

# The Effectiveness of Thinking Maps to Improve Reading Comprehension

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**Abstract**— The Malaysian education system has taken into account the importance of developing thinking skills. The Thinking Maps program or known as i-THINK, which is introduced as part of the education's huge transformational progress consisted of eight cognitive learning tools. Thinking maps are introduced to the learners as part of the teaching strategy intended to serve as a common visual language, so they will be able to gauge specific cognitive thinking across all academic content areas. Since reading is an essential language skill that should be mastered by all learners, this study aims to investigate the effectiveness of using thinking maps to improve the learners' reading comprehension. This quasi-experimental study was conducted in a sub-urban school in Kapit, Sarawak. 56 participants from Year 5 were involved in this study. The non-equivalent group design data were collected through pre-test and post-test and were analysed using t-test, the mean, standard deviation and effect size. Findings showed that the learners in the experimental group had outperformed the control in their reading comprehension test. Based on the results, using thinking maps in the teaching and learning process has facilitated the learners to comprehend their reading texts better and promoting Higher Order Thinking Skills (HOTS).

**Keywords**— Thinking Maps, i-THINK, reading comprehension, HOTS

## I. INTRODUCTION

One of the challenges that educators faced is preparing learners to be global thinkers. The Malaysian education system aims to provide learners with learning environment and opportunities that propels them through work challenges, preparing them for citizenship in the 21st century and beyond. In order to achieve that, the development of literacy and critical literacy are greatly stressed under the English language curriculum. Literacy and critical literacy are paramount to build building blocks in the language so pupils can develop their language proficiency at all educational levels and to function as an effective member of the society.

The results of the reading scores in PISA suggest that Malaysia still needs to improve as the reading scores were beyond the OECD average in reading with three consecutive participations in PISA (2009, 2012 and 2015). The OECD thumb of rule suggest that 30 PISA points roughly equivalent to the progress made in one year of schooling [1]. The PISA results in 2015 did show an increase in reading literacy with 431 points [2]. However, the global average scores for reading was still below the OECD average of 493. The 2015 assessment shows that Malaysia's performance was at least 100 points below that of exemplary developed country like

Singapore (535) in reading. This means that 15-year-olds in Malaysia are still performing at least 3 years behind in their schooling years compare to Singapore.

For Malaysia to be able to compete with other developed countries, improving reading skill at all levels of schooling is paramount to produce proficient readers. Performing at an advanced level of reading in PISA is the ability of the readers to make detailed and precise multiple inferences, comparisons, and contrast. On top of that, advanced level readers should also know how to develop critical evaluations or hypotheses, drawing on specialized knowledge [3].

The latest form of literacy is called critical literacy which means that, students in the 21st century are required to become more strategic readers, who self-manage, self-monitor, and self-modify [4]. Readers should be able to connect with the texts that they are reading using higher order thinking skills. For the learners to achieve this, they should be exposed to different text types and be taught effective comprehension strategies [5].

In the Malaysian context, the Thinking Maps program is known as i-THINK. It is a set of graphic organisers or visual teaching tools to facilitate learners with the process of building conceptual understanding of content and promoting achievement [6]. The program is introduced by the Ministry of Education in Malaysia to provide learners with strategies to become thinking individuals [3]. The thinking maps are used as tool for learning as an effort to inculcate the thinking culture in schools by fostering higher-order thinking skills (HOTS), encouraging lifelong learning, critical in solving problems and be creative thinkers.

There are 6 elements emphasized in the Malaysian Education Blueprint to ensure that all students will achieve their full potential. One of the paramount elements that is mentioned to ensure that students would be able to compete at a global level, is the need to master a range of thinking skills that includes creative thinking and innovation, problem-solving and reasoning and learning capacity. These thinking skills are known as Higher Order Thinking Skills [7]. Higher order thinking skills is defined as complex thinking processes that involves cognitive skills like comparing, reasoning, analysing, evaluating, synthesising, interpreting, creativity and critical thinking [8][9]. The definitions and the components of higher order thinking skills mentioned are relevant to the i-THINK program as it corresponds with the fundamental thinking process which are defining in context, describing attributes, comparing and contrasting, classification, part-whole spatial reasoning, sequencing cause and effect reasoning and

reasoning by analogy [10]. Thinking Maps consist of eight visual tools and they are; defining (circle map), cause and effect (multi-flow), sequencing (flow map), whole to part relationship (brace map), analogies (bridge map), describing (bubble map), comparing and contrasting (double bubble map) and classifying (tree map).

Thinking Maps were designed by David Hyerle. He describes Thinking Maps as a visual language which facilitates learners towards meaningful learning [11]. He further states that Thinking Maps as a synthesis of three types of visual tools which are brainstorming webs, graphic organizers and thinking process tools like the concept maps. There are eight thinking maps which are introduced to the learners through the i-Think program. These maps are based on eight fundamental thinking processes [11]. The Thinking Maps are made up of five major qualities which are consistency, flexibility, developmental, integrative and reflective [12]. The visual representation never changes despite the content. All maps can grow and be flexible in form as they can be integrated and used together depending on the learner and complexity of the content. Thinking Maps allow learners to construct new knowledge about a topic while recalling what they have already known based on the text and their past experiences. Therefore, Thinking Maps provides a platform for learners to be critical and independent in their thinking when completing their maps [13]. On top of that, learners will also be able to retain information better when the targeted information is visualized [14].

## II. LITERATURE REVIEW

### A. *Thinking Maps and Reading Comprehension*

The ability to read is the key to achievement because the global information economy requires learners to be equipped with literacy skills. Reading is interconnected between the learners' personal schema and the text they are interacting with. This process is called reading comprehension [15]. Reading and comprehension are intertwined with each other as academic achievement is profoundly molded by the ability to understand what is reading. Comprehension is a highly complex cognitive process that requires identification and interpretation of the reader's knowledge about the language structure uses in the text and relating the content to their schemata about a given topic [16]. Thus, for learners to comprehend what they read, appropriate strategies to facilitate reading comprehension is vital [17].

Reading comprehension can be facilitated effectively through visual mapping, relationship connections between concepts and the exposure to the appropriate strategies that are modelled and practice [18]. In the Subsumption Theory, Ausubel proposed the used of organisers in a lesson to facilitate new learning and retention [19]. This is because organisers provide the learners with what is expected to be learnt and help them to identify, package, and store the learning content in their cognitive structure for later retention [20].

A local study done by [21], on the effects of graphic organisers in teaching reading comprehension had generated positive results. The study aimed to facilitate students' comprehension skills by employing graphic organisers. A group of 78 form four students from a school in the east coast of Peninsular Malaysia were chosen were chosen randomly for the quasi-experimental research. The group that was exposed to

the instructional strategies using graphic organisers in their English Language lessons had shown improvement in their post-test as they obtained higher scores after being exposed to the use of graphic organisers to improve their reading skills. The t-test showed there was a significant difference of the reading comprehension achievement between the control group and the experimental group.

Another study done locally was by [22] on the effects of the thinking maps program in understanding literature texts. The effects of the i-THINK program in teaching reading comprehension of novels had generated positive results. The quasi-experimental design had involved 60 Form Four students from two classes in the same school at one of the National Secondary School located in Selangor. The research was carried for a period of eight weeks and the data from the pre-test and post-test were analysed. The data analysis involved the t-test, mean and standard deviation. Findings found that there was an increased in the post-test results from the pre-test of the experimental group. The t-test analysis also showed a significant difference between the achievement in comprehending the novel read between the control group and the experimental group. Based on the results, the utilisation of the thinking maps program was able to increase the students' comprehension in literature.

The effectiveness of thinking maps to improve reading comprehension is evident through the study carried out by [23]. A mixed-method design was used for the study that had included 856 third grade students from eight elementary schools in a large urban school district in Houston, Texas. There were 456 third grade students from four schools who had received the Thinking Maps instruction and a separate student sample consisted of 400 third grade students from four other schools who did not receive Thinking Maps as their reading instructional strategy. The independent two tailed t-test was conducted, and it was found that there was significant difference in the means of the reading comprehension gain scores between the students who had received the Thinking Maps instructional strategy and those who did not. Whereas, the results from the semi-structured interview revealed that the Thinking Maps instruction was able to engage better understanding of the texts, easy to use and the maps acted as canvas to help students to reflect their understanding in a clear and meaningful manner.

The implementation of the Thinking Maps program was also able to generate positive results for the reading achievement of fifth grade students in three Tennessee Schools. The purpose of the research was to determine if there were any effects between the Thinking Maps instruction and student achievement in Reading/Language and Mathematics over a period of two years [24]. The quasi-experimental design involved fifth grade students from three elementary schools from Tennessee were chosen. Students from School A and School B were designated for the purpose of the study. They were exposed to the Thinking Maps instruction since they were in their third grade. School C however did not choose to adopt the program because the school was involved in piloting a reading and mathematics program for the school system. The results from the study compared students' scores on the Tennessee Comprehensive Assessment Program (TCAP) of those who had received the Thinking Maps instruction and those who did not. The results indicated that there was a significant difference for the Reading/Language means for the

experimental group who had received 2 years of the Thinking Maps instruction which was from 2003 to 2005. Based on the findings, it was indicated that the implementation of the Thinking Maps program was able to improve the students' reading achievement.

### *B. Thinking Maps and Higher Order Thinking Skills*

Thinking Maps not only allow students to express their thoughts and ideas non-linguistically, but they also encourage more strategic thinking which involves Higher Order Thinking Skills [25]. Incorporating thinking maps in the classroom help learners to visualise links between non-linear ideas, which provides for creativity in thinking and meaningful learning. Reference [12], states that Thinking Maps has been found to affect students' achievement positively and to promote life-long learning by providing learners with skills such as problem solving and decision making. [26] also supports that Thinking Maps are beneficial for learners as they foster thinking and reasoning skills through the provision of visual representations of cognitive processes that allows learning and understanding to be more meaningful.

A case study approach was conducted to determine if the teachers' implementation of the Thinking Maps promoted critical thinking during the Literature lesson in the ESL classroom [27]. The study was carried out in a local secondary school which is one of the selected pioneer schools to implement the thinking maps. Three trained teachers in the field of Teaching of English as a Second Language were involved to implement the thinking maps. Data collected through observations found that the use of thinking maps to explain the learning content were helpful for students to understand the given topic better. Their understanding towards the topics given were demonstrated when they used the thinking maps to present their tasks. The responses from the interviews conducted with the teachers indicated that the implementations of the thinking maps in their literature lessons had given a positive outcome. This is because thinking maps promoted the generation and organization of ideas, improved oral and written skills and developed confidence during presentations. Incorporating Reader-Response with the thinking maps as part of the activity had also provided opportunities for students to discuss, interpret and respond to questions after reading.

A study was conducted on how Thinking Maps can be used by students to expand critical thinking skills and enhance understanding of the content of the lessons taught [25]. The data were collected through surveys, observations and post-test conducted on students. The Thinking Maps were introduced to four 8th grade students as a note-taking concept to provide visual representations to summarise the information learnt. They were taught to construct the correct format for using each map according to the intended purpose. The findings showed that when students used Thinking Maps, their level of understanding of learning content outperformed the students who used traditional strategies by copying the notes. Based on observations and data collected, students who utilised Thinking Map were found to have improved their academic progress as it encouraged high-level of thinking and linking to learning content.

## III. METHODOLOGY

### *A. Research Design*

The researcher selected to use the quasi experimental design. The non-equivalent group design was used because pupils were not randomly selected as they were already assigned into their own respective classes by the school administrators. The pupils were streamed into different classes by the school based on their year-end exam results.

### *B. Participants*

This research involved Year 5 pupils in a sub-urban school located in Kapit, Sarawak. 56 research participants from two different classes (5 Biru, N=28 and 5 Merah, N=28) were selected for the study and each was assigned to the treatment and control group. The assignment to conditions (treatment vs control) was by means of the researcher's selection because random assignment could not be carried out due to the fact that pupils were already assigned to their own respective classes by the school. The mid-year English Language exam result was used as a baseline for the selection of the participants as they had similarities. The participants from the 5 Biru (treatment group) had 9 females and 19 males. 5 Biru was chosen as the treatment group because the researcher was assigned as their English teacher at the time the research was carried out. Therefore, it was easier for the teacher to implement the thinking maps instructional strategy and monitor the participants' learning. On the other hand, the control group from 5 Merah had 11 females and 17 males. Therefore, the participants of the research consisted of 20 females and 36 males and they are all of Iban ethnicity.

### *C. Procedures*

The participants were assigned into two groups. Then, all the participants received a reading comprehension pre-test. Section B of the UPSR 2017 comprehension paper (Paper 013) was used as the pre-test for the pupils. After the completion of the test, the treatment group underwent the treatment session whereby the researcher included the use of Thinking Maps instruction during English lessons and there was instructional strategy involving the use of thinking maps for the control group.

## IV. DATA ANALYSIS

### *A. Normality Test*

Normality test was carried out to determine if the data were normally distributed for the researcher to decide whether to use parametric tests or non-parametric tests. Through the Shapiro-Wilks test, the decision will be made as to reject the null hypothesis if the p-value is below 0.05 or to retain the null hypothesis if the p-value is more than 0.05. The tests of normality generated through SPSS found that the data of the pre-tests and post-tests were normally distributed. The results generated for the pre-tests test showed the value of  $p=0.219$  and the post-tests with the value of  $p=0.05$ . Both values from the pre-tests and post-tests were more than 0.05, which concluded that the data were normally distributed. Therefore, the assumption of normality has been met and prompted the researcher to accept the null hypothesis.

### B. Independent Samples t-test

The independent samples t-test that was carried in this research was for the purpose to investigate if the Thinking Maps could improve the pupils' reading comprehension.

TABLE I. INDEPENDENT SAMPLES T-TEST STATISTICS FOR PRE-TEST

	Group	Mean	Std. Dev	t	df	p
Pre	Control	9.6786	2.62543	.105	54	.917
	Treatment	9.6071	2.46966			

Table I shows the analysis of the min scores of the reading comprehension pre-tests between the Control Group and the Treatment Group. The pre-test was given to both groups during the first week. The mean scores of the Control Group was (M=9.68, SD=2.63) whereas the mean score for the Treatment Group was (M= 9.61, SD=2.47). Based on the t-test for the reading comprehension pre-test, the researcher found that there was no significant difference between the achievement of pre-tests for the Control Group (M=9.68, SD=2.63) and the Treatment Group (M=9.61, SD=2.57),  $t = 0.105$ ,  $p > 0.05$ .

TABLE II. INDEPENDENT SAMPLES T-TEST STATISTICS FOR PRE-TEST

	Group	Mean	Std. Dev	t	df	p
Post	Control	10.8929	3.08328	-3.604	54	.001
	Treatment	14.1071	3.57294			

An independent samples t-test was also performed to find out if there was a significant difference between the mean scores of the reading comprehension post-tests between the Control Group and the Treatment Group. The test was given to the learners six weeks after the intervention. The results proved that the Treatment Group had attained higher scores in their Post-test compared to the Controlled Group. The t-test results proved that there was a significant difference between the post-tests of the Control Group (M=10.89, SD=3.08) and the Treatment Group (M=14.11, SD=3.57),  $t(54) = -3.60$ ,  $p \leq 0.05$ . The findings showed that the treatment group had better gain in their post-test scores. The treatment group performed better as the mean score for the treatment group was higher than the control group. The change indicated learners were able to improve their reading comprehension after the use of thinking maps during the lessons.

### C. Calculating Confidence Intervals

The researcher hypothesized that the use of Thinking Maps is effective to improve reading comprehension. The effectiveness of the Thinking Maps was measured by comparing results administered through pre-tests and post-tests for the control and treatment group. We are 95% confident that

scores for those who had received Thinking Maps instructions between -5.002 and -1.4262.

### D. Cohen's D Effect Size

Sullivan and Feinn (2012) mentions that Cohen has classified the effect sizes into three categories. The value of a small effect size is ( $d=0.2$ ), (medium ( $d=0.5$ ) and large a large effect size is ( $d \geq 0.8$ ). After calculation, the value of  $d$  was found to be 0.96. The  $d$  value of 0.96 indicated that the magnitude of the difference in the means of the two groups was large. The treatment group scored 0.96 standard deviation higher in the post-test than the control group who did not receive any intervention. The average standard deviation is about 3 points. If one group scores 1 standard deviation higher (that is, if  $d=1$ ), and that standard deviation is 3 points, this would mean that they score 3 points higher on average. Given that the value of  $d=0.96$ , this would mean that the experimental group score 0.96 standard deviation higher which would be 3.53 points higher. This indicated that the use of thinking maps had improved the learners reading comprehension in the treatment group.

## V. DISCUSSION

The implementation of Thinking Maps as a strategy to facilitate text understanding showed that the use of thinking maps was able to improve the reading comprehension of the pupils in the treatment group. It is important that the pupils should be able to comprehend the texts that they read because it contributes to their achievement in their learning progress, school exams and most importantly in the Primary School Achievement Test, which requires the pupils to sit for it during Year 6. The comparison of results of the pre-test and post-test between the treatment and control group clearly showed that there was an increased in the pupils' reading comprehension scores. The findings showed that the pupils in the treatment group gained higher scores compared to the control group after going through the intervention. The results proved that the used of Thinking Maps as an instructional strategy was able to increase pupils understanding on the text. The findings of this study are compatible with the research results from the past related studies done by [21][22][23] and [24]. The results are congruent with [21] and [22] who state that the provision of Thinking Maps instructional strategy has significantly impacted the students' performance in their reading comprehension and those results of [23] and [24] reveal that Thinking Maps can stimulate learning by helping students to build in-depth understanding of the content and the link of ideas. The researcher found that pupils performed better answering the comprehension questions as they were able to identify important and main points that were required by the questions. The use of thinking maps was able to foster reading engagement because it allowed the pupils to build connection with the context by incorporating their prior knowledge, so they will be able to make inferences, distinguish main ideas, understanding vague context and to recall for information.

Besides that, pupils were also required to answer comprehension questions that require Higher Order Thinking Skills (HOTS). This was because the comprehension questions were designed to be aligned with the UPSR format that integrated Higher Order Thinking Skills. Therefore, based on the comparison of result between the pre-test and post-test showed the treatment group was also able to improve their

Higher Order Thinking Skills through their improvement in the reading comprehension scores. The effectiveness of Thinking Maps to facilitate Higher Order Thinking Skills is also reflected in the study done by [27] and [25]. The findings of the past related studies reveal that Thinking Maps can be used to build higher level of thinking skills which are necessary for learners to be 21st century learner as each of the Thinking Maps reflect the cognitive process.

The used of thinking maps was also able to deliver a student-centered instructional strategy. This had facilitated the pupils to be more independent in their learning while generating their own ideas through the utilization of their own experiences with the new content that they have learnt. The study showed that the use of Thinking Maps has helped facilitate pupils' reading comprehension. In addition, this strategy has also helped pupils to be more independent learners and helped teachers moved away from the teacher-centered approach through active participation of the pupils in the classroom. From this study, we can conclude that Thinking Maps in i-THINK Program is able to improve reading comprehension in the ESL classroom.

## VI. CONCLUSION

In conclusion, Thinking Maps make an excellent addition to the ESL classroom as part of the strategy to help pupils to comprehend their reading texts. This is because Thinking Maps guides pupils to think critically about the subjects learned and form connections between subject disciplines. Other than that, the use of Thinking Maps can be an alternative to break the routine of a conventional reading class that only implements reading and answering of questions. The Thinking Maps can also be a form of reading strategy that can be utilised by pupils of various levels of proficiency. With proper guidance and training, the use of Thinking Maps will allow pupils to gradually progress as independent readers..

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