

## Implementation of Digital Mind Mapping Tools to Improve Academic Reading and Summary Writing

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**Abstract:** Computers, the world-wide-web, software applications have been found in every sector of human life. They are useful devices that make work productive and efficient in this 21st century. Therefore, language teachers should also consider blending these digital tools or platforms to improve the language proficiency of their students. Numerous studies on online reading have been conducted and most of them have found that there is a significant influence of the use of digital tools on readers' comprehension, inferences, and motivation. The present study aims to implement a digital mind map tool (Mindmeister) to improve academic reading and explore its influence on the summary writing skill of first-year students pursuing their Bachelor of Engineering in Power Engineering at Jigme Namgyel Engineering College, Bhutan. The research methodology employed both qualitative and quantitative approaches and data was collected via survey questionnaire, interviews, classroom observation, administration of pre-test, post-test, intervention task, and a five-dimensional rubric for assessment. The comparative result of the pre-test and post-test showed a significant improvement in learners' academic reading and summary writing ability. It is concluded that as learners improve in reading comprehension, they are able to distinguish main ideas from minor points, and produce effective summaries of the original text.

**Keywords:** Academic Reading, Digital Mind Mapping, Language Skills, Summary Writing

### Introduction

Reading is an essential skill for language learning and it can make learners autonomous and learn every aspect of the target language. According to Anderson & Pearson (1984); Decant (1991), Mullis, Martin, Kennedy, Trong, and Sainsbury (2009) reading can serve as the input for language learners since they might not be excessively exposed to native speakers. Similarly, Watkins (2017) agrees that in the second language (L2) learning contexts, reading is a crucial source of 'comprehensible input' and Stephen Krashen in his language learning theory has propounded that comprehensible input is a necessary and sufficient condition for language learning. Altbach and Knight (2007 cited in Watkins, 2017) recommends developing reading proficiency in the English language as the medium of instruction is widely becoming English with the internationalisation of education.

Reading is considered to be a complex process as there are a series of mental exercises happening in readers' minds. First, readers decode the print into speech by rapidly matching a combination of letters (graphemes) to their sounds (phonemes) and recognise patterns that make syllables and words. While this knowledge is constantly being used, the reading task becomes easier since they possess deeper lexical, phonological, grammatical, and discourse awareness. According to Elley (1991, p. 404), there is a "spread of effect from reading competence to other language skills-writing, speaking and control over syntax". Gündoğmuş (2018) asserts that the effectiveness of the skills gained in the primary reading instruction is very significant for the future reading, writing performance, and academic achievement of individuals. Teaching reading is considered to be a complex process but it is often underestimated. Reading is the process of looking at written symbols and letters and understanding their meaning. To be able to read one must be capable to recognize, comprehend, and connect words and extract meaning. Moats (1999) holds that a teacher should stimulate the learner's interest in reading, instruct explicitly to decipher words in print, tailor lessons to individuals, and illustrate concepts and connect linguistic symbols with 'real' reading and writing.

For adolescent or adult language learners, critical reading skills are said to be essential as it is linked to critical thinking and it is an essential life skill to achieve success both in school and in their future endeavours. According to Hazaymeh and Alomery (2021), critical thinking skills have been incorporated into the learning process as essential skills for building students' knowledge, solving problems, evaluating the content, acquiring reading comprehension, and most importantly, increasing students' learning awareness to facilitate the learning process. Therefore, teachers or instructors need to select activities and tasks to develop thinking skills. Jose (2021) asserts that literacy skills go beyond 3Rs- reading, writing, and arithmetic. They include the ability to find information, evaluate the credibility of information, combine information from multiple texts, think critically and solve problems using information gained, and create new information in the academic world. It is also termed a 'gate skill' by UNESCO and this has become a basic human right, ensuring equal access to information and empowerment (2017).

In this digital era, information literacy includes one's ability to implement 'gate skill' in digital platforms and Jose (2021) emphasises that information literacy is not a new skill; it is a combination of technical skills such as the ability to use the internet, understand web features, and navigate through websites. Thus, academic institutes can consider the technical skills of their learners as it might be beneficial in making their education relevant in this sophisticated time. In line with it, there are websites or online applications dedicated to exploring the relationship between critical thinking and their disciplined area. Digital mind mapping is one such tool that can help learners discover, analyse, and share ideas and thoughts visually. Rosciano (2015) as cited in Hazaymeh and Alomery (2021) claim that visual mind mapping is a useful resource for developing and implementing activities that promote various levels of students' thinking skills such as note-taking, analysing, completing assignments, preparing for exams, and reflecting on their practices.

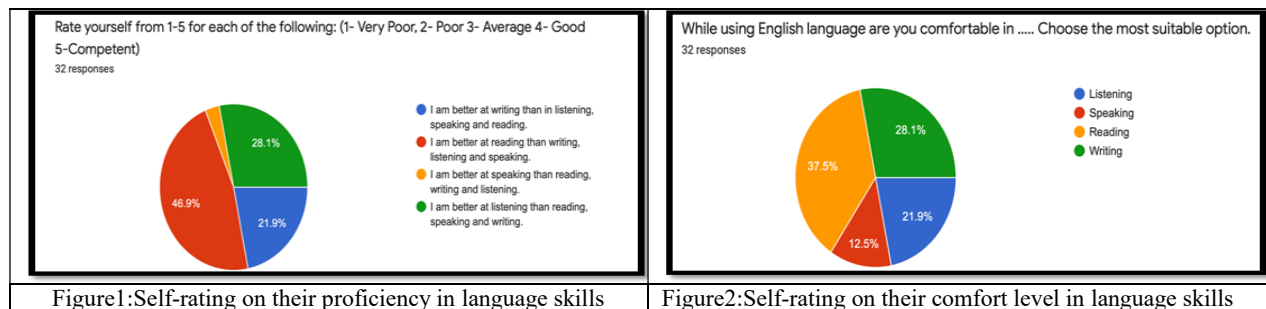
According to Buzan (2018), "mind maps are revolutionary thinking tools that can help learners process information, create new ideas, improve the way they study, and increase their power of creative thinking through diagrams used to organise information hierarchically". Thus, previous studies have proved to improve critical thinking skills and reading ability, especially for undergraduate students. Similar studies were conducted in the United Arab Emirates (UAE) where students were struggling with reading skills, (Eppard, Baroudi, & Rochdi, 2020) and visual mind mapping had a positive influence on enhancing critical thinking skills and reading ability. Therefore, this dissertation investigates the implementation of digital mind mapping tools in improving academic reading skills and summary writing. Further the paper also studies the perception of undergraduate learners towards the use of digital mind map tools.

## **Problem Statement**

As mentioned earlier, reading is a complex process but it develops knowledge in syntax, semantics, and lexis. According to Elley (1991), the effect of reading competence impacts other language skills such as writing, speaking, and grammar. This could be a reason for schools in Bhutan to make a collective effort in inculcating this habit in schools. Today, every school have 'reading week' and as a task for it, a book review is done. The same practice was encouraged to be implemented in colleges under the Royal University of Bhutan to inculcate reading habits and improve language proficiency.

A recent survey conducted by the researcher observed that out of 32 sample populations only 3 students read daily, while 11 students choose to read sometimes or frequently. Furthermore, the author also collected their perception of the 'reading program' they had in schools. Out of 32 participants, 37.5% of them shared that they just read during that specific session with enthusiasm, followed by 31.3% stating that such initiative has instilled reading habits in them. There is still a good number (15.6% out of 32) of participants who revealed that they are always avid readers. It indicates that such an initiative can be initiated by an academic institute and a teacher to improve their language proficiency. Wangchuk and Zangmo (2021) did a study on the attitudes of the students of a middle school towards reading and

examined the effects of a two-year in-class reading program. They learned that the reading program has seemingly improved speaking and writing skills, enhanced learning of subjects studied in English, and assisted their character and personality development. Their study recommends teachers and parents to institute reading programs both at school and at home to continue with their reading habits and improve language proficiency, as well as achieve academic success.



When it comes to reading for academic purposes, there are some challenges learners still experience. On the contrary, they presume that they are confident in reading as compared to other language skills such as listening, speaking, and writing. As depicted in figure 2, out of 32 participants, 37.5% believe that they are comfortable reading in English, followed by 28.1% in writing and the lowest for speaking (12.5%). In the last six years of my teaching career, I have observed that students at the tertiary level misconstrue academic reading from general reading. Students need an awareness that reading for academic purposes is different from everyday reading or reading they did in school. As SPARK (n.d, para.1) rightly mentions that academic reading "requires more active, probing, and recursive strategy than recreational reading." It involves identifying and analysing the main idea, interpreting meaning, connecting to prior knowledge or with other readings, reflecting on relationships among parts of the text, and connecting to your topic or purpose of writing. If this awareness is not provided to students, they might face challenges in achieving academic success.

Academic reading involves identifying, analysing, interpreting the source's information, and showing the accurate product of it in various academic writing platforms. Most studies have found that university students' lack of awareness of writing appropriate summaries and paraphrases leads to plagiarism. Giving significant importance to the process of academic reading and summarising might benefit them in at least writing original sentences. "Students hardly possess reading habits...When individuals are asked to provide a summary of the text, it is noted that they possess minimal techniques or strategies to analyse the text and provide summary" (N. Dorji, personal communication, March 21, 2022). The focus on academic reading to writing can be given the utmost attention, as it not only enables learners to comprehend texts but also helps them to reproduce statements with originality. Moreover, for the chosen participants, academic reading and summary writing are an essential skill that will help them during their final year project, which is a research-based or applied science project.

An empirical study conducted by Selemani, Chawinga, and Dube (2018) reported that students had intentionally and unintentionally committed plagiarism, and one of the reasons was a lack of good academic writing skills. Bailey (2011) asserts that academic writing is a complicated exercise because it involves summarising, quoting, and paraphrasing original text or other author's existing or prior ideas (as cited in Selemani, Chawinga, and Dube, 2018). Thus, it indicates that students' ability to acquire information from reading influences their writing. Furthermore, the COVID-19 pandemic has made most educators explore the internet and digital technology to optimise their online or virtual teaching-learning experience. Egbert, Chao, and Smith (1999, p.4) listed the conditions for an optimal language learning environment:

- Learners have opportunities to interact and negotiate meaning.
- Learners interact in the target language with an authentic audience
- Learners are involved in an authentic task
- Learners are exposed to and encouraged to produce varied and creative language
- Learners have enough time and feedback
- Learners are guided to attend mindfully to the learning process
- Learners work in an atmosphere with ideal stress or anxiety level
- Learner autonomy is supported.

With the increase in the number of computers available to language educators and learners, Levy (1990) believed that language learning-teaching approaches need to have an interrelationship with computer technology (as cited in Egbert, Chao, & Smith, 1999). Therefore, the study also aims to explore how these conditions for optimal language learning environments are fulfilled in online teaching environments.

### Research Context

The Academic Skills (ACS) course is one of the mandatory courses offered to all first-year students at the Royal University of Bhutan, regardless of whether it is an undergraduate or diploma programme. This course "aims to develop the knowledge and understanding of a range of academic skills required for study at university level...will enhance their learning throughout their studies at university and beyond, through close reading, discussions, and critiquing of academic texts. Further, it will enhance students' capacity to critically reflect on their own learning", (Module descriptor, 2019, p.9). The course comprises a range of units that are arranged in a progressive order of learning, whereby learners build on skills from the former units. The course starts with different aspects of academic standards focusing on academic integrity, intellectual property rights, and the purpose of this course in the first unit. Unit two focuses on various forms of note-taking methods that students require for academic purposes. Unit three teaches academic reading approaches to read academic texts and procedures to write summaries and paraphrasing. With the knowledge and skills of academic reading and summary writing, students are taught academic writing in the fourth unit. This unit teaches students about features and types of academic writing and constructing academic arguments. Unit five is on referencing style which is required when academic reading and academic writing are implemented practically by students. Unit six focuses on academic essays discussing the detailed treatment of academic essays, focusing on salient features, elements, and structures. The last unit covers oral presentation skills which enhance students' oral communication skills and strategies to make effective presentations. These generic skills are applied across other disciplines and also for success in the final year project.

### Background of the Learners

The medium of instruction in academic institutes is English and students learn English from their pre-primary level. English is also one of the official languages of communication along with Dzongkha. It is majorly used in most of the official documents and it is a second language in Bhutan. These students have English and Dzongkha as their language subjects. Except for Dzongkha, the majority of the subjects are taught in English. In addition, they will be awarded a pass certificate only if they can score a pass mark, both in English and Dzongkha. This policy came into place during the 18<sup>th</sup> National Education Conference in 2018 (BCSEA, 2020). Thus, most students have more than 10 years of exposure to English at school. The selected participants for this study are undergraduate students pursuing one of the Engineering programmes offered at Jigme Namgyel Engineering College under the Royal University of Bhutan. As mentioned earlier, the ACS course is offered during their first year and this study is observed when they were studying this course, in particular the 'Academic Reading' unit. Literature Review



The section provides literature related to the development of reading skills, improvement in reading proficiency in online text, and digital intervention in improving reading proficiency. Concerning literature, the current study attempts to see learners' development in academic reading using digital tools and its influence on academic writing, particularly their summary writing.

Reading is a primary skill for a language learner to excel in other language skills. Kolers (1973) states that it is one of the "most complex forms of information processing" and in an L2 context, reading is a key to academic success (Anderson, 2015; as cited in Sadeghi, 2021). In addition, Krashen's concept of 'comprehensible input' can be achieved through reading. It is through understanding a written text by extracting required information or main ideas and making the input comprehensible. Moreover, teaching reading to language learners makes them autonomous learners. The history of research on reading dates back to the mid-nineteenth century. The research in reading progressed with a focus on reading skills, the psycholinguistic nature of reading, the cognitive process of reading comprehension, and the process of reading in digital arenas.

The quasi-experimental study conducted by Cain, Oakhill, Barnes, and Bryant (2001) observed that learners' reading comprehension skill has a relationship with their ability to draw inferences. While comparing skilled comprehenders and less-skilled comprehenders, the latter group faced difficulty in inferencing not only because of limited prior knowledge and memory but also the inability to select information relevant to make inferences. It indicates that learners should be involved in active learning or experiential learning strategy. Bruce and Bloch (2012) agree that such a pedagogical approach engages learners in hands-on, creative modes of learning and makes sense of their experiences.

Coiro (2000) brings in new dimensions to reading comprehension, as electronic or online texts are introduced. Through the study, she recommends that teachers should effectively prepare students for literacy futures. "Electronic text introduces new supports as well as new challenges that can have a great impact on an individual's ability to comprehend what he or she reads", she added. Another study by Coiro (2011) compared the performance when reading offline and online text. The quasi-experimental study found that learners with higher levels of online reading ability could perform well in reading comprehension tasks, regardless of their level of topic-specific knowledge. While students with lower levels of online reading ability tend to have higher reading comprehension scores when they are provided tasks with topic-specific prior knowledge.

A similar study was also conducted on pre-service teachers by Yamaç and Öztürk (2019) their action research was to examine insights of pre-service teachers' new literacies through online research and comprehension. In other words, it was to study the differences between digital reading and traditional reading. The participants did two online research and comprehension tasks, whereby the study found a change in the nature of information and learning. During the online research and comprehension process, the candidates' employed strategies to locate information, determine reliability, reading, online information synthesising, and content creation. The study observed that pre-service teachers developed certain digital skills, online research, and technological competencies.

Another study by Samiel and Ebadi (2021) explored EFL learners' inferential reading comprehension skills through a Web Quest-based flipped classroom. Reading comprehension encompasses analysing and interpreting a text and reading between the lines, which entails higher-order thinking skills. The result showed that Web Quest-based methods improved critical thinking among the learners. Web Quest-based flipped classrooms could enhance both the learner's responsibility and motivation levels to a greater extent than the traditional teaching language method. The flipped classrooms enable students to benefit from classroom time and interaction, collaborative learning, and assessment. It is successful in helping students earn the content, and increased self-efficacy in their ability to learn independently. Helmer's study on third-grade students reading comprehension through the use of technology and collaboration was

found to be effective as their performance improved on their weekly comprehension assessment (2017). For the study, Helmer adopted the READ intervention program, which was designed by teachers and consists of instructional strategies and instructional tools. READ here refers to Reading with the teacher, Enjoying vocabulary, Answering questions, Diving into story, and independent reading.

Another digital tool used was the Cloze application, which aims to promote text comprehension with the specific aim to recover the process of lexical and semantic inferences (Capodiecì, Cornoldi, Bertolo, Carretti, 2020). This application is a distance rehabilitation program, where participants complete personalised training activities. They were around twenty-eight children from 3<sup>rd</sup> to 6<sup>th</sup> grade with comprehension difficulties. These children completed a distance program for 15-20 minutes at least three times a week for about four months. Using this application, learners were found to improve their vocabulary and comprehension monitoring skills. The researchers recommend that it is possible to promote reading comprehension with a distance individualised program avoiding the need for the child's displacement and reach a rehabilitation centre.

Gilbert's (2017) study aimed to investigate English language learners' way of processing web texts, navigating the internet, or evaluating and comprehension through digital literacy skills. The study gained insight into online reading strategies of English language learners to explore if there is a need for the English as a Second Language profession to teach digital literacy in the language classroom. In addition, it examines the metacognitive online reading strategies of intermediate and upper-intermediate ESL learners. Similar to that, Jose (2021) also studied learners' interaction with print text and online text. She also looked into reading strategies used by these readers and found that both High language proficiency and low language proficiency readers found comprehension of online text easier than the print text; irrespective of familiar or unfamiliar text. Further, she suggested that even though learners benefited from cognitive, metacognitive, and navigational skills, explicit training to use these strategies might promote online literacy skills.

While Roy (2017) studied improving learners' reading comprehension skills using concept maps on Cmap tool software. The study compared learners' performance using paper-and-pencil concept maps and electronic concept maps using the software. It was noted that performance was high in the latter group as technology and computer-assisted learning allowed learners to learn at their pace, enhanced their ability to deal with multiple texts, and most importantly increased the motivation to learn. The study found the differences between online and traditional reading and its influence on reading skills, in particular, comprehension and inferences. Hazaymeh and Alomery (2021) also studied the use of mind mapping in improving critical thinking skills and reading ability. In their study, they investigated the implementation of visual mind mapping and assess learners' mind maps using California Critical Thinking Test, where the rubrics include five items such as organisation, depth, design, creativity, and spelling/grammar. The study observed that a visual mind mapping strategy has a positive effect on students' critical thinking skills and reading ability. Further, this practical method of teaching reading and critical thinking skills inspires students to practice, generate, and organise their ideas and thoughts.

However, in my study, I would like to explore whether online reading and the use of digital mind mapping improve the learner's ability to comprehend text and write an effective summary. To make it specific, the current study studied learners' summary writing as a part of their academic writing exercises. Summary writing is one of the critical reading strategies that are essential for undergraduate students as it will enhance their critical thinking ability, and summarising is found to be essential when they prepare for the final year project.

## **Research Questions**

- Does a digital mind map have any effect on a learner's reading comprehension?

- If there is a significant development, does that affect their summary writing ability?

## Research Methodology

**Sample Population:** In this study, the researcher chose first-year students pursuing their Bachelor of Engineering in Power Engineering at Jigme Namgyel Engineering College and their English Lecturer as the research participant. Initially, the study had 31 participants but 18 students participated in the study regularly. Therefore, the study analysed the data gathered from 18 students only. There were around 13 students who missed participating in one or two sessions, for them analysis were done separately. This was mainly done to understand the majority of learners' growth in academic reading and summary writing. Participants were mostly above 18 years and studying English as their second language. They have been pursuing their education in English as a medium of instruction for more than 10 years. Out of 17 respondents, 6 were female and 12 were male.

At the time of this current study, they were enrolled in an Academic Skills course, which is a mandatory course for all first-year students in the colleges of Bhutan. They also did DIALANG test, an online diagnostic system designed to assess language proficiency. Since the study mainly deals with reading and writing skills, participants were asked to test on these two skills only. Majority of them fell under the category of B1-B2 level and few with A2 level in reading category and in writing most of them feel between B1 and B2 level and few on C2 level of Common European Framework of Reference for Languages framework (CEFR). This indicates that participants fall under lower-intermediate and Upper-intermediate level. Teacher participant for the study was their English tutor, he has 14 years of experience in teaching Technical English and Academic Skills in that same college.

**Data Collection:** To study the impact of digital mind mapping on learners' academic reading and simultaneously assess their summary writing, participants had to undergo a pre-test, four intervention tasks, and post-test. A detailed explanation of various data collection tools and their administration is given in the following paragraphs.

**Tools:** Before the implementation of the task and tools, researchers conducted a pilot study on studying their level of proficiency in reading and writing. Further, to gather an accurate result, participants did self-assessment on reading and writing skills using 'DIALANG' an online diagnostic assessment tool. According to Kektisodu and Tsagari, this diagnostic tool helps learners self-assess their abilities and obtain diagnostic information about their language proficiency (2019).

For digital mind mapping, the participants used 'MindMeister', a mind mapping software. The software is used mainly because it is user-friendly and allows collaboration; which might be helpful for participants during their final year Project. Participants were given a six-reading passage, whereby they read, solve comprehension questions and write a summary for their pre-test, intervention tasks, and post-test. The passages were on familiar topics for participants such as pollution, water issues, and cybercrime. For the pre-test, participants solved the task without the use of a MindMeister; followed by interventions such as a guest lecture on using MindMeister, using mind maps for academic reading, and writing the summary. Summary and paraphrasing strategies were also taught as an intervention and finally, academic features of writing were also taught. In between interventions, participants were assigned passages to practice using the digital mind mapping tool and also improve their summary writing skills. In the post-test, they were again assigned a summary writing task using 'MindMeister'.

For evaluating the pre-test, the effectiveness of an intervention, and the post-test, the study used 'The five-dimensional rubric' from Yamanishi, Ono, and Hijikata (2019). The rubric consists of five areas of assessment that allows both analytic and holistic assessment. It looks at the content of the summary, quantity, and quality of the paraphrase, language use, and overall quality of the summary. As the study intends to monitor learners' development in academic reading as well as summary writing, the researcher

saw this rubric to be suitable. The rubric gives an area where the teacher or evaluator can observe learners' ability to comprehend, grasp main ideas, discard minor ideas, and restate in their own words. Hamp-Lyons (1995) as cited in Yamanishi et al. (2019) mentions that the analytic assessment enables the assessor to provide diagnostic and comprehensive feedback on students' performance and a holistic assessment gives an overall impression of the summary. Thus, this rubric allows the study to understand the strength and weaknesses of learners' language proficiency. The five-dimensional rubric is presented below:

Table 1: Rubrics for evaluation from Yamanishi, Ono, and Hijikata (2019)

The Five-Dimensional Rubric			
Dimension	Grade	Level	Criteria
Content	4	Very Good	Can grasp all the main ideas. Can develop the main point substantially by occasionally using secondary information.
	3	Good	Can grasp most of the main ideas. Includes somewhat incorrect information beyond the original text, but does not substantially deviate from the main point.
	2	Fair	Can grasp only limited main ideas. Cannot demonstrate an adequate development of the main point. Noticeably includes incorrect information or information beyond the original text.
	1	Poor	Cannot identify main ideas. Cannot grasp main ideas correctly.
Paraphrase (Quantity)	4	Very Good	Can paraphrase 80% or more of the expressions included in the summary in one's own words.
	3	Good	Can paraphrase from 50% to less than 80% of the expressions included in the summary in one's own words.
	2	Fair	Can paraphrase only from 25% to less than 50% of the expressions included in the summary in one's word.
	1	Poor	Can paraphrase only less than 25% of the expressions included in the summary in one's own words.
Paraphrase (Quality)	4	Very Good	Can actively attempt to paraphrase. Can demonstrate effective paraphrases where both sentence construction and vocabulary choice are different from the original text.
	3	Good	Can actively attempt to paraphrase. Can paraphrase using vocabulary different from the original text. Seldom changes sentence construction from the original text.
	2	Fair	Includes a few expressions consisting of more than 4 words in a row copied from the original text. Can only demonstrate paraphrases using vocabulary from the original text. Deletes expressions partially or changes word order.
	1	Poor	includes a number of expressions consisting of more than 4 words in a row copied from the original text. Cannot demonstrate effective paraphrases.
Language Use	4	Very Good	Can demonstrate a sophisticated range of vocabulary with effective word/idiom choice and usage. Can demonstrate effective and complex sentence construction with few grammatical errors.
	3	Good	Can demonstrate an adequate range of vocabulary with good word/idiom choice and usage. Can demonstrate simple but effective sentence construction. Includes minor and occasional errors.
	2	Fair	Can demonstrate only a limited range of vocabulary, word/idiom choice and usage. Can demonstrate simple sentence construction. Meaning is obscure due to frequent major errors.



	1	Poor	Can demonstrate little knowledge of vocabulary, idioms, and word form. Can demonstrate little knowledge of sentence construction rules and English writing conventions. Meaning is obscure due to several minor and major errors.
Overall quality	4	Very good	As a response to this task, the overall quality of this summary is.....
	3	Good	
	2	Fair	
	1	Poor	

## Method of Administration

Along with pre-test, intervention task, post-test, and uniform rubrics for evaluation, the study also interviewed teachers and selected student participants to gather qualitative information on their experience in teaching and learning academic reading and summary writing with digital mind maps. Their experience on using digital mind maps for academic reading and summary writing. In addition, the researcher of this current study also observed nine classrooms teaching-learning which constituted 270 minutes in total. The observation was conducted to explore academic reading processes or strategies and reading to writing techniques delivered in the classroom teaching-learning. Furthermore, the researcher was also invited to provide a guest lecture by the teacher to share her educational experience on using digital mind maps, the influence of technology in language learning, the importance of academic reading in academic writing, and also to motivate learners.

Initially, the study intended to investigate face-to-face teaching-learning and planned to use think-aloud protocols to assess cognitive and metacognitive strategies. Teacher Vision (2019, p.1) states "getting students into the habit of thinking out loud enriches classroom discourse and gives teachers an important assessment and diagnostic tool." However, the college resumed its spring semester in online mode as the country was in lockdown due to the COVID-19 pandemic. Therefore, the study used participants' reflections and interviews to understand their growth in academic reading to writing and the strategies they adopted to improve reading and writing proficiency.

Finally, three sets of questionnaires were used to gather learners' perception on reading proficiency before the intervention, their perception of reading after using a digital mind map, use of the digital tool, and a final questionnaire for the teacher to understand the challenges in teaching the English language in Engineering college and gather information on teaching methodologies teacher practices in the classroom.

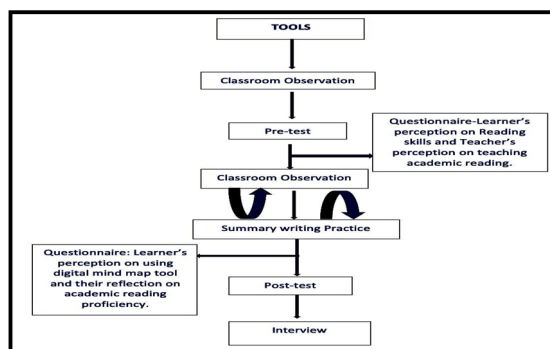


Figure 3: Chart showing the administration of data collection tools

## Data Analysis

For this study, both pre-test scores and post-test scores from teacher and researcher's assessments were gathered and analysed using descriptive statistics. Further, the researcher also assesses four intervention tasks on writing a summary, to understand the impact of the digital mind map, progress after each

intervention provided in the class, and detect their progress in each task. The test scores from both teacher and researcher were compared and when there were drastic differences in the score, they discussed and came to a common agreement. In addition, the supervisor of the current study also compared the scores and also conducted an inter-reliability check for an accurate outcome.

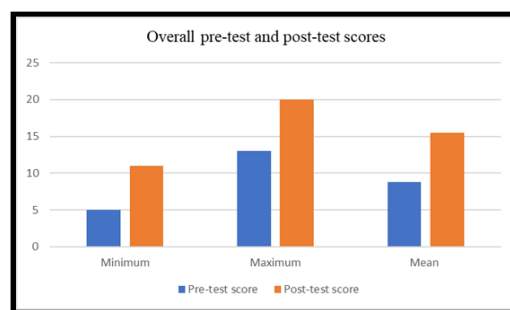
These four-intervention tasks and two tests were assessed using the five-dimensional rubric and were analysed by comparing their scores for each dimension; namely, content, paraphrase (Quantity), paraphrase (Quality), language use, and overall quality in participants' summary. It is aimed to capture the growth of participants in their reading and writing proficiency.

## Results and Findings

**Finding 1:** To reveal the effectiveness of the use of digital mind mapping in academic reading and summary writing; the pre-test and post-test scores were analysed using the analytic five-dimensional rubric, where 4 is the highest mark awarded and 1 is the lowest on each dimension. Thus, the highest score possible for a student is 20. The analysis showed that the lowest overall score for the pre-test was 5 and the highest overall pre-test score was 13. The mean score for pre-test scores is 8.78. The lowest post-test score was 11, while the highest post-test score was 20 and the mean post-test score was 15.50. As compared to pre-test scores, participants improved their overall performance in the post-test scores. This is evident in table 2 and figure 4.

**Table 2: The overall analysis of pre-test and post-test scores**

Test	Maximum	Minimum	Mean	Median	Mode	SD
Pre-test score	13	5	8.78	9	10	2.10
Post-test score	20	11	15.50	16	16	2.32



**Figure 4: Bar chart showing the overall performance in pre-test and post-test**

**Finding 2:** In this section, the researcher analyzed pre-test, and post-test scores on each dimension given in the rubric. The following findings answer the second research question. While comparing scores of each dimension given in rubrics, one can understand that the summary writing ability has improved. With a series of intervention tasks and test, participants are aware of how to distinguish main idea from minor points, paraphrase in their own words, and maintain originality by using vocabulary that is different from the original text.

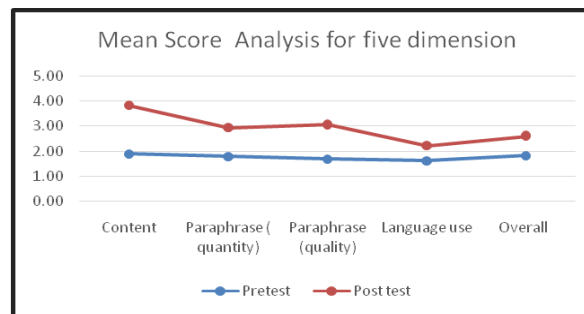
**Table 3: Pre-test scores analysis**

	Content	Paraphrase (Quantity)	Paraphrase (Quality)	Language use	Overall	Total
Maximum	3	2	3	3	3	13
Minimum	1	1	1	1	1	5

Mean	1.89	1.78	1.67	1.61	1.83	8.78
Median	2	2	2	2	2	9
Mode	2	2	2	2	2	10
SD	0.66	0.42	0.58	0.59	0.60	2.10

**Table 4: Post-test score analysis**

	Content	Paraphrase (Quantity)	Paraphrase (Quality)	Language use	Overall	Total
Maximum	4	4	4	4	4	20
Minimum	2	2	2	2	2	11
Mean	<b>3.83</b>	<b>3.11</b>	<b>2.89</b>	<b>2.56</b>	<b>3.11</b>	<b>15.50</b>
Median	4	3	3	2	3	16
Mode	4	3	3	2	3	16
SD	0.37	0.74	0.57	0.68	0.57	2.32



**Figure 5: Mean score along five dimensions in the pre-test and post-test**

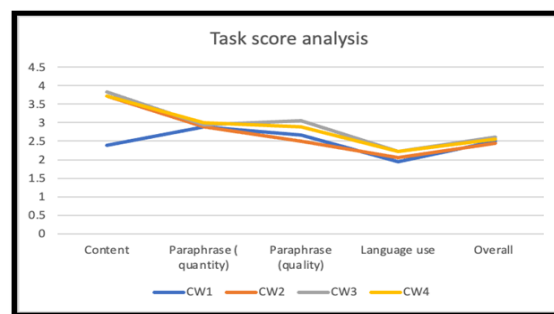
As we can see from the figure, students had obtained very low scores along all dimensions of the analytic rubric, particularly for paraphrase (quality), paraphrase (quantity), and language use from both the teacher and the researcher during the pre-test. The scores were below 2 points suggesting that students could grasp only some of the main ideas and tended to include information that was not relevant to the summary. They tended to use words from the text while paraphrasing indicating poor vocabulary control and the range of structures used was also limited.

In the post-test, however, we find that the overall quality score (mean) has increased from 1.83 to 2.61. While comparing the scores along the five dimensions, we find that there is a notable improvement along all dimensions with content showing the greatest change in score. A score of 3.83 suggests that students have been able to read and extract quite successfully the main idea of the passage even though there may be instances where some incorrect information is included. Similarly, the post-test scores for paraphrase (quantity), paraphrase (quality), and language use have improved nearly two-fold. This suggests that having used the mind mapping tool and practising summary writing after the targeted interventions, has led them to be able to paraphrase the text provided using their own words to a great extent. They have also been able to use synonyms, and other vocabulary that is different from the words used in the original passage. While they have been able to write on their own, structures are still somewhat problematic and frequent grammatical errors persist.

During the pre-test the maximum score for all dimensions were 3 and 2 for paraphrase (quantity) dimension. As they proceeded through the intervention tasks and post-test, the performance has improved upto a maximum of 4 points for all dimensions. This indicates that learners were able to grasp all the main ideas and could develop the main points by using secondary information in their summary content. 80% of their paraphrased information is in their own words and they can demonstrate effective paraphrasing

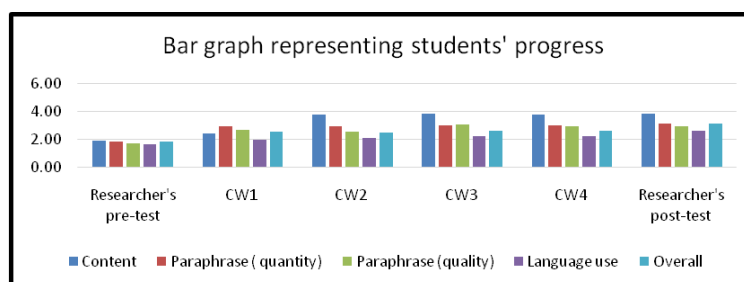
where sentence construction and vocabulary choice are different from original text. They are able to use a sophisticated range of vocabulary with effective word choice.

**Finding 3:** In this section, the study observed the development of participants' summary writing skills during their classroom intervention period. After each intervention, participants were made to read a passage, create a mind map using MindMeister, and write a summary. A total of four passages were given to them on a weekly basis and each time the participants submitted their task, the teacher evaluated it and gave feedback. The teacher provided intervention for further improvement in their task. Some of the interventions were demonstration on creating mind maps using Mindmeister, sharing ways to paraphrase information by using synonyms, changing word form, changing sentence structure, and introducing them to features of academic writing.



**Figure 6: Mean score for five dimensions**

The chart indicates that overall performance for all four tasks has improved in a relative manner. Most significantly, the ability to grasp the content from the original text to write an effective summary has improved drastically from the second, to the third and fourth tasks. From a mean score of 2.39 in the content dimension, we see an increase to 3.83 and 3.72 respectively. As compared to content and overall dimension, participants had difficulty in improving the quantity of paraphrase, quality of paraphrase, and language use. Nevertheless, classroom interventions have gradually improved the mean score on these dimensions as well. The highest mean score for paraphrase (quantity) was 3 and lowest was 2.89. For paraphrase (quality) the score improved from a low of 2.5 to 3.06. The score for language use moved from a low 1.94 to 2.06 and this is where the change in scores is the least indicating that students' overall language still needs improvement. It indicates that learners are not only able to grasp main ideas, but are also able to paraphrase the original information using different vocabulary from the original text, write in academic language, and maintain originality with some grammatical errors.



**Figure 7: Distribution of Mean score for Tests and Tasks**

The bar chart illustrates the participant's pre-test and post-test scores, as well as their score across the four intervention tasks. It can be seen that the blue bar which represents the 'content' dimension has increased rapidly from the second intervention task. This indicates that participants were able to understand and grasp the main ideas of the original text. During their pre-test, participants faced difficulty in identifying main ideas and cannot grasp main ideas correctly. Therefore, the score in 'content' dimension was the



highest with mean score 3.83 as compared to other dimensions. After the content dimension, paraphrase (quantity) and paraphrase (quality) have seen a gradual improvement. The mean score for these dimensions increased from 1.67 to 3.11. From their summary writing, it was observed that they could improve in maintaining originality by not including the same expressions. As mentioned in the five dimensional rubrics, it is considered a poor paraphrase if the summary 'includes a number of expressions consisting of more than 4 words in row copied from the original text.' Their summaries showed considerable improvement as they could construct sentences with relevant vocabulary that was different from the original text. In fact, 80% or more of the expressions included in the summary were their own. The purple bar which represents the 'language use' dimension did not observe drastic improvement. Nevertheless, the mean score increased from 1.61 to 2.56 and the highest score was 4 and minimum was 2 in the post-test. This indicates that with the lesson on academic features of writing, they could demonstrate an adequate range of vocabulary with suitable signal phrases, and frame sentences with few grammatical errors. Due to these features available in their summary, the overall score steadily improved from a mean score of 1.83 to 3.11.

**Findings 4:** In this section, the researcher selected the summaries of six participants and analysed their progress in each task with reference to the five-dimensional rubric. These six students were selected since they had shown significant improvement in their performance. In addition, they also volunteered to participate in interviews for the current study. In their pre-test summaries, we will see that the distinctive feature is that the main idea is missing. Students appear to have difficulties in identifying the main idea of the text they have read and their summaries included minor ideas. Their paraphrased sentences lacked originality as most of the expressions were the same as the ones in the original text. Since the expressions were copied from the original passage, it signified limited knowledge of vocabulary. Most of the summary started with "Air pollution is a major problem...." and participants missed to notice that the major source is the increase in the number of vehicles. Nevertheless, after the first intervention using a digital mind map, their ability to comprehend the passage and separate main ideas from minor ideas improved. Sample digital mind maps are presented in APPENDIX I. In the third intervention task, participants have improved by being able to provide an appropriate title to their summary; which is an indication of being able to identify the main idea. In addition, the features of academic writing showed significant improvement in their use of signal phrases and ability to maintain a coherent sequence unlike in the pre-test and initial phase of intervention, where the sentences were found to be fragmented, deadwood or run-on sentences. The excerpt below is one of the examples, where participants did not use signal phrases, while there is a progress in intervention tasks.

*Student 1: "With growing numbers of population the number of vehicles is increasing and this number of vehicles release harmful gas like CO (Carbon monoxide). This causes major air pollution. People are getting different types of health issues. They are getting affected by lung cancer and heart attacks"*

*Student 1: "...Amongst all, virus is the most common threat to the computer. Moreover, it comes unnoticed. Despite being just an attachment that comes with downloaded files, it may lead to the complete crash of the computer. Specially, Trojan Horse is designed to get credit card details and bank passwords..."*

*Student 3: "Air pollution is the biggest problem that the today's world is facing. And the main cause of this problem is due to motor vehicles and other man-made sources like factories, power stations, mining, building and burning of fire woods in our home. Volcanoes and forest fires are some natural sources of air pollution that produce lots of pollutants in the air..."*

*Student 3: "...The four main water problems are water scarcity, water sanitation, water access and resource management. Due to climate change in some parts of the world, water sources are drying and leaving people without access to safe water and it causes death, illness and affects food production..."*

In the post-test, participants presented a well-organised summary as they could state the main idea clearly and precisely. Through their summary, the reader can identify the main idea of the original passage. Their summary also had concise and precise sentences with minimal repetition and maintained originality. The following excerpt shows the introductory sentence of the summary.

Student 2: "Water scarcity, water sanitation, water access and water resource management are some of the critical water issues..."

Student 3: "The four main water problems are water scarcity, water sanitation, water access and resource management..."

Student 6: "Tobacco is harmful to the public's health and should be strongly controlled..."

Table 5: Participants' summary for Pre-test, Intervention task, and Post-test

Student	Pre-test	Intervention 3	Post-test	Dialang Test
Student 1	Air pollution has become a major problem in today's era. With the growing numbers of the population, the number of vehicles is increasing and this number of vehicles release harmful gas like CO (Carbon monoxide). This causes major air pollution. People are getting different types of health issues. They are getting affected by lung cancer and heart attacks. Due to increasing population and dust and pollution, children living in crowded traffic areas have a higher possibility of developing Asthma. Therefore, we should be responsible, act responsibly and save our future generations.	Computer Insecurity - Connecting a computer to the internet leads to high computer insecurity. Be it via mail, a software program, or downloaded music. Besides, CD ROM also isn't always safe. Amongst all, a virus is the most common threat to the computer. Moreover, it comes unnoticed. Despite being just an attachment that comes with downloaded files, it may lead to the complete crash of the computer. Especially, Trojan Horse is designed to get credit card details and bank passwords. Furthermore, spyware also collects one's information and sends it to commercial companies. In addition, 'Spam', though less dangerous, can drag one's information through phishing. Therefore, it is very important that an up-to-date anti-virus program is used.	Water Problems - Amongst many issues related to water, water scarcity, water sanitation, water access and resource management have become the key issues around the world. Due to the changing climatic condition, traditional sources are dying leading to lack of safe drinking water. This scarcity also affects the food production. In some underdeveloped countries, water sanitation has also become one of the major problems where the drinking water is polluted due to poor sanitation. There are many lives without access to safe drinking water. This is because of the growing population and lack of water infrastructures in the areas. Resources that the world already has are also an inappropriate (inappropriate) management system where poor people without political link suffer.	B1
Student 2	Air pollution is a major problem all over the world which is caused by motor vehicles, man-made sources and natural sources. Among these increasing numbers of motor vehicles is the main cause of air pollution. This problem of increased pollution in the world has led to an increase in the	Whenever the computer has access to the internet the chances of attacking come through sources such as email, software program, downloaded music and CD-COM. The most common danger attack is viruses such as Trojan which steals bank details and Spam too act	Water scarcity, water sanitation, water access and water resource management are some of the critical water issues. First of all, 1.1 billion people in the world are facing water scarcity and have no access to safe water due to climate changes. Similarly, 2.6 billion people lack water sanitation leading to 5 million deaths. And experts	B1

	number of studies done to look at the effect of our health. Study found that risk of disease such as heart attacks and lung cancer increase as the size of polluted air decreases. They also found that people living near the area are likely at high risk of suffering from asthma as compared to people residing in other parts. The time has come where every people on Earth is responsible for reducing air pollution according to studies.	same like Trojan which is termed as phishing. And another most common type of attack is Spyware which steals personal information. Moreover, all these types of attacks slow down computer systems and lead to stoppage of computer working. Therefore, to avoid these types of attack anti-virus are updated and avoided giving bank details.	expect another 2 billion to live in slums because of this issue. Both water scarcity and sanitation are linked to the problems of water access. Some of the problems with water access include walking long distances to access water, lack of water infrastructure and untapped resources such as underground water. Moreover, shared water resources among different groups may cause political conflicts and further the difficulty of resource management. All of the water issues might disrupt the global food chain supply thereby making it difficult to afford food. Therefore, water issues must be tackled.	
Student 3	Air pollution is the biggest problem that the today's world is facing. And the main cause of this problem is due to motor vehicles and other man-made sources like factories, power stations, mining, building and burning of fire woods in our home. Volcanoes and forest fires are some natural sources of air pollution that produce lots of pollutants in the air. Overall increasing number of motor vehicles is creating more pollution and Beijing, Mexico City, Moscow and Mumbai are some of the most polluted cities in the world. And some studies have found that due to air pollution many health problems are also increasing like lung cancer, heart attack, asthma and other similar diseases that are risking the human life. So, for the sake of our future, we all should start reducing the level of air pollution in our cities.	Computers under attack Whenever computers are connected with the internet it is attacked by viruses which come via email, software program, or downloading music. When a virus becomes too serious it damages the whole computer system and to destroy the virus the companies spend millions of dollars. Viruses such as Trojan horse are designed to steal money from bank accounts and Spyware collects person's information and relays to other parties. More than 50% of all the messages are spam. Now some people are using spam to trick people to get money from them. This is called phishing. So therefore, always update anti-virus programs and never share bank details to others.	Water complications the four main water problem are water scarcity, water sanitation, water access and resource management. Due to climate change in some parts of the world, water sources are drying and leaving people without access to safe water and it causes death, illness and affects food production. In poor countries, the explosion of clean and safe water is the big water threat and because of this every year 5 million people die. Water access connects to both scarcity and sanitation problems, though there is enough water for the people in that area due to no proper well and water pumps installed. People have to walk more than an hour to get water and there is no access to safe water. Since the human population is increasing and water sources are decreasing extreme water tension is created among the people. Resource management is a political issue and is handled by the government.	B1
Student 4	Air pollution is a major problem all over the world today. Motor vehicles being the main cause and other natural causes has contributed to air pollution. Beijing, Mexico, and all are	Disaster in computer "Have you ever wonder what's going to happen to your computer as soon as you switch it on and connect it to internet?" Virus is the main	Hydrological Cycle Have you ever thought about the water and its cycle? Water problems like scarcity, depletion, pollution, lack of sanitation, global warming, big dam projects and all	B1

	examples of polluted areas. The studies have shown heart attacks and lung cancers during the first study and asthma during the second study. so, the main cause of air pollution known today is air pollution.	source of danger to computer where they stop the computer working, and it cost a million of dollars to repair. Trojan horse is the one of the viruses that steals one's credit card detail and take all the money from the bank. Similarly, spyware hide inside the computer and collects information about what the user use to with the computer and sent it to commercial companies. Unwanted advertisement like offers to trick people to get money is "spam". So, make sure that never to give bank detail to any advertisement and keep using antivirus program.	are the main causes of problems for people. Freshwater on earth is continuously being replenished; some of it soaks into the ground, some to vegetation and some to rivers and streams to sea. One start using freshwater beyond the rate at which it can be replenished leading to extinction, similarly, lying deep under the surface in aquifers, where it takes thousands of years to form and humans have been tapping water endlessly that may lead to extinction.	
Student 5	Air pollution is a major problem all over the world today. The causes of air pollution are categories into two types, that is, man-made and natural resources. The biggest contributor to air pollution is motor vehicles, and increase in use of motor vehicles increases the rate of pollution. Beijing, Mexico City, Athens, Moscow, and Mumba are the most polluted cities in the world. The first study carried out by residents of a Cairo suburb found out that the smallest particles cause three times as many long-term health problems. A connection between the number of particles in the air and health is suggested by DR Razia of Cairo University and they found out that the tiny particle that has less than 2.5 microns diameter, increases the risk of dying from lung cancer and heart attacks. The second study carried out at Ottawa; Canada found out that children living near busy roads were more likely to develop asthma. The researchers studied the health condition of children	Computer Virus In today's digitalized world, use of computers has increased in everyday lives but the threats to computer systems have also increased equally. Viruses are the most common threats, which are more likely to hide themselves in documents or software and later attack computers. Of numerous viruses' Trojan horse, hacks bank details and eventually steals money whereas Spyware hacks personal details and sends them to merchandising companies. Spam could also be dangerous to the user, which trick people to get money also known as phishing. Computer attacks can be prevented by updating anti-virus programs daily and unrevealing personal details.	Water crisis With the geometric increase in population water has become a global issue due to Water scarcity, Water sanitation, Water access and Resource management. Water shortage is caused due to climate change and it also causes dispute over scant resources, increase of food prices due to reduction of food production and increase rate of mortality. Water sanitation is the major threat in poor countries which causes about 5 million deaths annually. Water access is caused due to lack of infrastructure in an area, and results in water sanitation and scarcity problems. Lastly resource management is a political issue where people use water as much as they could if politics do not interfere.	B1



	and concluded the connection between how close the child lives to traffic and the possibility of developing asthma and other diseases.			
Student 6	In today's era, air pollution has become the main problem through both natural and man-made means. Beijing, Mexico City, Athens, Moscow, and Mumbai are the most affected cities in the world due to air pollution. The first study conducted on the residents of a Cairo suburb by Dr. Razia of Cairo University suggests minute polluted particles could lead to long-term health effects for more than 3 times the number of particles in the air. It was proved with data records of nearly 25,000 residents over two decades that people are affected by heart attacks and lung cancer. The second research conducted in Ottawa, Canada, found that there is a link between children residing near roads and the development of asthma and other diseases.	When the computer is connected to the internet, the computer system has the potential to be raided. The "virus" is the most common source of danger. The Trojan Horse virus is the most dangerous of the Trojan Horse and spyware viruses, designed to steal credit card information or bank passwords. Another danger is spyware, which hides inside the computer so that the system operator may not know about its presence. It might not do any damage, but it collects information about the system holder and sends it to commercial companies. The simplest phishing trick is to send an email promising the receiver will prosper. However, to get this money, the account holder must first send the bank details.	Tobacco Tobacco is harmful to the public's health and should be strongly controlled. The tobacco settlement makes cigarette manufacturers responsible for their previous conduct. The annual expense of smoking-related healthcare exceeds \$75 billion and claims the lives of more than 400,000. Tobacco companies must pay \$206 billion in order to assist smokers in quitting, provide healthcare to present and former smokers, and repay states. The tobacco settlement requires the tobacco industry to contribute money to "smoking cessation initiatives, healthcare, education, and children's programs." This is an unjustified government intrusion into the private realm. Cigarettes are legal, and the decision is yours. The cigarette business should not be forced to cover the costs of public healthcare.	B1

## Discussion

A comparison between pre-test and post-test scores indicated that digital mind maps had enhanced academic reading and summary writing skills. The participants showed an improvement in comprehension of the original passage, expressed the main idea in their own words, effectively used appropriate vocabulary, accurate sentence structure, and maintained formal language with the use of appropriate signal phrases. In an interview with student participants, the majority of them stated that the use of digital tools (Mindmeister) has urged them to an active reading process. Firstly, since Mindmeister was new to them they had to collaborate with each other to learn to construct mind maps apart from the tutorial shared by the teacher. This led to communication and peer collaboration in the language classroom. Participants also revealed that, had there been no MindMeister in the lesson, they would have simply written a summary individually. Student 1 said "seeking help from my classmate was one strategy that helped me in improving my academic reading and writing a summary." Student 2 claimed that "MindMeister was helpful as it made me take notes actively and the pattern of taking notes eased me in distinguishing significant ideas and minor points."

According to Alnoori and Obaid (2017), the flexibility that blended learning provides, improves reading proficiency as students can practise and develop their reading skills in any type of location at any convenient time. Kim (2014) supported their claim showing that significant improvement is seen in

learners' reading comprehension ability when they are exposed to blended learning rather than the traditional approach to reading. In an interview with the teacher, he shared the view that he could observe notable changes in learners' academic reading proficiency. "Students could analyse text, identify key points with the help of MindMeister and use their language to summarise the text" he added. In his comparison with non-participant students, students who used digital tools are aware of how to approach the text and develop a cohesive summary while others failed to identify the main points in the text and organise ideas while writing a summary.

As seen in figure 7, with the help of digital tools, language learning and teaching can be effective. The learner's ability to comprehend the reading passage, and identify main ideas and minor details improved drastically when compared to pre-test performance. This could be because learners discussed with peers using MindMeister (a digital tool) and the teacher also made them have a group discussion where they exchanged their activities with each other for comments and made improvements. Furthermore, the teacher demonstrated the ways and techniques while comprehending the text and constructive feedback was also given to students after each submission of the task. These interventions might have enhanced their performance in summary writing since an active learning process is observed among them.

In addition, the five-dimensional rubrics for assessment were beneficial as it allowed assessment to be holistic as well as analytical. Holistic assessment usually looks at the overall performance and it cannot provide informative feedback. Therefore, neither the teacher nor the student can know their weaknesses or strengths. According to Bacha (2001 cited in Yamanishi et al. (2019, p. 4) "holistic assessments are its practicality and cost-effectiveness, as it takes less time for raters to complete the assessment, thereby reducing labour cost as compared to analytic assessment." In analytical assessment, the teacher looks into several dimensions and assesses the writings based on the dimension's descriptor. The teacher participant also agreed that the Holistic and Analytical rubrics for assessment were found to be comprehensive and easy to follow. "With the help of rubrics, students' work has been evaluated fairly, consistently, and objectively. It is also helpful in understanding the level of students' understanding of the text, their approach, and paraphrasing skills" he added.

The whole process of academic reading-writing has made participants realise the differences between general reading and academic reading. This realisation could help them in applying suitable reading strategies and improve their summary writing skills. A student participant said "Basically when we come across the word 'READING' we simply understand it as normal reading but having attended the 'Academic reading' class, now I understand what it means for us. It mainly deals with note-taking and being able to notice the main idea. To be proficient in academic reading I should improve in writing summaries, understand[ing] the words written in the text, and do[ing] more group tasks." Some agree that the Mindmeister tool helped them in organising ideas and improved summary writing.

*Student 11: "Whenever I read the book, I should use Mindmeister as it helps us to collect all the information from the text we are reading and I should mark the difficult words so that I learn their meaning after finishing reading the book. Moreover, I should write a summary after the reading as it can help me to recollect the information and it can help me remember the whole text in brief."*

*Student 9: "Summarising a text is possible if we happen to do an effective reading. We can be assertive enough to put it into words and later deliver it to people. So, after attending the Academic Reading session I am a lot confident regarding summarising a text/passage."*

However, the study could not gain additional insight into learners' behaviour in using digital tools in improving their academic reading-writing skills. Initially, the researcher wanted to implement the think-out loud protocols and monitor their meta-cognitive strategy but the academic session was in the online mode due to rising COVID-19 cases in the country. Nevertheless, to know their perspective on using digital tools as a new intervention, participants were asked to share their reflections. Although they

admitted that using digital technology during their first attempt was exciting, they were also very anxious. Egbert, et al. (1999) claim that one of the conditions, for an optimal language learning environment, is to make learners work in an atmosphere with ideal stress or anxiety level. Participants in their interview shared that due to anxiety; they discussed with their classmates and solved the summary writing task. As mentioned earlier, in the absence of digital tools students might have worked without much communication. Therefore, the intervention of digital tools in language classrooms can bring a positive learning environment. Moreover, it makes them responsible for taking charge of their learning; which is pivotal in language learning.

## Conclusion

The findings of the current study suggest that digital mind map tools contribute to improved academic reading and also have an influence on summary writing skill. Learners can identify main ideas from minor points while reading text and gather the essence of the original passage. In other words, reading passages and subsequently creating a mind map enables them to organise ideas, and comprehend the text more easily. The inclusion of a digital mind map tool in academic reading not just improves their writing proficiency but also enhances communication and collaboration. The teacher in the language classroom was more like a facilitator where learners took responsibility for their learning; while, the teacher's role was to guide them with strategy, and feedback and provide related intervention. This can be one measure in making learners autonomous.

There are some limitations in implementing a digital mind map tool in language classrooms since some learners might not be proficient in IT skills. To equip them with basic skills to use digital tools, teachers can initiate a tutorial and assist them in class when they use digital tools for language learning. Since the study was conducted during the lockdown, it was challenging for a teacher to help learners to use MindMeister. Nevertheless, he shared some YouTube tutorials prepared by Mindmeister and also demonstrated them in the class. As it was a new concept for learners, they were also enthusiastic to use it by discussing and collaborating with their peers. Another challenge was to convey the feedback on the tasks they submitted. As the class was online, it was challenging for the teacher to provide constructive feedback to individual students, therefore he gave general comments in the class. Had it been an offline class, the teacher could have given feedback and guided them on how to improve further. In addition to that, he could have also focused on the think-out loud protocols. Nevertheless, future research can study this and observe and document the meta-cognitive strategies learners apply while using digital mind map tools.

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