes.” In addition, the post-test mean score of experimental class (66.67) is much higher than the mean score of control group (59.68). It implies that mind maps technique has a significant effect on students reading skill that help them achieved higher scores on the post-test. According to Cahyani (2012), mind mapping improves pupils' reading comprehension skill. Students could simply determine the implicit and express details information about the text, determine the text's meaning, determine the text's reference and determine the most plan of the text. The findings of this study are consistent with prior research, indicating that mind mapping can improve pupils' reading abilities (Maestas & Croll, 1985; Deesri, 2002; Singtui, 2008). However, it was noted that only 60 percent of the participants in this study increased their reading comprehension skills while other 22.8 percent did not improve created it attention-grabbing to unfold why it had been the case. It is frequently said that pupils weak reading abilities made they find it challenging to engage in higher-level reading activities such as summarizing reading passages. Students' deficiencies in a variety of areas, such as vocabularies, grammatical data, and locating major concepts, will all cause problems. Siriphanich and Laohawiriyanon (2010) determined that "The English reading comprehension post-test mean score of students was higher than the pre-test mean score at the 0.05 level of significance".

APPENDIX-I

RUBRIC

Level	Score	Indicators
COMPREHENSION	25	Understand the subject with none difficulties.
	20	Understand most of the topic, there are some repetitions.
	15	Understand only a little about the topic, there are many repetitions.
	10	Understand too little about the topic.
FLUENCY	25	Read fluently, no significant pause.
	20	Read well enough, pause here and there.
	15	Read diffluent, too many pauses.
	10	Read unclearly.
VOCABULARY	25	Use key diction, supporting diction, additional.
	20	Use supporting diction and additional diction.
	15	Use supporting diction.
	10	There is no key diction, supporting diction and additional diction.
PRONUNCIATION	25	The pronunciation is very clear and easily understood.
	20	Easily understood the word. Despite, the influence of mother tongue can be detected.
	15	The pronunciation is not really clear, but it can be understood by the listener.
	10	The pronunciation is not clear.

APPENDIX-II

Semi-structured interview questions for mind mapping

1. Have you ever heard detected regarding mind mapping strategy before?
2. Will mind mapping strategy improve your reading ability?
3. Did you face any obstacles in mistreatment mind mapping strategy?
4. What are the difficulties you long-faced in reading English?
5. However does one overcome your reading problem?
6. What are your resolution to alternative students who still troublesome to specific their reading?
7. Did you summarize the content in text using this strategy?
8. Did this strategy help you prepare for the examination?
9. What has helped to increase your motivation in this strategy?
10. Did this strategy help you plan for future?
11. What has helped to increase your creativity?
12. As a result of using this strategy, can you use your both side brain properly?
13. Have you faced any problems while using it?
14. Is there any stress on your brain while using this strategy?

APPENDIX-III

Topic for pre-test

Instruction:

- 1. Researcher uses this story for pre-test.**
- 2. Researcher tells this story in front of students.**
- 3. Researcher gives instruction for the students to write the important point based on the story that researcher tells.**
- 4. Researcher gives few minutes for the students to prepare their selves before they do English reading test.**
- 5. Researcher gives 2 or 3 minutes for the students to deliver their mind idea based on the story.**

A King's Tale

(A Popular British Legend)

Many hundreds of years ago, England was ruled by a king called Uther Pendragon. The king, who was friend and protector to all his people, was fair to everyone. The people of Britain lived in peace and happiness, tending their flocks and tilling their fields. King Uther- Pendragon had married the beautiful Lady Igraine, and had a son. The child was the heir to the royal throne.

The king and the queen died soon after the baby boy was born. It was a difficult time. Many of the king's opponents were looking to seize the throne. King Uther Pendragon had two wise counsellors-Merlin, a prophet and a magician, and the brave knight, Sir Ulfius. They were greatly trusted by the royal family. When the king and the queen were no more, the two counsellors met Sir Ector the Trustworthy, a loyal subject of the king, on a cold and windy midnight. They placed in his hands a baby wrapped in a scarlet cloak. Merlin, "We order you and your wife to bring up this child as though he were your own son."

"The boy is to be called Arthur," Sir Ulfius said. Sir Ector, being a true knight, asked no questions and promised to obey his late king's counsellors.

As Merlin and Ulfius had feared, trouble broke out in Britain after the passing away of the king. The barons were fighting among themselves and plotting to capture the throne. Britain was in the grip of lawlessness. Travelers were regularly robbed. The peasants were unhappy.

APPENDIX-IV

Topic for post-test

Instruction:

- 6. Researcher uses this story for post-test.**
- 7. Researcher tells this story in front of students.**
- 8. Researcher gives instruction for the students to write the important point based on the story that researcher tells.**
- 9. Researcher gives few minutes for the students to make mind mapping method based on their mind point.**
- 10. Researcher gives 2 or 3 minutes for the students to presents their mind idea based on the story that they listen.**

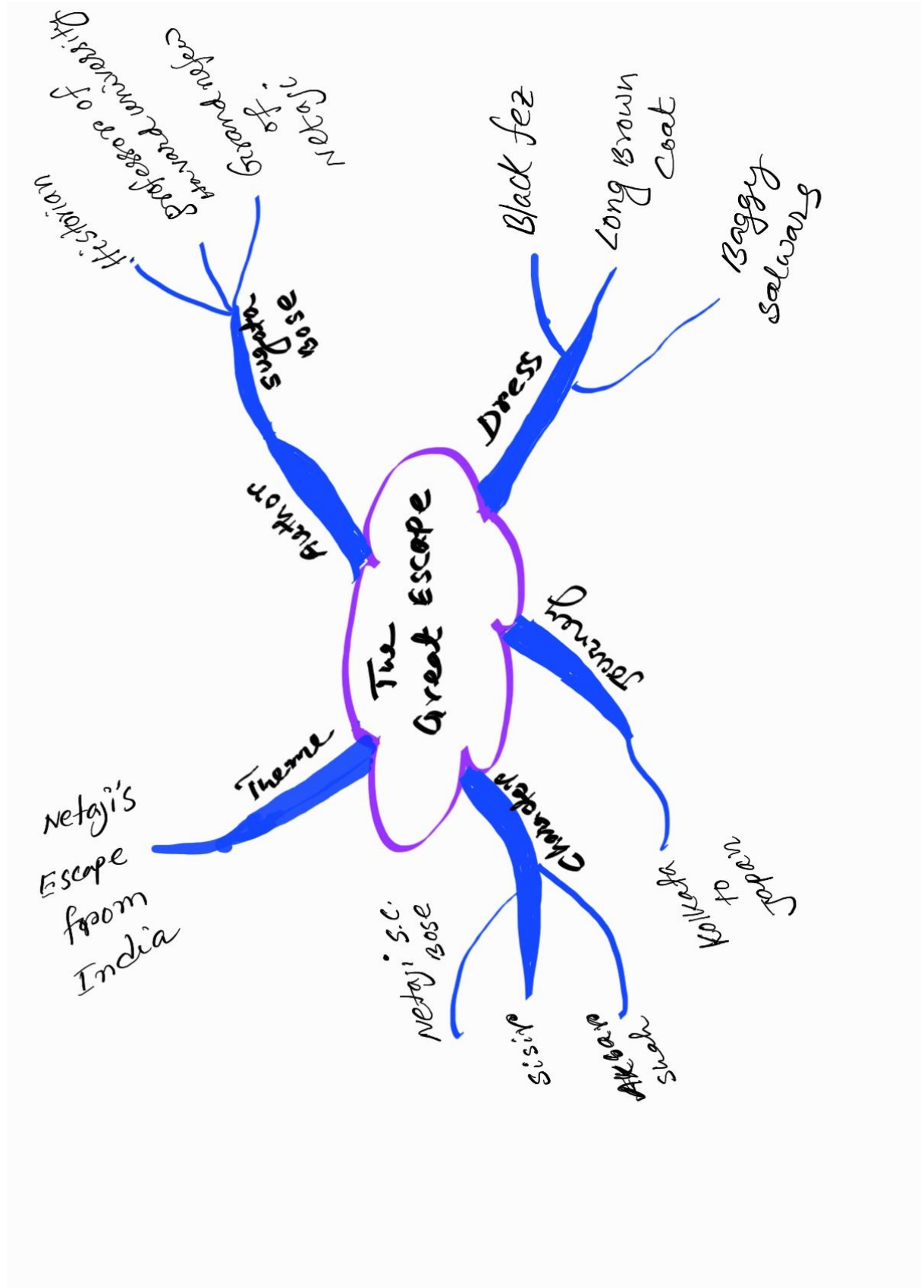
The great escape

Sugata Bose

Looking pale and thin, with a bushy half-grown beard, Subhas was reclining on his pillows when Sisir, his nephew, entered Subhas's bedroom that December afternoon. Subhas made him sit to his right on the bed. Looking intensely at Sisir, he said, "Can you do some work for me?" Sisir nodded. The task, as it turned out, was to help plan and carry out Subhas's escape from India. Sisir would have to drive his uncle, in the dead of the night, to a railway station far away from Calcutta. From his uncle's residence at Elgin Road, Sisir walked back that night to his own house at 1, Woodburn Park in a state of wonder and subdued excitement. The police were keeping watch on Subhas's house. Though it was normal for a nephew to visit an ailing uncle, Subhas had an additional excuse for meeting his nephew. Sisir was good at operating the radio. He helped Subhas listen to foreign broadcasts. Subhas and Sisir discussed various means of escape. Finally, they decided to drive out, in the most natural fashion, through the main gate. Sisir owned a German car called the Wanderer, which he and Subhas chose for their journey.

APPENDIX-V

Mind map drawn by researcher



APPENDIX-VI

Certificate from Head of Institution

BHAGWANCHAK PATIRAM SIKSHANIKETAN

(RECOGNISED HIGHER SECONDARY SCHOOL)

Estd:- 1950, Index No:- L4-004, H.S. Code- 205982, DISE Code-19202910702

P.O- SATPOTA, BLOCK- DASPUR-II, DIST- PASCHIM MEDINIPUR, PIN- 721153

To whom my concern

Certified That Miss Souravi Ata collected data from class VIII students of school for PhD research work.

I found that her study is very interesting in case of teachers as well as the learners. I wish her all success in life.



Teacher-in-charge
Bhagwanchak Patiram Sikshaniketan
P.O.-Satpota, Dist.-Paschim Medinipur

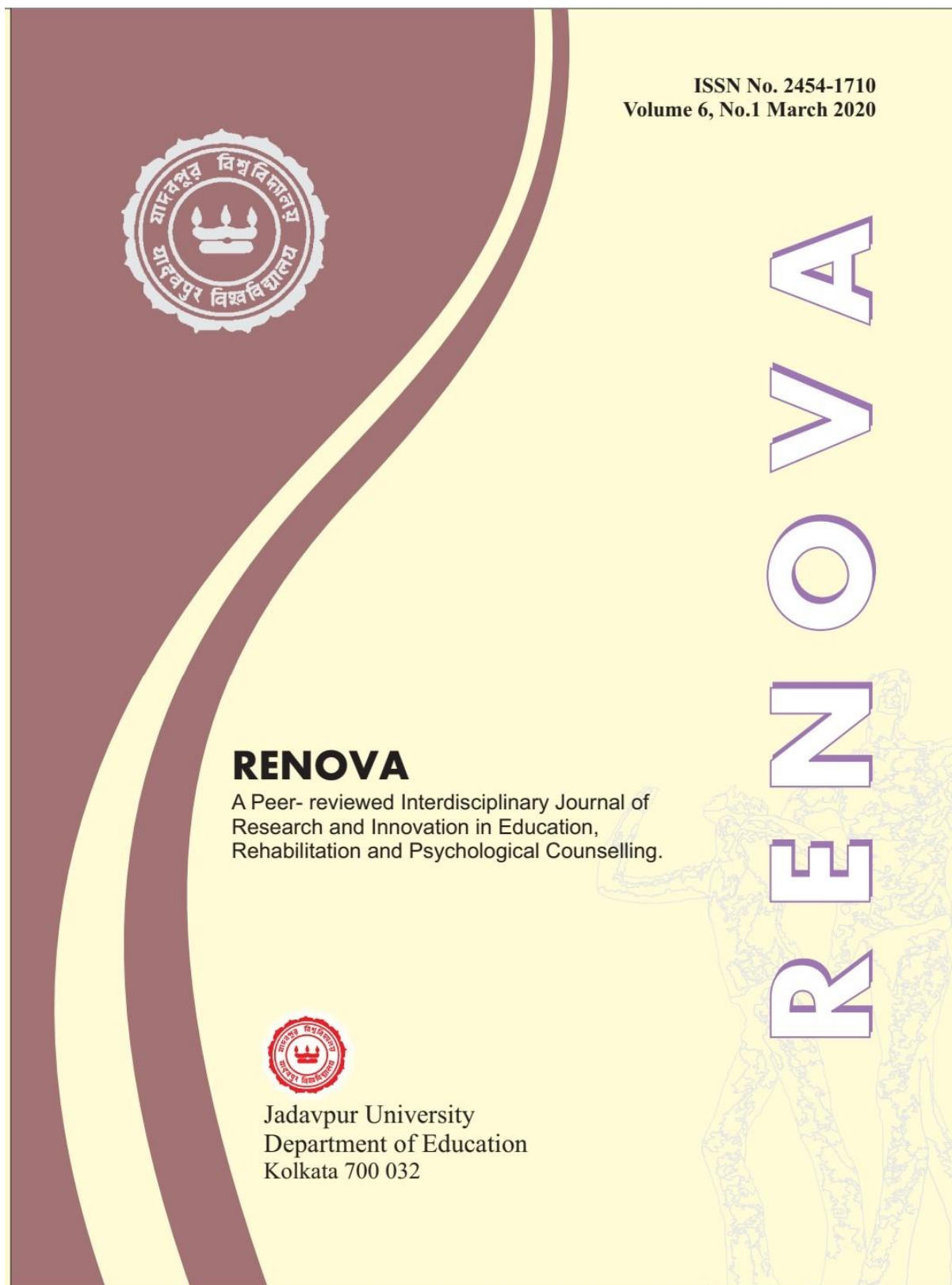
APPENDIX-VII

Seminar presentation certificate



APPENDIX-VIII

Published Paper 1



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MIND MAPPING AS A STRATEGY FOR ENHANCING ESSAY WRITING SKILLS

Souravi Ata*

ABSTRACT: *This study examines the issue of essay writing of students in education field. The main focus of this research is to bring improvement in their essay writing skills. Essay writing is critical to academic success; usually, an essay is a piece of writing that systematically analyzes and evaluates a topic or issue. Mind mapping is one of the versatile tools that help to break down the topics into manageable chunks, fire up the brain, and boost creativity. This study focuses on how mind mapping was effectively used as a strategy to support and develop students' writing skills. Result implies that the students could use mind mapping to improve writing ability as it can help them to generate, elaborate, and organize their ideas*

KEYWORDS: Essay writing, Mind map, Quality of writing, Writing skills

INTRODUCTION: A mind map is one of the most efficient tools to think, recollect, and organize ideas in a visually friendly way. Mind mapping is usually deliberated as an approach to conceptualizing and brainstorming, through which one can attain the desired outcomes or more often outstanding ones. According to tutors, mind mapping is one of the greatest assets for teaching students. It is an intellectual technique which provides help in the alignment and formulation of information when introducing the students to a new topic (Hillar, 2012).

Writing is a complex work of language. It involves some aspects like grammar, spelling, punctuation and organization. To be able to produce a good work of writing, students need to be given chance to learn how to write well. They also have to be given more opportunity to explore their creativity in arranging their ideas, the organization of their writing works. In mind mapping, ideas are presented in a radial, graphical, non-linear manner; mind maps encourage a brainstorming approach to planning and organizational tasks. Though the branches of a mind map represent hierarchical tree structures, their radial arrangement disrupts the prioritizing of concepts typically associated with hierarchies presented with more linear visual cues. This orientation towards brainstorming encourages users to enumerate and connect concepts without a tendency to begin within a particular conceptual framework. Therefore, it gives students broad chance to dig and develop their ideas. Furthermore mind mapping uses not only verbal feature but also pictures and symbols, which is in line with human brain's attitude in perceiving and retrieving information. Human brain perceives and retrieves information nonlinearly and it also processes information not only in the form of verbal but also in the form pictures and symbols. Therefore, it can be assumed that mind mapping is very effective to increase students' writing achievement.

Mind maps go under a variety of names. In general, they are known as semantic mapping, concept maps, think-links, graphic organizers, knowledge mapping, or cognitive maps (Svantesson, 1989). As analyzed by Buzan (1993), in terms of a graphical and visual manner, mind maps endeavour to depict a relationship between concepts or ideas. These maps are referred to as 'mind maps' in this study. During the time span of the 1960s, Tony Buzan developed the concept of mind mapping. It is the entire brain which acts as a substitute for linear thinking. Mind maps harness an entire range of cortical skills – image, word,

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logic, number, colour, rhythm, and spatial perception and awareness in a distinguished, uniquely powerful manner. Mind maps are usually a reflection of the way our brain reacts in deriving the ideas and concepts from our head onto paper.

The mind mapping strategy can be used to explore almost any topics in writing and also used in every kind of writing such as: narrative, descriptive, recount, persuasive, argumentative, essay etc. Language is an important device and a very beneficial means for human being to communicate with other people. By using language, people can talk and understand each other. Writing is one of the language skills that will never be left in education. It is very essential part of the lesson, not only in language class, but also in other classes such as Biology, Mathematics, and History etc. Writing skills are complex and sometime difficult to teach, requiring mastery not only of grammatical and rhetorical device but also of conceptual and judgmental elements (Heaton, 1988). As Harmer (1998) stated writing as a skill, of course, it is a basic language skill, just as important as speaking, listening and reading.

Hayes (1992) states that mind mapping can reduce difficulty in starting writing assignments by giving students an organizing strategy to get them started. He explains that ideas are freely associated and written out without pressure, thereby reducing tension and resistance often associated with writing. The product of the prewriting activity is an organized cluster of thoughts, which helps students stay on task when they write. Sufficient

PURPOSE OF THE STUDY: Several studies were conducted to investigate the effect of mind maps on writing skill.

LITERATURE REVIEW: The methods of bringing enhancement in the writing performance of students during examinations were explored by Wallace (1997) with the use of the technique of mind mapping. Moreover, the repetitive style of action research gives current opportunities to teachers, who demonstrate and elevate their personal manner of teaching.

Jarf (2009) investigated the compelling distinction among the group of students who used the software of Mind Mapping while writing and the ones who did not. The researcher stated that the software of Mind Mapping could be used to help students in brainstorming, development of new ideas, making correlations among various concepts and supporting details as students face problems in propagating ideas in EFL and writing paragraphs with topic sentences and supporting details. This study was performed by considering freshman students as a sample of research, who were divided into two groups, i.e., experimental and control. The results of post-test showed that the members of the experimental group had higher gains in their final writing.

Davies (2011) carried out research in which he explained a number of techniques and tools used in mapping, as well as distinctions among those methods. This research paper also comprised different advantages and disadvantages of each of the mapping tools. According to Davies, choosing a mapping tool is principally dependent upon the primary objective or aim for which that relevant tool should be used and that the tools may be well concentrated on offering instructions as still inferential and potentially interrelated functions.

Naqbi (2011) examined the use of mind mapping in the context of eFL as a strategy of prewriting brainstorming under the circumstances of examination. This study aimed to guide students in planning and organizing their concepts and ideas as well as providing answers about the writing topic instead of giving answers to the questions asked in exam without any prior planning. As stated by the author, students should perform in a different manner during examinations because of limited time availability. In particular, students have little time to think about the questions and in such a case, the strategy of Mind Mapping helps them to respond to questions in an efficient ways. This is the main reason why the tools of collecting data used by Naqbi include interviews, observations, and sample of work performed by students. Actually, the researcher believed that most students try to memorize information for their exams, instead of understanding it. Hence, students' capability of planning and organizing their concepts before essay writing is likely to be enhanced by application of the mind mapping strategy. After conducting the

study, it was found out that by mastering the technique, students' cognitive skills and thinking abilities could be enhanced, and they showed greater ability in finding ideas, examining them, and stimulating their background knowledge.

Riswanto and Putra (2012) conducted research in Indonesia on the appropriateness of the mind mapping strategy while providing training in writing. The design of pretest-posttest disparate groups was used by the researchers. As the study was carried out in the town of Bengkulu, 234 students of the first year of SMAN3 were the population of the study during the academic year of 2011/2012. A total of 66 students were selected as a sample and divided into two groups. The writing test was conducted in order to collect data, and t-test was used as the tool for analysis of the data. Results showed a compelling distinction was present in the writing accomplishment of the students taught with the use of the strategy of mind mapping. Hence, it is evident from this study that writing achievement of students can be enhanced through the application of the mind mapping strategy.

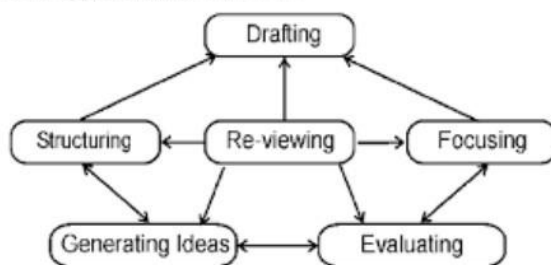
Budiono, Degeng, Ardhana and Suyitno (2016) explore the effect of mind mapping strategy on writing short story learning skills. The participants of this study are 64 Indonesian students at private junior high school of nine grades in Mojokerto. Findings of the study demonstrate that mind mapping strategy is beneficial in improving Indonesian students' writing of short story,

Riswanto (2016) examines improving the students' ability in writing report genre through the mind mapping strategy. The participants are nine grade 43 students at Junior high schools in south Sumatra, Indonesia. The researcher uses observation, questionnaire and test to collect data. The results show that there is a good impact to the students' ability in writing report through mind mapping strategy.

Rahmah (2017) reports the effectiveness of using mind mapping strategy on students writing skill in descriptive text. The participants are 52 at the eighth grade of Negeri 1 Kota Tangerang Selatan. The instrument of this study is a written test, to score the students' descriptive text on pretest and posttest. The writer uses a rubric of an analytical scoring. The result shows that there is a positive effect of students' descriptive text after using the mind mapping strategy.

Process Writing Approach: The process writing approach involves a number of interwoven activities, including creating extended opportunities for writing; emphasizing writing for real audiences; encouraging cycles of planning, translating, and reviewing; stressing personal responsibility and ownership of writing projects; facilitating high levels of student interactions; developing supportive writing environments; encouraging self-reflection and evaluation; and offering personalized individual assistance, brief instructional lessons to meet students' individual needs, and, in some instances, more extended and systematic instruction. The overall effect of the process writing approach was small to moderate, but significant (Graham and Perin, 2007). According to White and Arndt in Harmer (1991), process writing is an interrelated set of recursive stages which include: Drafting, Structuring (ordering information, experimenting with arrangements, etc.), reviewing (checking context, connections, assessing impact, editing), focusing (that is making sure you are getting the message across you want to get across), generating ideas and evaluation (assessing the draft and/or subsequent draft).

Figure 1. The writing process (White and Arndt, 1991).



White and Arndt's model can be represented diagrammatically, one of the disadvantages of getting students to concentrate on the process of writing is that it takes time: time to brainstorm ideas or collect them in

some other way; time to draft a piece of writing and then, with the teacher's help perhaps, review it and edit it in various ways before, perhaps, changing the focus, generating more ideas, redrafting, re-editing and soon. This cannot be done in fifteen minutes. However, the various stages may well involve discussion, research, language study, and a considerable amount of interaction between teacher and students and between the students themselves so that when process writing is handled appropriately it stretches across the whole curriculum.

The Mind Mapping Strategy: Mind Maps were popularized by author and consultant, Tony Buzan. He used a two-dimensional structure, instead of the list format conventionally used to take notes. As Tony Buzan (2002), mind mapping is a graphic representation of ideas (usually generated via a brainstorming session). It shows the ideas which are generated around a central theme and how they are interlinked. It is a tool primarily used for stimulating thought. He realized that the education system primarily focused on the left and brain strength, which include the use of "language, logic, numbers, sequence, looks at detail, linear, symbolic representation and judgmental characteristics. Mind Mapping is a useful technique that helps you learn more effectively, improves the way that you record information, and supports and enhances creative problem solving (Alamsyah, 2009)

Mind mapping (or concept mapping) involves writing down a central idea and thinking up new and related ideas which radiate out from the centre. By focusing on key ideas written down in your own words, and then looking for branches out and connections between the ideas, you are mapping knowledge in a manner which will help you understand and remember new information. To use Mind Maps effectively, make sure you print your words, use different colours to add visual impact, and incorporate symbols and images to further spur creative thinking. Having an organized display of information from the outset of the writing process may help some students, as it is more easily converted into a draft, whereas in brainstorming, the random recording of ideas might lead to problems with the structure of students' texts. As Alamsyah (2009) explained that Mind maps work well as their visual design enables students to see the relationship between ideas, and encourages them to group certain ideas together as they proceed. Mind maps work especially well when created in groups, since the discussion this engenders aids the production of ideas, and makes the task livelier and more enjoyable.

DISCUSSION: The mind mapping strategy is an excellent and innovative technique which enables students to generate new ideas for essays, assignments, etc., in a very short time. This study has proved that mind mapping as a prewriting strategy helps in improving the quality of essays and helps students to enhance their writing skills in a given time frame. It also helps in understanding a particular topic assigned for essay writing in a better way by focusing on ideas written down in one's own words and observing connections between them. Thus, mind mapping as a strategy is useful in both situations, i.e., before essay writing and during essay writing. In the current study, the mind mapping strategy was demonstrated as an excellent and innovative strategy as it enabled the participants' students to generate new ideas for essays and assignments writing. More specifically, the prewriting component of mind mapping helped the students in experimental group A to write a better quality essays for the prewriting strategy helped students to understand the assigned topic for the assigned essays. In this way, students had the chance to focus on ideas written down in their own words along with observing connections between ideas.

Interestingly, Freeman (2004) explains that mind mapping strategy enables students to construct new conceptualizations and to create abstract thoughts. In this concern, mind mapping used in the experimental group a reduced students' miscommunication and lack of clarity in written texts as it involved pictures and colours which, in turn, motivated students and inspired them to write essays. Most students actually enjoyed creating mind mapping as reported by Jones, Ruff, Snyder, Petrich and Koonce (2012) who find that mind mapping is an entertaining and interesting strategy that enhances students' essays. Here, Sturm, Rankin and Erickson (2002) state that mind mapping assists students to write confidently. As such, this strategy made students proficient and confident enough to write essays in different topics. During the training, students had a chance to refer to the maps drawn at the planning stage and make the writing process work efficiently. To conclude, mind mapping strategy enables students to construct and organize their ideas in the pre-writing phase. This is in congruence with Sturm and Rankin and Erickson (2002) who reports that mind mapping helps students enhance their writing skills.

The advantages of using mind mapping strategy to develop students' writing in the experimental group A were as follows. Firstly, most students enjoyed it as it contributed to develop their writing ability as reflected in the post test scores while being interested way. Secondly, the researchers noticed mind mapping strategy enhanced students' ability did not only help students to organize their ideas in a hierarchal structure, but also helped them to produce linked and better connected essays. Thirdly, students' understanding topics is superior as they were able to relate ideas effectively. Similarly, Bharambe (2012) claims that students become skilful in organizing their thoughts and ideas and thus become able to present information clearly and attractively by mind mapping. Although not measured, using mind mapping strategy in this study promoted students' creativity in writing. In this regard, Keles (2012) supports that mind mapping is an effective strategy in learning and promoting students' creative and critical thinking and in providing permanent learning. More specially, students at the experimental group A were able to understand the relationship between ideas they wrote and the writing topic. This is in alignment with Saed and AL-Omari (2014) who assures that mind mapping gives students the opportunity to solidify their ideas with adequate procedures before writing.

All through the training, students at the experimental group a applied mind mapping strategy in the pre-writing stage in order to explore ideas and generate thoughts on each writing topic under study. The researchers observed how mind mapping strategy allowed students to gather ideas relevant to the main themes in each essay. Such ideas gathered by this strategy were coherent without any linear or flexible structure of outlines. More specifically, mind mapping strategies involved using information with images, symbols, key words, codes and colour to the level each student wishes to use in the target essay. In Gardner's (1985, 1999) terms, such type of organization of ideas is capable of capturing the spatial and bodily-kinaesthetic of students.

CONCLUSION: This study confirms that the mind mapping strategy improved students' writing performance in test scores. This result is similar to some other studies (Darayesh, 2003; Saed & Al-Omari, 2014; Saqqa, 2005) because they provide students with strategies to organize their thoughts and develop their writing sub-skills. This strategy under study demonstrates students' engagement in thinking of the writing topics along with prior knowledge activation which, in turn, enables them to generate ideas through group work and oral discussion in an interesting way.

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APPENDIX- IX

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Developing creative thinking of children by mind mapping technique

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Abstract

Mind mapping is a learning technique that was developed by Tony Buzan (1970). A Mind Map is a powerful graphic technique which provides a universal key to unlock the potential of the brain. It harnesses the full range of cortical skills — word, image, number, logic, rhythm, colour and spatial awareness—in a single, uniquely powerful manner. Application of mind map is to construct “Divergent Thinking” in the brain. While applying mind mapping, the ability of logical analysis, reasoning of left brain, creative thinking and memory of right brain can be maximized. Thus, this study reviews related researches to figure out whether mind mapping can be applied by children to develop their creative thinking.

Keywords: Mind Mapping, Children, Creativity.

Introduction:

In so doing, it gives an individual the freedom to roam around the infinite expanses of an individual's brain. Through mind maps, one's attention, coordination ability, logic, reasoning, thinking, power of analysis, creativity, imagination, memory, ability of planning and integration, speed reading, character, number, visuality, hearing, kinesthetic sense, sensation, etc. can be enhanced significantly. “Picture” is not limited by nationality and language and it is the best tool for young children to explore new things and learning. The Mind Mapping can be applied to every aspect of life where improved

learning and clearer thinking will increase human performance. Mind mapping is a technique for delivering effective and creative thinking (Buzan, 1989; Mento, Martinelli & Jones, 1999; Buzan & Buzan, 1996; Buzan, 2005). The technique helps in arranging and presenting research concepts visually around a central keyword or idea (Borchardt, 2011; Burgess-Allen & Owen-Smith, 2010; Buzan, 1995, Kern, Bush & McCleish, 2006; Crowe & Sheppard, 2012; Meier, 2007; Mueller, Johnston & Bligh, 2002; Wheeldon, 2011). This visual presentation helps to organise thoughts (Mattos, Mateus Junior & Merino, 2012), create ideas (Cheng, Hu & Chen, 2012), focus discussions (Chang & Chen, 2015), solve problems (Buzan, 2005), make decisions (Borchardt, 2011) and achieve learning (Mattos, Mateus Junior & Merino, 2012).

It takes some practice in defining locations and placement of topics and details. It has been noted that the use of colors and symbols can positively influence the information retention of the presented information. If the maps are to be shared, the photocopying or scanning must be used which can slow the transfer of the map to others. It also makes the maps a reference document, not a living document for changes. Cain (2001/2002) found that Mind Maps also promote active learning, foster motivation, improve confidence, and support a diverse range of learning styles and levels of ability – all in a fun way. Goodnough and Long (2002) found that Mind Mapping is a useful strategy for introducing new concepts, providing a whole-class focus for a large research project, assessing learning of individuals and offering greater choice in how people choose to complete assignments and projects. It is easy to recall multi coloured, multi-dimensional mind maps rather than traditional linear notes (Buzan & Buzan, 2006).

Creativity is one of the most significant human activities. It is a dynamic concept exceptionally complex and undergoing transformations. It is a mental process through which one comes to accurate, unique and innovative results. Torrance (1974) suggested four components of Creativity,

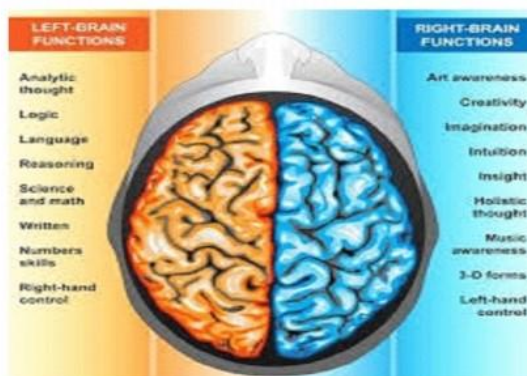
- A. Fluency – the continuity of ideas, flow of associations and use of basic and universal knowledge;
- B. Flexibility- changing ideas, approaching a problem in various ways and producing a variety of solutions;
- C. Originality– this is at the heart of all creative thinking, and represents your ability to produce ideas that are unique, unusual, and ‘eccentric’, literally ‘away from the centre’. Although

many people think such a person is ‘uncontrolled’, exactly the opposite is true: originality often results from a great deal of directed intellectual energy, and it generally shows a capacity for high levels of concentration.

- D. Elaboration – the ability to describe, illuminate and generalize ideas. Creativity can be general or specific. General creativity as explained by Leikin (2009) is associated with using problem solving patterns from one field, in solving problems in another field and specific creativity brings about creativity in a particular field by taking into account the logical deductive nature of the field.

The creative thinker is able to build up, develop, embroider, embellish, and generally elaborate and expand upon ideas.

Creative thinking involves the use of the full range of left-brain and right-brain mental skills, which is shown in the following picture. If the total brain of an individual functions at the same time then it will be termed as mind mapping.



Education systems tend to focus on left-brain skills and place less emphasis on right-brain skills, which immediately impacts on our capacity to think creatively. Academic background tends to develop one’s verbal, mathematical, and analytical abilities but neglects skills such as drawing, painting, and music. But there are chances for tapping into a fraction of one’s creative capabilities. What do we get when we combine the skills of left and right hemisphere of the brain? A Mind Map! A Mind Map includes each aspect of the left and right cortex and is therefore a superb whole-brain thinking tool.

- -

Mind Maps are an excellent tool for strengthening ability of an individual to make associations and create images in the Mind Maps of individual's thoughts. Mind Maps encourage creativity. If an individual wants to come up with brilliant ideas, find inspired solutions to any problem or find new ways to motivate himself and others, he needs to set his imagination free with Mind Maps.

Furthermore, mind maps present information and data in an organic and visual format that many of the proponents of the technique claim can increase the ability to retain informations (Buzan, 1976; Meier, 2007; Buzan, 1993; Buzan, 2005). When originally developing the technique, research attempted to gain an understanding of how people learn and remember resulting in gaining insights on how the brain operates (Mento, Martinelli & Jones, 1999). For instance, Zampetakis, Tsironis and Moustakis (2007) convey that the brain works by focusing on a central point from which outward ideas can be added and organised. Additional research uncovers the brain's division into two hemispheres which are connected together facilitating different intellectual functions (Buzan, 1991; Buzan & Buzan, 1995;

Buzan & Buzan, 1996; Buzan & Buzan, 2006). By using both hemispheres, humans are able to think effectively and creatively (Mento, Martinelli & Jones, 1999; Nast, 2006). Buzan and Buzan (1995, 2006) demonstrate this creativity by providing examples of the working notes of great thinkers such as Leonardo da Vinci and Picasso which reflect the use of the mental capabilities which exist in both hemispheres. Leonardo da Vinci realized the power of using images and associations in order to unleash his brain's infinite capacity.

It is a skill to develop the whole brain, applying characters, images, numbers, logics, rhythm, colors and unique observation method, providing a limitless and free imaginary space to the brain. Briefly, mind map is a map for the brain (Buzan & Buzan, 1996). Application of mind map is to construct "Divergent Thinking" in the brain. While applying mind mapping, ability of logical analyzing and reasoning of left brain and creative thinking and memory of right brain can be maximized. Mind maps are considered to be a type of spider diagram.

Objectives:

1. To explore the theoretical concepts and functions of mind mapping.
2. To describe how to develop creative thinking in children by mind mapping technique.

Functions of mind map:

1. Build a concept or viewpoint in a broader scope or topic.
2. It provides a direction while planning or making decisions, helping users to collect and organize large amount information.
3. It encourages users to solve problems by a new and creative way and thus enhances the effectiveness.
4. It attracts and controls one's attention and thinking.
5. It makes observation, reading, thinking or memorizing interesting.

Benefits of Mind Maps:

- Help students brainstorm and explore any idea, concept, or problem
- Facilitate better understanding of relationships and connections between ideas and concepts
- Make it easy to communicate new ideas and thought processes
- Allow students to easily recall information
- Help students take notes and plan tasks
- Make it easy to organize ideas and concepts

1. Mind mapping



Related works on application of mind mapping in developing creativity of children:

Goodnough and Woods (2002) discovered that Mind Mapping is a fun, interesting and motivating approach to learning. Several of these participants attributed the fun aspect to the opportunity to be creative when creating Mind Maps through lots of choice in colour, symbols, key words and design. Research by D'Antoni and Pinto Zipp (2005) found that, from a pool of 14 physical therapy students, 10 out of 14 agreed that the Mind Map technique enabled them to better organise and integrate the material presented in their course. A study conducted at New Church Community Primary School in Warrington showed a variety of improvements in pupils' learning after Mind Mapping was introduced. Evidence includes improved concentration, staying on task for longer periods of time, improved questioning and answering during class discussions and improved independence. According to Dalke (1998), young 3 years old children showed some ability to make and use maps but performed poorly on the false belief tests. Children were more likely to use an incorrect map to predict behavior if the represented object was missing instead of in a wrong location. Many children were also able to predict that someone who used an incorrect map would not "Find" the object. In particular, it would be useful for at least two individuals to go through the mind map independently to help ensure objectivity when reporting the number and strength of the relationships and connections listed (Cresswell, 1998). Mundy and Gilmore (2009) used a novel task to assess children's mapping ability. They showed that children can map in both directions between symbolic and nonsymbolic numerical representations and that this ability develops between 6 and 8 years of age. Chen (2007) examined the role of experience on 2.5- to 5-year-old children's discovery of spatial mapping strategies. With experience 3- to 4-year-olds discovered a strategy for mapping corresponding locations that shared both featural and spatial similarities. When featural and spatial correspondences were placed in conflict, requiring children to negotiate both object-centered and location-centered mapping possibilities, 4- to 5-year-olds proved capable of discovering a novel mapping strategy, abandoning an ineffective strategy, and generalizing the acquired strategy across analogous tasks. It has been successfully used in community serving programs and could be similarly applied in youth serving agencies (Wells & Arthur-Banning, 2007).

Conclusion:

Mind Maps are therefore the best way to express our brain's infinite creative potential. Mind mapping is a thinking method which stimulates thinking and helps to integrate thoughts and

information, and it is also a strategy of thinking visualizing concepts (Buzan & Buzan, 1996). This mind mapping utilizes lines, colors, characters, numbers, symbols and pictures to quickly record information and thoughts. It clearly and easily record large amount of information or ideas which originally require magnitude of words to record on a mind map. The structure becomes open and organized, allowing one to organize a variety of information and evoke more new ideas. Finally, we propose some guidelines for later researches to improve course design of information education for young children. This allows one to find that picture is helpful for young children on learning and interaction. However, there are still some unanswered questions such as: how to implement mind mapping in teaching, how to train the teachers to become master on this method, etc., that needs further investigation.

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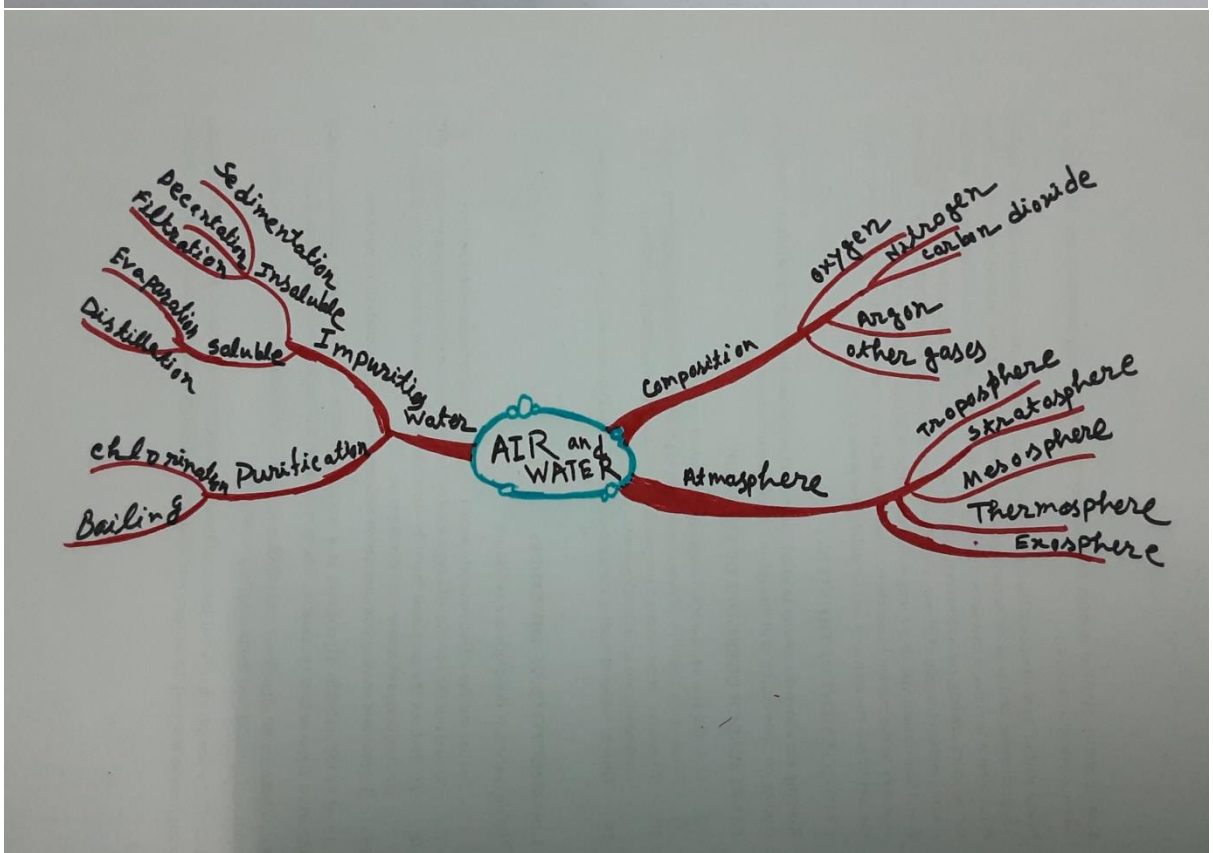
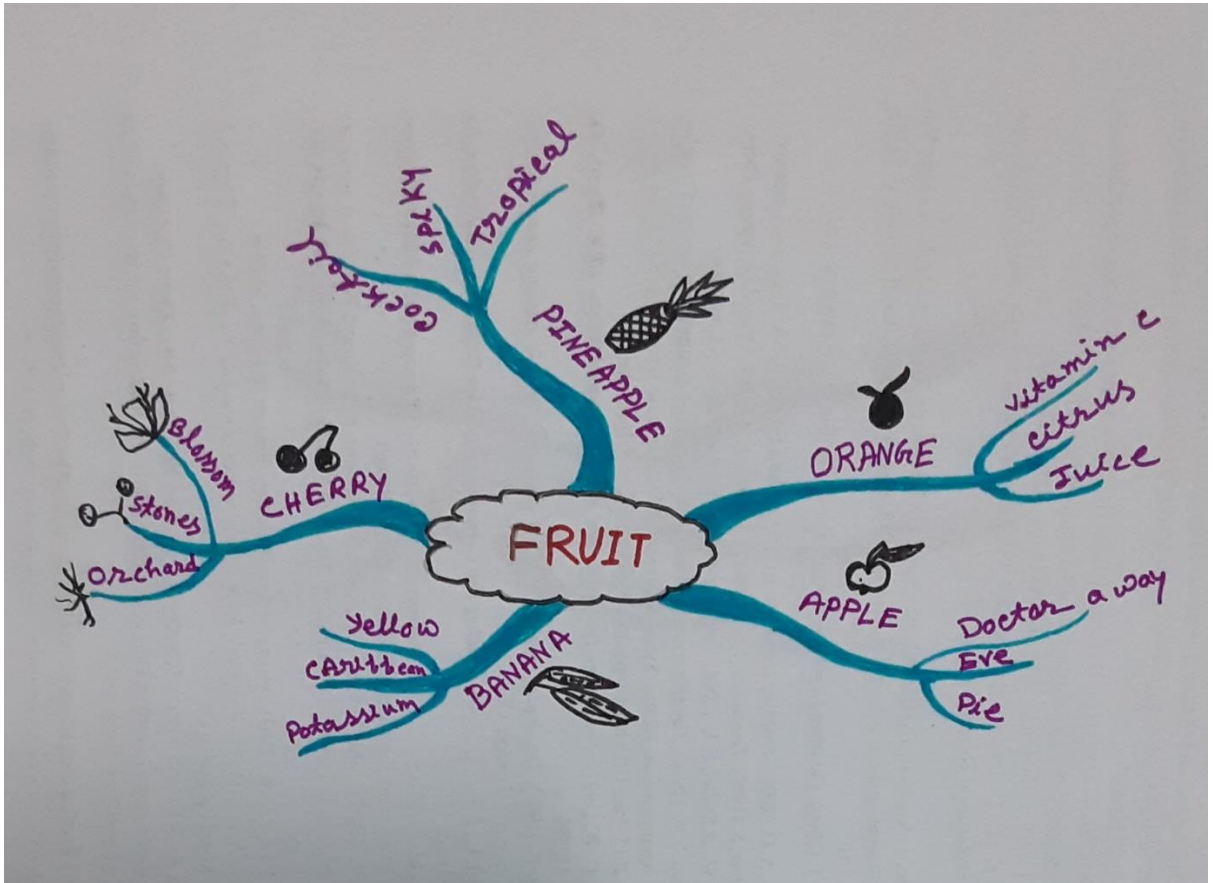
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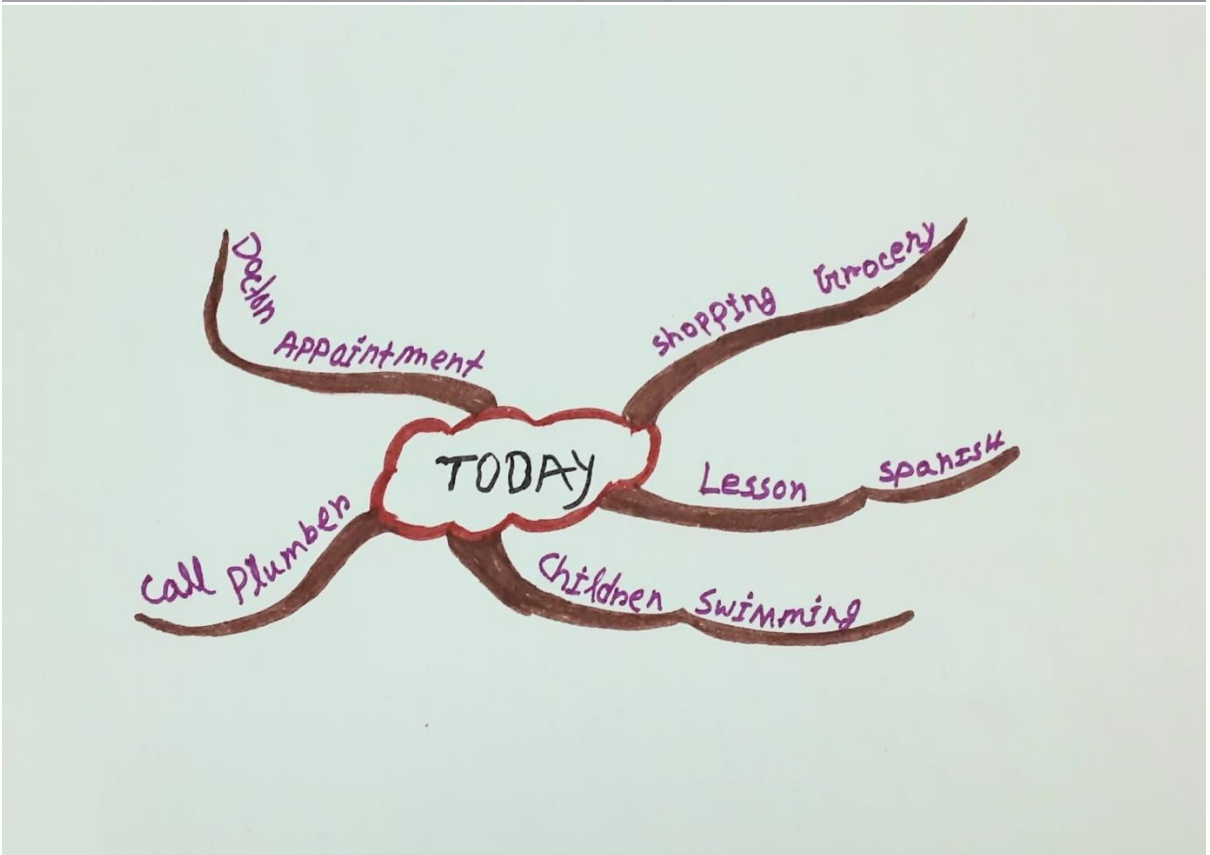
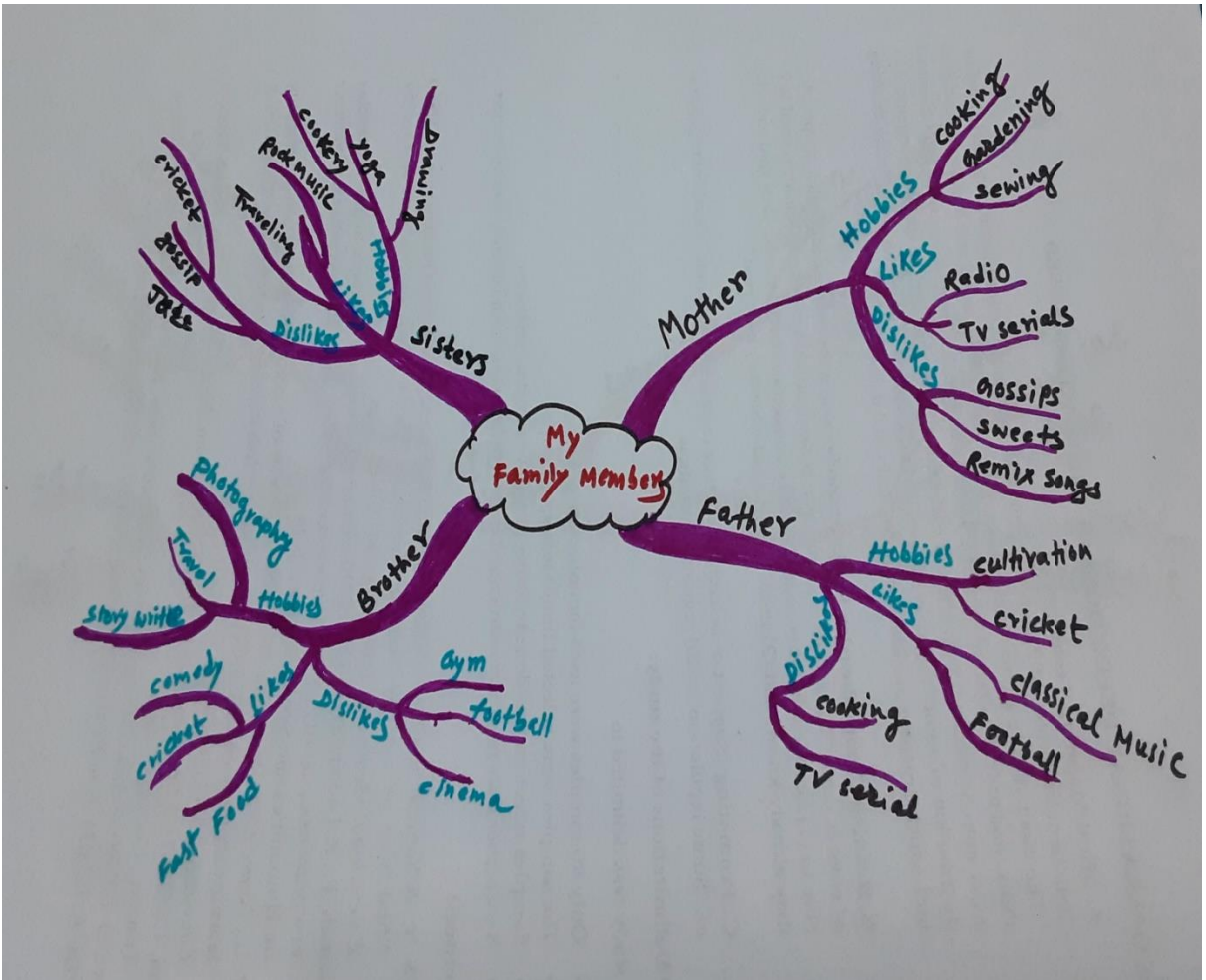
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APPENDIX- X

Mind maps drawn by students





APPENDIX- XI

Plagiarism Report

Promoting reading comprehension skill through mind mapping technique

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