

## مفاهيم المعلمين حول دور استراتيجيات رسم الخرائط الرقمية في تعزيز فهم الطلاب

### Teachers' Conceptions on the Role of Digital-Mapping Strategy in Advancing Students Comprehension

د. مريم بنت أحمد عبد الله العمير

أستاذ المناهج وطرق التدريس المساعد

كلية التربية - جامعة الملك فيصل بالأحساء

#### الملخص:

الخرائط الذهنية الرقمية نوع من تقنيات رسم الخرائط الذهنية التي تستلزم استخدام أنواع مختلفة من البرامج لمساعدة المستخدمين على تصور الأفكار والمفاهيم. وفي الفصل تُستخدم التقنية أيضًا لكسر المفاهيم وتمثيلها في شكل سهل فهمه. ونظرًا لأن المعلمين يشاركون في تنفيذ واستخدام الخرائط الذهنية الرقمية وقضاء المزيد من الوقت مع الطلاب في الفصل، فقد سعت هذه الدراسة إلى تحديد مفاهيمهم لدور هذه التقنية في تعزيز فهم الطلاب. وتم جمع البيانات النوعية باستخدام مقابلات شبه منظمة من عشرة معلمين في المدرسة الابتدائية. وتم نسخ جميع البيانات وتحليلها باستخدام التحليل الموضوعي لتحديد الموضوعات الرئيسية. وتشير نتائج الدراسة إلى أن غالبية المعلمين استخدموا واستمتعوا باستخدام الخرائط الذهنية الرقمية في التدريس. وأفاد المعلمون أيضًا أن غالبية الطلاب يستمتعون باستخدام الخرائط الذهنية الرقمية التي كان لها تأثير إيجابي على الفهم. وبناءً على النتائج، تشمل بعض الفوائد الرئيسية لرسم الخرائط الذهنية الرقمية: سهولة الاستخدام، وزيادة مشاركة الطلاب، فضلاً عن المساعدة في تحسين الحفظ. وهذا يسلط الضوء على أهمية مشاركة الطلاب وكذلك الحفظ عندما يتعلق الأمر بتعزيز الفهم. وأحد التحديات الرئيسية التي تم تحديدها فيما يتعلق برسم الخرائط الذهنية الرقمية هو أنها تعتمد على التكنولوجيا التي يجب تحديثها من وقت لآخر، لذلك من المهم تسليط الضوء على أهمية تشجيع الكفاءة التقنية بين الطلاب والمعلمين لتبسيط وزيادة كفاءة التقنيات مثل رسم الخرائط الذهنية الرقمية.

**الكلمات المفتاحية:** الخرائط الذهنية الرقمية، فهم الطلاب، تصورات المعلمين، المربية.

## Abstract:

Digital mind mapping is a type of mind mapping technique that entails the use of different types of software to help users visualize ideas and concepts. In class, the technique is also used to break down concepts and represent them in a form that is easier to understand. Given that teachers are involved in the implementation and utilization of digital mind maps and also spend more time with students in class, this study sought to determine their conceptions of the role of this technique in advancing students' comprehension. Qualitative data was collected using semi-structured interviews from ten teachers in elementary school. All the data was transcribed and analyzed using thematic analysis to identify major themes. Results of the study indicate that the majority of teachers have used and enjoy using digital mind mapping in their teaching. The teachers also reported that the majority of the students enjoy using digital mind mapping which has had a positive impact on comprehension. Based on the findings, some of the main benefits of digital mind mapping include ease of use, increased engagement on the part of students, as well as helping improve memorization. This highlights the importance of student engagement/participation as well as memorization when it comes to enhancing comprehension. One of the main challenges identified with regard to digital mind mapping is that it relies on technology which has to be updated from time to time. This is another important finding that highlights the importance of encouraging technology competence among students and teachers to simplify and increase efficiency of techniques like digital mind mapping.

**Keywords:** Digital mind mapping, students' comprehension, teachers' conceptions, visual.

## Introduction

Mind mapping is a contextualization method that was developed in the 1960s and popularized by Tony Buzan in the 1970s (Debbag, Cukurbasi, & Fidan, 2021). It entails a visual organization of knowledge and concepts in a manner that is easy to remember and understand (Bhattacharya & Mohalik, 2020). Typically, texts and graphics are used to display links between ideas, words, and information in a structured fashion which also makes it easier for users to synthesize and analyze information. As Debbag, Cukurbasi, & Fidan (2021) explain, mind mapping serves to organize information like a cobweb in the mind for learning and permanence.

Although paper-based mind maps are still common, technological advancements and the growth of digital natives have greatly popularized digital mind mapping. Compared to paper-based mind maps, digital ones are generally more visually appealing, easier to update, and save, and thus more attractive to those who frequently use computers and other digital devices like tablets and smartphones (Debbag, Cukurbasi, & Fidan, 2021). Today, a variety of mind mapping software exists. These include Coggle, Ayoa, Xmind, and MindMeister among others. Because of its simplicity and ability to generate ideas by association, digital mapping has many uses including note-taking, problem-solving, brainstorming, revision, and presentation. This also makes it an excellent tool for teachers and students given that it can be used to break down a complex topic into simpler components that are easier to grasp (Debbag, Cukurbasi, & Fidan, 2021; Bhattacharya & Mohalik, 2020).

For students, comprehension is one of the most important aspects of their learning process. Without comprehension, they cannot gain meaning from what they read or are taught. According to Ma (2019), poor comprehension can be attributed to a number of factors depending on the students. While some students may be unable to identify the main idea of a passage, others may be unable to find a logical relationship between passages and paragraphs. On the other hand, some students may generally find various topics to be

complex which can off-putting and discouraging. Whatever the case, poor comprehension is a major obstacle to the learning process. Digital mind mapping can help address this problem by breaking down what some students find to be complex into simpler components that are easier to digest. As Rhodes (2013) explains, the strategy helps the user to "break apart the problem or the details of the data even further. Eventually, this will provide clarity in your thinking" (p. 26). Fadillah (2019), on the other hand, identifies three major advantages of mind mapping, namely, it makes it easy for students to think and organize their ideas, it helps students develop their ideas, and lastly, it helps students to better remember about these ideas. These are also beneficial aspects of mind mapping that can greatly promote comprehension among students.

Mind mapping can also help improve motivation and productivity by promoting concentration (Debbag, Cukurbasi, & Fidan, 2021; Erdem, 2017). This, according to Erdem (2017) is because students can focus while organizing information in a manner that may sense to them. This is particularly beneficial for individual students given that the strategy allows them to structurally and practically organize information in a manner that they can easily understand. In this case, the central idea is likely to start making sense as they arrange and re-arrange individual parts that contribute to the whole. This approach can therefore help meet the specific needs of students by providing different unique perspectives to solve a problem or understand the material (Rhodes, 2013). Although existing literature has identified and presented many benefits of mind mapping, it is important to find out what teachers think of this strategy. As educators, they spend a lot of time with students and may have unique perspectives that can prove beneficial in future implementations. This study, therefore, aimed to determine teachers' conceptions of the role of digital mind mapping in advancing students' comprehension.

### **Problem Statement and Significance of the Study:**

Although digital mind mapping has been associated with many benefits ranging from the development of students' ideas to enhanced organization skills, little focus has been given to the difficulties that some students face when using digital mind mapping techniques. According to a study by Fadillah (2019), it takes a long time for some students to create and organize ideas using mind mapping. Davies (2010), also, identifies several important challenges including those associated with idiosyncrasy in design, establishing clear links between ideas, and relating between different concepts. Taking these issues into consideration, some students may experience challenges understanding how to correctly apply this strategy in their learning which can further hinder comprehension. On the other hand, teacher's beliefs, attitudes, and knowledge about digital mind mapping tools can shape the way these tools are used, which in turn can impact student learning outcomes. Therefore, it is crucial to understand how teachers conceive of digital mind mapping tools and their potential benefits and limitations. By gaining insights into teacher's conceptions, it is also possible to develop targeted professional development programs that help teachers use digital mind mapping tools more effectively, design instruction that more effectively supports student learning, and identify areas where digital mind mapping tools can be improved to better meet the needs of teachers and students. These improvements can ultimately lead to enhanced learning outcomes for students.

This study aims to contribute to this understanding by determining teachers' conceptions of the role of digital mind mapping in advancing students' comprehension. Consequently, it will also add to the existing literature on digital mind mapping and promote the efficient implementation of these tools going forward. By identifying teachers' perspectives on digital mind mapping, it is possible to better understand how to support their use of these tools and how to mitigate potential challenges that may arise. This knowledge can help inform the development of more effective professional development

programs and improved digital mind mapping tools, which can ultimately lead to better learning outcomes for students.

### **Research question**

Main research question:

What are teachers' conceptions of the role of digital- mapping strategy in advancing students' comprehension?

### **Purpose of the Study**

The study is primarily aimed at gaining a proper perspective of teachers on how to use digital mind mapping strategies and how these strategies can advance students' comprehension, and what are the challenges that teachers faced in applying digital mind mapping strategies. Teachers, more than any other party, are in a suitable position to not only identify some of the issues associated with the implementation of digital mind mapping but also those related to the utilization of these strategies. The study, therefore, aimed to determine their perspective on how it can be used efficiently and how these approaches can enhance comprehension. Through this study, teachers also highlighted how they have overcome some of the challenges and managed to increase the efficiency of these tools to boost students' comprehension.

### **Definition for Terms:**

**Comprehension:** In other words, comprehension is a kind of up-market synonym for understanding in discussions that are (or are intended to appear) technical and scientific. In such contexts the word frequently doesn't appear alone, but in such combinations as comprehension

skills or the comprehension process, even by people who would never use expressions like understanding skills or the understanding process (Smith, 2012)

**Mind mapping** is a contextualization method that was developed in the 1960s and popularized by Tony Buzan in the 1970s (Debbag, Cukurbası, & Fidan, 2021). It entails a

visual organization of knowledge and concepts in a manner that is easy to remember and understand (Bhattacharya & Mohalik, 2020).

## **Theoretical Framework**

### **Constructionism**

This study guided by Papert's constructionism. Developed from Piaget's constructivism, constructionism is a theory of knowledge that holds that children learn more efficiently when they are actively constructing. As compared to constructivism, this theory places greater emphasis on conscious engagement on the part of the student when constructing knowledge (Ackermann, 2001). The approach could therefore be described as "learning by making". As Ackermann (2001) puts it, "The emphasis shifts from universals to individual learners' conversation with their own favorite representations, artifacts, or objects-to-think with" (p. 4).

The theory aligns with mind mapping which revolves around constructing knowledge through linkages established between concepts and ideas. Using Cacao, for instance, students can build flowcharts, tables, comments, and mockups which consequently help them develop their knowledge and understanding of various concepts (Mani, 2012; Bhattacharya and Mohalik, 2020). As Mani explains "in mind mapping, any idea can be connected to any other. Free-form, spontaneous thinking is required when creating a mind map and the aim of mind mapping is to find creative associations between ideas. Thus, mind maps are principally association maps" (p. 78). Students are therefore active participants in the learning process, by building, rather than passive learners. From this perspective, constructionism therefore served an important role in explaining how students learn through digital mind mapping and why this approach might be ideal for younger students.

### **Literature Review**

Comprehension is a crucial cognitive process that forms the basis of all learning. It involves actively constructing meaning through reading, listening, speaking, and writing.

According to Butler et al. (2010), comprehension serves as the foundation of all learning. Hans and Hans (2015) also stress the importance of comprehension in the learning process. Comprehension can be divided into two categories: lower and higher-level comprehension. Lower-level comprehension involves developing a basic understanding of knowledge by recognizing and understanding the meaning of words, understanding grammar, and connecting words. This level serves as a foundation for higher-level comprehension, where mental processes construct meaning. Higher-level comprehension involves making inferences from the text, monitoring comprehension to avoid incorrect interpretations, and acquiring structure knowledge (Srisang & Everatt, 2021). If lower-level comprehension is not well developed, learners may struggle to acquire structure knowledge. Therefore, comprehension is integral to learning outcomes as it provides the foundation on which knowledge is developed at every level.

Popularized by Tony Buzan in the 1970s, mind mapping is aimed at enhancing memory and understanding of concepts. Today, digital mind mapping has become more prevalent due to the availability of software like Xmind, Mindjet, Drakonhub, Mindmeister, Ayoa, and LucidChart. Mind mapping has been found to have a positive correlation with reading comprehension, analysis skills, and understanding of main and sub ideas (Mohaidat, 2018). According to Brinkmann (2003), mind mapping strategies achieve this by organizing information, prompting consolidation, and summarizing. However, mind mapping can only achieve these outcomes when used correctly (Paulino, 2015). Mind mapping also encourages learners to become more involved in the teaching and learning process, which allows them to comprehend the learning material better (Chairani, 2015). However, some students may find the process complicated (Puspitasari, 2020). Despite this, the continued production of new mind mapping software and reports of over 250 million people using the tool worldwide suggest that mind mapping will continue to grow in popularity for purposes ranging from brainstorming to revising for exams (Cunnah, 2020).



Research studies have highlighted several key advantages of mind mapping as a strategy for facilitating comprehension among students. According to Puspitasari (2020) and Paulino (2015), mind mapping helps balance the left and right parts of the brain, stimulates critical and creative processes, and enhances memory recall by summarizing content and converting cognitive structures into visual aids. Additionally, mind mapping tools are enjoyable for students, encourage active participation, and facilitate socialization and communication. These positive attributes have made mind mapping a popular strategy among educators to not only overcome comprehension issues but also to reinforce understanding.

A number of studies have also shown that mind mapping is an effective teaching strategy that can engage students, improve their retention and understanding of concepts, and stimulate creative thinking. Wilson et al. (2016) found that incorporating Emirati artistic and collaborative practices into mind mapping was particularly effective in engaging Emirati English Language Learners (ELLs) in an Environmental Science class. Mind mapping has also been found to be useful for early childhood educators to improve their mastery of development assessment concepts and reflect on their learning strategies (Pujianti et al., 2019). Additionally, studies by Koster et al. (2017) and Polat et al. (2017) have found that mind mapping enhances simulation learning, increases test scores, improves listening comprehension and vocabulary, and supports high-level mind organization skills.

Furthermore, Bawaneh's (2019) study found that the use of mind maps significantly improved tenth-grade students' immediate achievement and retention of electric energy concepts. This suggests that mind maps could be a valuable tool for curriculum developers, textbook authors, and teachers to enhance students' understanding and retention of complex concepts. Finally, Zhao et al. (2022) explored the effects of mind mapping on primary school students' computational thinking (CT) skills in programming language instruction using Scratch. The study found that both construct-by-self mind mapping (CBS-MM) and construct-

on-scaffold mind mapping (COS-MM) approaches were effective in improving students' CT skills, with the COS group students showing greater improvement with the assistance of the COS-MM method. This study provides insight for instructors on how to design programming teaching with different kinds of mind mapping support to enhance students' CT skills.

Despite the many advantages of digital mind mapping, some teachers have reservations about its effectiveness. Debbag, Cukurbasi, and Fidan (2021) found that pre-service teachers reported that digital mind mapping was easy to prepare, fun to use, and encouraged collaboration among students. However, some teachers still preferred paper-based mind mapping. Nonetheless, multiple studies, including those by ThinkBuzan (2009), Chang, Hwang, and Tu (2022), Marin (2021), and Christiani, Tungka, and Nainggalon (2022), have shown that digital mind mapping enhances student understanding of module objectives and recall of subject matter. These findings suggest that while the effectiveness of mind mapping may be subject to individual preferences, it remains a useful and nearly universally applicable tool for teaching and learning.

Some of the drawbacks that have been reported by teachers include technical issues, such as difficulty correcting mistakes or adding visual elements (Debbag, Cukurbasi, & Fidan, 2021). Marin (2021) also notes that some teachers have reported difficulties connecting all the elements together in their mind maps. Furthermore, some teachers have abandoned the use of mind maps due to difficulties in implementing the technique in their teaching process. Sari et al. (2019) attribute this to a lack of awareness of the implementation process and how to effectively incorporate it in their teaching.

To overcome many of the challenges associated with the visual maps, Woloyo (2017) recommends that teachers start by understanding and thoroughly explaining the concept of mind mapping to their students and repeating the explanation as necessary. They should also teach and encourage their students to be creative and effective in drawing mind maps. Furthermore, teachers can use mind maps as a guide to help students determine the sequence of the given concepts, as well as a tool to help students construct their

narrative text. By using these strategies, teachers can help their students better understand and utilize the benefits of mind mapping, leading to more effective and engaging learning experiences. Similar recommendations have been made by (Debbag et al., (2021 and Handoko, (2018) through their interactions with elementary and pre-service teachers.

## Methodology

### Qualitative research

This study used the qualitative research approach. The primary goal of this approach was to understand phenomena from the perspective of participants and their social and institutional context (Kaplan & Maxwell, 1994). This perspective of qualitative research was supported by Myers (1997) who notes that "Qualitative research methods are designed to help researchers understand people and the social and cultural contexts within which they live" (p. 4). Compared to quantitative research, Palmer and Bolderston (2018) emphasize that qualitative research was subjective in that it is dependent on the experiences and opinions of the participants to gain insights into specific meanings and behaviors that have been experienced in a social phenomenon.

The current study aimed to determine the role of digital mind mapping strategy in advancing students' comprehension from the perspective of teachers. Qualitative research was, therefore, suitable for the study given that the data to be used for analysis and conclusions were consist of different views, opinions, and experiences of the teachers. One important aspect of qualitative research was that it values the experience of the participant as the source of valuable insight into the phenomenon (Clarke & Jack, 1998). Compared to any other stakeholder, teachers have more experience with a variety of methods and have used these methods on a regular basis with their students. This placed them in a good position to explain various aspects of strategies like mind mapping based on their experiences. Therefore, qualitative research was ideal for the study because it allowed these participants to share as much as possible about the strategy with respect to students' comprehension making it easier to make informed conclusions.

### **Study population and sample selection**

The study population for this study consisted of elementary teachers in Saudi Arabia from a government schools particularly in urban city with over 5 years of teaching experience. The main benefit of selecting a sample from this population was that they are likely to have experiences with students at both levels of comprehension (lower and higher levels of comprehension). For this reason, they are in a good position to understand how digital mind mapping has influenced the development of comprehension from one level to the other. Therefore, experiences of working with students using these strategies was also greatly informed the study.

10 to 15 participants were selected through random selection. Also known as probability sampling, this is a type of sampling where participants (representative group) are selected from the population group by chance. A random number generator was used to ensure that potential participants have the same probability of being selected. The main advantage of this approach is that it eliminates bias by allowing the population a fair chance to participate. Moreover, those selected acted as true representatives of public school teachers given that they were randomly chosen and not specifically selected based on special characteristics (Sharma, 2017).

### **Source of Data**

Data were collected via semi-structured interviews. According to Palmer and Bolderston (2018), semi-structured interviews are a type of interview where questions are formulated but the researcher/interviewer may deviate from scheduled questions if unforeseen points of discussion prove fruitful. This means that the approach was sufficiently flexible to allow the researcher to pursue points that prove relevant to the study even if they were not scheduled. However, this method was also less time-consuming compared to unstructured interviews. For this reason, it allowed the study to only focus on what is relevant to the study.

### Data collection procedure

All the participants were contacted beforehand so that they can give consent to proceed. A consent form will be provided to confirm that they agree to participate and support the study. The interviews were face-to-face. This allowed them to participate in a manner that is convenient to them. Each of the participants was then asked ten questions with follow-up questions being used to clarify important points. As mentioned, one of the main benefits of semi-structured interviews was that they are flexible. Therefore, important points that are relevant to the study will be pursued using follow-up questions. All interviews will be recorded for transcription. Whereas face-to-face interviews were recorded using smartphone recording features. All the data was saved on personal computers, external memory devices, as well as cloud storage. This ensured that the data can be recovered even when some of the storage options are damaged or not accessible.

Data collection procedure table:

STAGE	STEP	DESCRIPTION
1	Contacting Participants	All participants were contacted beforehand to request their consent to participate in the study. A consent form was provided to confirm their agreement to participate and support the research.
2	Conducting Face-to-Face Interviews	Semi-structured interviews were conducted face-to-face, allowing participants to participate in a manner that was convenient for them. Participants were asked ten questions, and follow-up questions were used to clarify important points.
3	Recording Data	All interviews were recorded for transcription purposes. Smartphone recording features were used to record face-to-face interviews.
4	Saving Data	All data was saved on personal computers, external memory devices, and cloud storage to ensure it could be recovered if some storage options were damaged or inaccessible.

## **Data analysis:**

### **Thematic analysis:**

Thematic analysis was a method of data analysis that involves a thorough examination of data to identify repeated patterns (Kiger & Varpio, 2020). This method of data analysis was flexible and can be used to understand experiences and thoughts across the data set. It consisted of six main steps that include:

Familiarization with the data - In the first step of thematic analysis, the researcher went through the data in order to get a general idea. Although voice-recognition software was used, this step also involved going through the transcripts for accuracy.

Generating initial codes - The first step of code generation helped organize the data into specific levels. As a result, it was possible to organize data in a manner that is more meaningful and systematic in preparation for the third step. In this step, data was also collated if connections between items are identified.

Searching for themes - The third step involved the examination of coded/collated data in search of potential themes. In this phase, thematic maps were used to visually demonstrate any cross-connections between the main and sub-themes.

Review of themes - In this step, coded data within each of the themes was examined to ensure that they fit. In the process, some of the codes may be replaced or removed if they do not properly fit. Before proceeding to the next step, the entire data set will also be examined again to determine if there is a need to rearrange data (re-code) into appropriate themes.

Defining themes - The fifth step of analysis involved a proper description of individual themes. Aside from naming these themes, they were described and arranged in terms of how they contribute to the understanding of the research questions. Areas of overlap between the themes were highlighted to assess whether and how they answer given research questions.

Report - The final step of analysis involved making a report describing the findings.

### Ethical considerations

Maintaining research ethics was essential in all research studies. In studies involving human participants, it was important to ensure that they volunteer, are informed and consent, their data is protected, and that they are safe. For this study, no participant was pressured/impelled to participate. This ensured that potential participants do so voluntarily. Their data were stored in three different locations so that it is protected and can be readily retrieved during analysis. During data collection, confidential/private data of participants was not collected. This was particularly important given that confidentiality is one of the primary concerns among participants. The decision not to collect such data ensured that they are not compromised even if unauthorized parties access the data.

### Data Analysis

Focus questions (Q)	Themes (T)
Duration of use and teachers' perspectives	Most teachers have used it for several years All teachers have a positive view of the technique
Students' attitudes and impact on comprehension	Students enjoy using the technique The technique has enhanced comprehension among students
Advantages	Easy and enjoyable to use Boosts memorization through student engagement and visualization It is flexible and accommodates creativity
Disadvantages	May require software/technology update from time to time It can result in over-complications
Recommendation and comparison to other techniques	Majority of teachers would recommend the method Majority of teachers prefer it over other techniques

Table 1

Q1 - Question relating to the duration and teachers' perspectives of digital mind mapping

Q2 - Question relating to the attitudes and impact of digital mind mapping on student comprehension according to the teachers

Q3 - Question relating to the advantages digital mind mapping

Q4 - Question relating to the disadvantages of digital mind mapping

Q5 - Question relating to teachers' recommendations of digital mind mapping and how it compares to other methods

Themes (T)

Q1-T1 - The majority of teachers have used digital mind mapping for several years. They all have a positive perspective of the method

Q2-T2 - The students enjoy using digital mind mapping according to the teachers. The technique has enhanced comprehension

Q3-T3 - Main advantages of digital mind mapping include ease of use, improved memorization through visualization and increased engagement, as well as flexibility

Q4-T4 - The main disadvantage is that it relies on technology and equipment have to be updated from time to time. Complications can also occur when students are not guided

Q5-T5 -

## Discussion

Based on the results, the majority of teachers have used digital mind mapping for several years and therefore have a good understanding of its strengths and weaknesses. Teachers 1, 3, 5, 6, 7, 9, and 10 have used it for over 4 years. To the question whether he plans to continue using it, Teacher 1 says "Of course. It's perfect ". This view is shared by the majority of the other teachers. The teachers also reported that the method has met their expectations and that they would recommend it to other teachers. Teacher 7 says "I would. I highly recommend it... more than any other technique".



With regard to advantages, some of the main benefits mentioned include ease of use, increased student engagement, and visualization which promotes memorization according to some of the teacher. For instance, according to Teacher 6, digital-mind mapping encourages students to contribute and become actively involved in the learning process. Teacher 6, on the other hand, mentioned that the learning process with digital mind mapping is enjoyable, easier and that visualization allows students to recall information better. This aligns with several findings from previous studies. According to Puspitasari (2020) and Paulino (2015), mind mapping helps balance the left and right parts of the brain which not only stimulates critical thinking, but also enhances memory allowing students to remember content better. Similar findings have been reported by Buzan (2009), Chang, Hwang, and Tu (2022), Marin (2021), and Christiani, Tungka, and Nainggalon (2022). These views were also reported by many of the other teachers. Teacher 5 said that "It is easy to use and makes it significantly easy for students to remember associations. This is why comprehension becomes easier with time".

All the teachers also agreed that the method promotes comprehension among students. As Teacher 7 explained, "It improves comprehension by helping students connect what they know to new information. Connect existing and new information and thus develop on their knowledge". This is also the reason most of the teachers felt that digital mind mapping is one of the most effective methods to enhance comprehension. According to studies that were conducted by Mohaidat (2018) and Paulino (2015), mind mapping was also found to contribute positively to comprehension. In the study by Paulino (2015), mind mapping achieves this by encouraging learners to become more involved in the learning process. Similar sentiments were shared by Teacher 6, who noted that the strategy motivates students to become more actively involved in the learning process. Through this, according to Paulino, students are more likely to get a better grasp of what they are learning.

According to Papert's constructionism, children learn more efficiently when they are consciously involved in the constructing knowledge. As Ackermann (2001) describes it, it is the process of "learning by making". Han and Bhattacharya (2001), on the other hand, note that "knowledge is not simply transmitted from teacher to student, but actively constructed in the mind of the learner" (par 13). In the study, several teachers reported that digital mind mapping motivates students to become active participants who are involved in the construction of knowledge. As Teacher 3 explains, the method motivated students to contribute new ideas and information and were also able to exhibit creativity during problem solving. According to Teacher 7, the method helps students connect existing and new information in a manner that helps students develop or increase their knowledge. On the other hand, Teacher 6 explained that students will share whatever comes to mind to mind. These aspects of digital mind mapping align with Papert's constructionism not only because of active student engagement/participation but also because students have been shown to contribute knowledge building and generation of ideas using the strategy to organize information. These examples are indicative of conscious engagement/contribution that is characteristic of constructionism. From this perspective, it becomes possible to see how digital mind mapping contributes/promotes comprehension by motivating student to become involved in the construction of knowledge. However, as Teacher 3 pointed out, things can easily become complicated as students continue to share or contribute their ideas/opinions. For this reason, it is important for teachers to facilitate the process and ensure that students are moving in the right direction. This approach is emphasized by Woloyo (2017), (Debbag et al., (2021 and Handoko, (2018) who agree that the implementation process should start with the educators understanding and thoroughly explaining the concept of mind mapping to their students and repeating the explanation as necessary. By helping the students understand how to use the tool, then the actual utilization process would become easier.

## Conclusion

Comprehension is one of the most important aspects of the learning process in that it allows students to continue building on to their existing knowledge. Having understood existing knowledge, they can easily build onto it and understand more complex concepts. In this study, many teachers agreed that digital mind mapping is one of the best strategies to help improve comprehension. As one of the teachers (Teacher 7) pointed out, it is a great tool for the early stages of comprehension because it helps the learners connect existing to new information and consequently develop their knowledge. Being a visual tool, digital mind mapping is also beneficial because it allows students to structure their thoughts and easily remember associations in simple and complex ideas. Another important aspect of digital mind mapping, one that is often overlooked, is that it enhances student engagement and contribution in the learning process. Rather than being passive learners, students can contribute by sharing their ideas and observations in a manner that helps in problem solving. In the study, several participants mentioned that they had noticed increased student engagement and participation while using digital mind mapping. This is especially important because students can easily remember what they and their peers contributed in an engaging classroom. This, along with the visual representation of concept and complex ideas enhances comprehension.

## Recommendation

Future studies on the role of digital mind mapping in advancing students' comprehension should address the limitations of this study by increasing the sample size to include more participants. Additionally, future research could explore the perceptions of students and the impact of digital mind mapping on their comprehension. It may also be beneficial to investigate the effectiveness of digital mind mapping in different subjects or academic levels to assess its generalizability. Another recommendation is to conduct follow-up studies to explore the long-term effects of using digital mind mapping as a learning tool. Finally, researchers should also consider examining the role of digital mind

mapping in promoting critical thinking skills, as this may be another important benefit of this strategy. By addressing these recommendations, future studies can further advance our understanding of the potential of digital mind mapping in improving students' comprehension.

### **Limitation**

One of the primary limitations of this study is the small sample size, which included only 10 to 15 participants. Despite this limitation, a significant amount of data was collected, which required considerable effort and time. Additionally, as qualitative research is inherently subjective, participants' perceptions of the interviewer may have influenced their responses. To address this limitation, it was crucial to maintain a professional demeanor and remain objective during the interview process.

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د. مريم بنت أحمد عبد الله العمير

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