A Scoping Review on Implementation of I-Think Maps and Its Effects on Higher Order Thinking Skills in Malaysian Schools

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Abstract: Malaysian schools have been implementing i-Think program as a means to develop higher order thinking skills among primary and secondary school students since 2013. Thus, there is a need to assess the implementation of the i-Think program since it was made compulsory almost seven years ago. This paper reports a scoping review of research activities conducted on the implementation of the i-Think program in Malaysian schools to synthesize studies on the implementation of the i-Think program in the classrooms; teachers' and students' acceptance of the program; examine its impact on HOTS and students' achievement; and to identify and disseminate the gaps in the works of literature. Forty articles were reviewed and the results indicated that the data on how i-Think programs were implemented in classrooms were so small that no definite conclusions could be made. Results on both students' and teachers' levels of knowledge on i-Think maps were mixed. Majority of studies showed that i-Think maps significantly enhanced students' achievement. However, no study measured the impact of i-Think on HOTS despite researchers' claim that i-Think maps had stimulated students' HOTS. Thus, future studies should focus on showing correlation between i-Think and HOTS by using a validated measurement scale to assess students' HOTS, development of valid and reliable measurement scale to gather a large pool of data to illustrate more comprehensively the status of i-Think implementation in schools throughout Malaysia, support systems provided to teachers at school and district level, and identifying barriers that hinders teachers from implementing i-Think program.

Keywords: HOTS, i-Think Maps, Malaysian schools, Scoping review.

1. Introduction

In 1996, the Ministry of Education (MOE) in Malaysia had introduced the teaching of creative and critical thinking skills under a program called KBKK (Kemahiran Berfikir Kreatif dan Kritis). At that time, teachers were exposed to a variety of thinking tools. Moreover, the government had also started smart schools in 1997 to foster and enhance school students' thinking abilities. However, according to the literature, some of the teachers failed to conduct thinking activities with their students during teaching and learning (Rosnani & Suhailah, 2003; Zulkarami, 2011; Wilson & Narasuman, 2018). This was manifested in PISA and TIMSS achievement. Based on the results of TIMSS in 2011, 35% and 38% of Malaysian students failed to achieve a minimum score in Mathematics and Science subjects. Additionally, the Organisation for Economic Co-operation and Development (OECD) reported that in 2012, Malaysia ranked 39 out of 44 in PISA for creative

problem-solving assessment. This indicated that Malaysian students were weak at problem-solving. In other words, Malaysian students lacked higher-order thinking skills. The emergence of International Mathematics and Science Study (TIMSS), and the Programme for International Student Assessment (PISA) had become international benchmarks in evaluating students' performance in Science and Mathematics. Both these programs emphasized higher-order thinking skills.

Therefore, in 2012, MOE drew-up the Malaysian Education Blueprint 2013-2025, which explicitly emphasized the development of higher-order thinking skills (HOTS) as one of the necessary abilities to face the challenges of the 21st century. These efforts indicated the government's resolute intention to foster students' thinking skills. Therefore, in 2013 MOE introduced a new program named "i-Think," which was piloted in 10 distinctive Malaysian schools. Subsequently, this program expanded to 1000 schools, and finally, the program was implemented in all schools across the nation in 2014. This program aimed to encourage and develop students' higher-order thinking skills. The i-Think program utilized eight types of visual instruments that were infused in the teaching and learning sessions for all subjects.

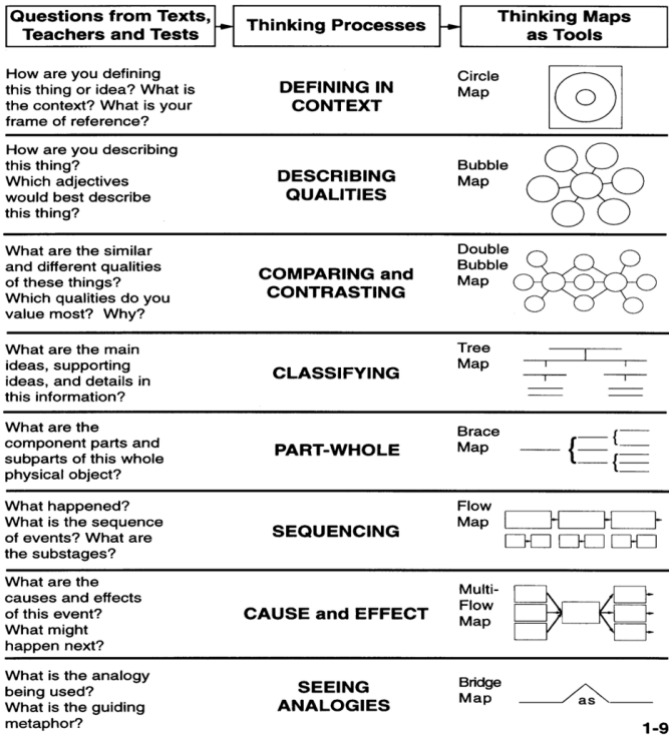

Fig 1. Thinking Maps.
Source: Hyerle & Yeager (2017).

The i-Think program was chosen by MOE to be implemented in schools in collaboration with the Malaysian Innovative Agency (MIA). It consists of eight selected thinking maps to present data and information in visual form. Thus, i-Think maps are parts of thinking maps, which means that there are other types of thinking maps invented by various individuals. The aim of this program was to cultivate students' higher-order and innovative thinking at the primary and secondary levels of education. MOE was convinced with MIA's proposition that the i-Think program was a realistic and practical approach to cultivate students' and teachers' thinking processes during the teaching and learning sessions in schools. Additionally, David Hyerle's (2008) Eight Thinking Maps had been a chosen instrument to enhance students' higher-order thinking skills. Hyerle is widely recognized as an international leader in the field of thinking skills development, critical reflection, and 21st-century learning. He was among the first who introduced thinking maps as tools to organize information in graphic forms. These visual representations of the data and information are referred to as "mental

models" (Hyerle, 1989). Then, he expanded the enterprise of thinking maps by training educators (Thinking Maps, Inc., 2011). Currently, thinking maps are widely implemented in the United States, the United Kingdom, Canada, New Zealand, and Australia (Thinking Maps, Inc., 2011). Thinking maps consist of eight sets of visual tools such as the Circle Map, Bubble Map, Double Bubble Map, Tree Map, Brace Map, Flow Map, Multi-Flow Map, and Bridge Map as illustrated in Figure 1.

The thinking maps are used to help students visualize the connections between data and information in visual forms. This is because thinking is a mental process, which combines, arranges and establishes links between ideas. In other words, the eight thinking maps are visual or graphic representations of the students' thinking. This graphic organization of ideas helps students to categorize, compare and contrast, create relationships between information, and manage information wisely (Gallavan & Kottler, 2007). This is because 90 percent of the information that the brain receives is in visual form (Paivio, 1990). Lower order thinking skills (LOTS) revolve around activities that make connections between the data and information, which are considered prerequisites for higher-order thinking skills (HOTS). If students' lower-order thinking skills are not well developed, then their higher-order thinking skills would be underdeveloped too. Thus, Hyerle suggested applying these thinking maps to help students see the interconnections between ideas and, therefore, develop a holistic understanding, (1989) which is pre-conditioned for HOTS. Therefore, i-Think maps are necessary to develop HOTS. He further asserted that "…through connective views of knowledge, lower order thinking skills are presented to students…lower order thinking skills are still not richly developed by students nor applied in connected, holistic ways" (Hyerle, 1989: 16-17). Even though he made this statement about 3 decades ago, it is true in Malaysia that students' LOTS need improvement.

The first groups of teachers and educators were trained by MIA and Kestrel Education from the United Kingdom. The first training module developed by Kestrel Education was titled "Draf Program i-Think" (Bahagian Pembangunan Kurikulum (BPK), 2012). In the module, Kestrel Education presented a matrix, which showed the development of two distinctive orders of thinking. The higher-order thinking was developed by asking complex questions and the lower order by asking simple questions. The examples of simple questions in the module were, "What is this?", "Can you explain about this?", "Which one can be eaten?", and "How many people are in the passage?". These were the test questions for recalling and understanding. The complex questions were questions on application, analyzing, evaluating, and creation. Such questions were "How can we change this situation to become better?", "Why do you think like this?", "Is there any other example?", and "What is the evidence?". Teachers were trained to ask simple questions to gauge students' understanding and guide students to see the interconnection between the data and information so that students could reorganize and represent the information via visual forms.

Teachers also need to ask complex questions to stimulate students' HOTS and further add their own ideas, conclusions, elaboration, modification, adaptation and etc. to the existing data and information. This way teachers can stimulate both LOTS and HOTS. Kestrel Education adopted Bloom's Taxonomy to classify LOTS and HOTS. Apart from that, students can develop their own knowledge based on their experience through discussions in a cooperative learning environment. Therefore, MOE decided that the i-Think program can inculcate thinking skills naturally and engage students during classroom teaching and learning. Scholars and researchers from human cognition and cognitive skills almost unanimously agreed that HOTS is the combination of critical and creative thinking skills.

Critical thinking involves the mental activity of analyzing, interpreting, making inferences, evaluating, making judgment, meta-cognition and self-regulating (Facione, 2006; King, Rohani, & Goodson, 1997). Creative thinking includes the ability to adapt, modify, elaborate, combine, and be fluent in generating new and original ideas (Torrence, 1979). Bloom categorizes top three thinking skills such as analysis, evaluation, and creation into HOTS (Anderson & Krathwohl, 2001). Therefore, it can be concluded that higher-order thinking skills can be used to analyze, interpret, evaluate, and explain the new data and information based on prior knowledge to generate novel or better understanding of ideas that are innovative, and help solve real life problems.

In Malaysia, i-Think program is specifically applied to develop HOTS among primary and secondary school students. Since its implementation in 2014, it is high time to conduct an investigation on research activities that had focused on the implementation of i-Think program in Malaysia, as well as to examine

teachers' and students' acceptance of the program, and the impact of the program on the students' achievement and HOTS. Hence, a scoping review was conducted on past studies that had examined the implementation of the i-Think program in Malaysia to further guide and expand research. Scoping reviews are fairly new in the field of education but are increasingly used to summarize works of literature. A Google Scholar search on "scoping review" revealed that 213000 of the literature was on allied health and 61100 was on education (searched on 25th July 2019). Despite the non-existence of a unanimous definition and the purpose of scoping review, the majority of the scoping reviews that had been published, adopted the purpose and the methodological framework proposed by Arksey and O'Malley (Tricco et al., 2016).

2. Research Methodology

2.1 General Background

A scoping review has the ability to answer broad questions from a wide range of literature which employs study designs without much concern for the quality of study (Arksey & O'Malley, 2005). According to Arksey and O'Malley, scoping review is done for the purpose of investigating the magnitude, scope, and nature of the research activities. Besides that, it is also done to decide the value of a conducted systematic review, to encapsulate and communicate research conclusions, and point out the gaps in literature that warrant further studies. The present study was conducted to investigate the research activities that had focused on the implementation of i-Think program in Malaysia. The existing literature selected in this study were summarized and concluded. In doing so, the gaps in the literature were identified and disseminated. This study provided insights on the current status of the research activities which facilitated further research, and informed policymakers of the impact of i-Think program on students' performance and HOTS.

2.2 Instrument and Procedures

This scoping review employed the five-stage methodological framework established by Arksey and O'Malley (2005) to ensure transparency and replicability of the study, and the reliability of the research findings. The five-stage framework begins with identification of guiding research questions followed by identification of relevant studies; selection of studies; charting the data; and finally collating, summarising and reporting the findings (2005: 8-9). The main aims of this study were to map, summarize, and identify gaps in the existing literature. The search for existing studies was guided by a broad research question which was "Which conducted studies had given information on the implementation of i-Think program, teachers' and students' acceptance of the program and its impact on students' academic performance and HOTS in Malaysia?" Therefore, this study focused on four aspects, predominantly the implementation of i-Think in the process of teaching and learning, teachers' and students' views of i-Think, the impact on students' academic performance, and the impact of i-Think on students' HOTS.

These four aspects were viewed as the main criteria to accept studies to be reviewed. Furthermore, studies were done in Malaysia at Malaysian public schools in either Malay or English language and had been published in peer-reviewed journals. The only grey literature accepted were conference proceedings, and Master and Ph.D. thesis and dissertations. Additionally, the articles that did not explain the methodology explicitly were excluded. This study aimed at searching all available literature on the implementation of i-Think in Malaysia since it was newly implemented nation-wide in 2014. Moreover, broad search terms were used to ensure a comprehensive search of literature. The search terms 'i-Think Maps', 'Malaysia', and '*peta pemikiran*' were used to search on the following electronic databases: EBSCO, JSTOR, ProQuest, ScienceDirect, Scopus, Taylor & Francis, MyJurnal, and Google Scholar. This search located 105 publications: 86 from Google Scholar, 1 from ProQuest, 1 from Scopus, 1 from Taylor & Francis and 15 from MyJurnal. The reference list of the articles found in the electronic databases was also searched and yielded one publication. Based on the set of criteria, 40 articles were carefully chosen to be reviewed at the end of the process of selection, as illustrated in Figure 2.

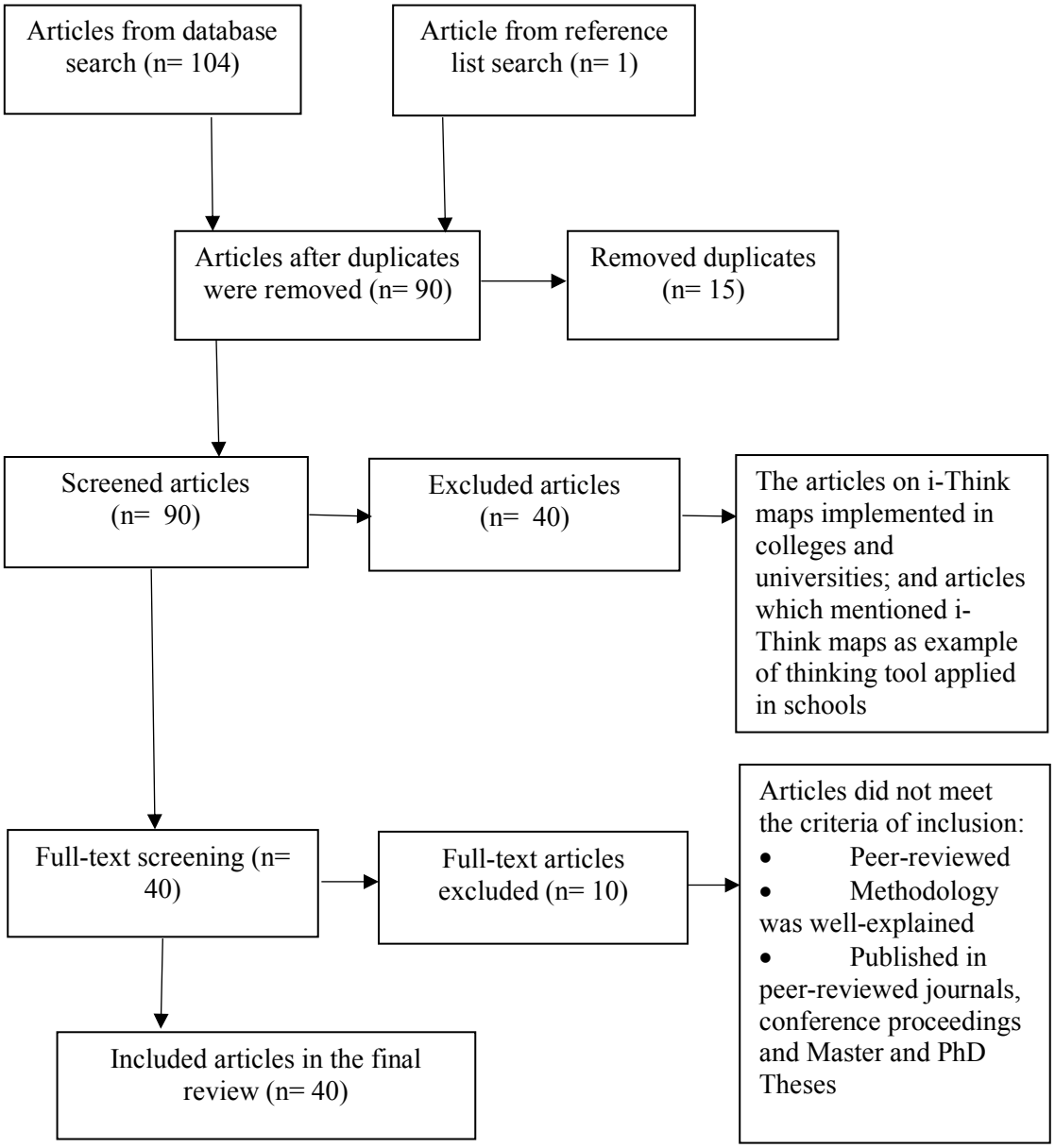

Fig 2. PRISMA flow diagram for process of article selection.

2.3 Data Analysis

Quantitative and qualitative methods of analysis were used to summarize the 40 articles. Quantitative analysis was employed to count the frequency of the publications according to the year of publication, sources of publication, research methods used, participants, and the focus on teaching and learning. Next, qualitative analysis was conducted to categorize and segregate major themes from the publications that were aligned with the four aspects mentioned above.

2.4 Research Results

The findings from quantitative and qualitative data analysis of 40 articles were presented below. The results were organized according to year of publication; methodology of research and participants involved in the studies; the subject matters in which teachers chose to implement i-Think maps; the implementation of i-Think maps in teaching and learning processes; teachers' and students' responses on the use of i-Think maps during teaching and learning processes; the impact of i-think maps on students' achievement; and the impact of i-Think maps on students' HOTS.

2.5 Year of Publication

The implementation of i-Think maps nationwide began in 2014 after it was piloted in 2013. Nevertheless, only one article was published in 2014. The majority of the articles selected in this scoping review were published in 2017 (11 articles), followed by the year 2016 (10 articles), 2018 (9 articles), 2015 (6 articles); and lastly 3 articles published in 2019.

2.6 Methodology and Participants

The majority of the studies reported in the selected articles employed the quasi-experimental (11 studies) and case study (12 studies) research designs. Five studies were conducted using a developmental research method to develop and validate modules for teaching and learning via the i-Think maps. Study also employed other research methods such as exploratory study (3 articles), action research (3 articles), cross-sectional study (3 articles), content analysis (2 articles) and one needs analysis study. All of the studies were conducted at 95 primary schools and 28 secondary schools involving 1832 students (719 primary school students and 1113 secondary school students), 887 teachers, and 221 trainee teachers.

2.7 Teaching and Learning Focus

The accepted articles reported that the studies on i-Think maps were applied to the teaching and learning of Malay Language (16 articles), English as a Second Language (4 articles), Science (3 articles), History (1 article), Arabic Language (1 article), and Business Studies (1 article). Two publications reported the development and the validation of the Science i-Think modules for primary school, 2 Mathematics i-Think modules for secondary school, and 1 Biology i-Think module for secondary school.

2.8 Implementation of i-THINK Maps in Teaching and Learning

Six articles were reported on how i-Think maps were applied during the teaching and learning processes. These six studies (Ainon & Intan Safinas, 2016; Ainon, Haniff & Goh, 2016; Hani Shafikah & Khalijah, 2016; Woo et al., 2017; Muhammad Faez, Wan Muna Ruzanna, & Melor, 2018; Linawati & Sharifah Nor, 2017) employed the case study method to investigate how teachers taught English Language (11 teachers), Malay language (6 teachers) and Mathematics (1 teacher) using i-Think maps by observing teachers teaching in the classrooms and conducting interviews. All 17 teachers used the same strategy to teach via i-Think maps. They began with choosing a specific i-Think map and explained the topic of the day using the map.

A primary 2 teacher never used i-Think maps because of the lack of time to prepare lessons and to explain to the students the maps and their functions (Linawati & Sharifah Nor, 2017). LOTS questions were asked to gauge students' understanding of the topic and one teacher specifically asked LOTS questions to test students' ability to memorize facts (Hani Shafikah & Khalijah, 2016). Teachers seldom ask HOTS questions because of time factor. One English teacher admitted that she used Reader-Response strategies to promote students' HOTS (Ainon & Intan Safinas, 2016). To assess students' grasp of the topics discussed, teachers chose a specific map and asked students to use the map to reorganize information from the text. Teachers would

also choose a map and ask students to organize ideas garnered from the classes or group discussions using the map. However, one study reported that teachers used i-Think maps but they lacked the understanding of the correct usage of the maps (Woo et al., 2017).

2.9 Teachers and Students' Responses on i-THINK Maps

The articles reviewed in this paper revealed inconsistent results of teachers' and students' responses. As early as 2014, the year i-Think was made compulsory to be implemented in schools nationwide, one study was conducted to investigate trainee teachers' opinions on the implementation of i-Think maps in teaching number literacy. The majority of the 183 trainee teachers concurred that the i-Think maps could assist students to understand and memorize, and, therefore, elicit students to think. Another group of 38 trainee teachers held similar opinions and they all thought that i-Think was a creative way to teach and encourage students to engage and collaborate (Khalidah et al., 2014; Wan Roslina, Abdul Rahim, & Arfah, 2018).

The majority of the 602 teachers from schools in Kuala Lumpur had a high level of readiness to implement i-Think in the process of teaching and learning. However, their ambitious plan was not equivalent to their levels of readiness probably because they were not fully trained or supported by their schools' management (Shamsazila, Muhammad Faizal, & Ghazali, 2017). Another cross-sectional study was conducted by Rubananthan and Nurfaradilla (2018) involving 153 primary school teachers in Baram, Sarawak to examine teachers' concern about implementing i-Think maps. The study found that 93% of the teachers had no concern about its implementation in classroom teaching.

They also had no concern about the impact of using i-Think maps on students' achievement because they believed that there was no correlation between i-Think maps and the students' success rate and HOTS. However, these teachers had a positive attitude to the i-Think program and they were ready to apply it provided that they were given good materials and training. Similarly, Fadilla and Zamri (2019) found that the majority of 108 primary school teachers from Kapit, Sarawak were highly ready and had a positive attitude to the implementation of i-Think maps. In terms of giving support to teachers, only one study was conducted involving 7 teachers examining the needs to provide teachers with i-Think teaching modules for every subject (Nik Rosnizasuzila, Azlina, & Zakiah, 2015). This study suggested that modules should be developed to scaffold the teachers before they are skillful at integrating the i-Think maps in their teaching. In response to this suggestion, five studies were conducted to develop and validate the i-Think modules to teach secondary 4 Biology, primary 5 Science, secondary 1 and 2 Mathematics, primary 5 Science for rural students, and secondary 2 Mathematics (Kavita, 2015; Azlili & Norazilawati, 2016; Nur Hasanah & Abdul Halim, 2017; Nurulwahida, Sarimah, & Zuhailah, 2018; Ismail, 2018).

Ten articles reported research findings on students' responses on the implementation of the i-Think maps. Three studies that involved 320 secondary school and 2 primary school students found that the students showed high interest in the i-Think maps and were motivated to use them (Jumaliah & Zamri, 2016; Ahmad Fikri & Zamri, 2019; Nalini & Rozita Radhiah, 2015). Quite similar findings were reported in two articles on the case studies that examined 16 primary school students. The findings of these studies indicated that these students enjoyed using i-Think maps, and they liked the shapes of the maps which lessened their fear to write short English essays (Hemadevi, Paramaswari, & Fauzilah, 2017; Linawati & Sharifah Nor, 2017). However, the majority of the 20 secondary school students were not interested in the i-Think maps and they opined that the maps gave no impact on their achievement (Chiew & Lim, 2015).

Furthermore, a more recent study of the 118 mediocre secondary school students' perception on i-Think maps found that the students had quite a satisfactory viewpoint of the maps and they thought that the maps could moderately assist them in understanding and acquiring knowledge (Mohd Zikri Ihsan et al., 2019). With regards to the students' knowledge of the i-Think maps, one article reported that 96.7% of 300 secondary school students could identify the 8 maps correctly while 79% of them could identify the functions and ways to use the maps (Jumaliah & Zamri, 2016).

Similarly, a cross-sectional study conducted by Shamsazila, Muhammad Faizal and Ghazali (2017) found that the majority of the 302 secondary and 349 primary school students could identify the names, and

functions of the maps. However, 51-58.2% of the students failed to use the circle map, bubble map, brace map, and the bridge map correctly. Additionally, 40.9% of them used the tree map wrongly. Even though the majority of the students had a hard time applying the maps, they had a positive attitude and aspiration to the use of i-Think maps. Another case study reported a not so encouraging finding because 84% of 234 Bidayuh students from four secondary schools in Serian, Sarawak rarely used i-Think maps (Zamri & Linsah, 2018); and their knowledge of the i-Think maps were poor. Nonetheless, they were willing to accept i-Think maps (Linsah & Zamri, 2018).

2.10 Impact of i-THINK Maps on Students' Achievement

The articles that reported the impact of using i-Think maps on students' achievement revealed the same findings. Eleven quasi-experimental studies, four case studies and three action research were conducted to investigate the effectiveness of the i-Think maps in enhancing students' performance in Malay Language (Siti Halijah, 2015; Rohaida & Zamri, 2015; Noor Hidayu & Yahya, 2016; Abdul Rasid, Martini, & Azhar, 2017; Anthony Alysius & Yahya, 2017; Nik Nur Farihah, 2018; Linsah & Zamri, 2018), Science (Rosnidar et al., 2015; Shahril, 2016; Normah et al., 2018), Mathematics (Khoo, 2017), History (Subadrah & Moganasundari, 2017), Arabic Language (Khairudin & Norazilawati, 2016) and Business Studies (Chiew & Lim, 2015). All of the quasi-experimental studies found that the experimental groups scored significantly higher marks in the post-tests compared to the control groups after the eight-week intervention. Likewise, the case studies and action research, which did not have control groups, discovered that the examination grades post-i-Think maps were significantly higher than the previous examination grades.

2.11 Impact of i-THINK Maps on HOTS

There was only one study conducted specifically to examine the correlation between i-Think maps and HOTS (Ainon & Intan Shafinas, 2016). The two researchers concluded that their study showed the i-Think maps promoted HOTS when teachers used it alongside the Reader-Response strategies to ask HOTS questions. Consistently, an article supported the importance of questioning skills when applying i-Think maps to promote HOTS (Siti Ruzila, Roslinda, & Effandi, 2016). Other studies concluded that the i-Think maps stimulated HOTS since the use of the i-Think maps improved students' examination marks significantly. This therefore, proved that students knew facts better and had better understanding (Abdul Rasid, Martini, & Azhar, 2017; Ainon, Haniff, & Goh, 2016; Kavita, 2015; Muhammad Faez, Wan Muna Ruzanna, & Melor, 2018; Nur Hasanah & Abdul Halim, 2017; Normah et al., 2018; Wan Roslina, Abdul Rahim, & Arfah, 2018; Ahmad Fikri & Zamri, 2019). However, there was no appropriate measurement to gauge HOTS and no other empirical evidence presented in the articles to support the claim that students' HOTS had improved. Woo (2017) and his team conducted a study to investigate, among others, how teachers implemented the i-Think maps in the classroom to promote HOTS. They found that teachers had low competency levels in the area of i-Think maps and they asked LOTS questions most of the time. This study involved 4 teachers only.

3. Discussion

This scoping review was conducted to investigate the extent of the research activities that had been done on the i-Think program in schools to inform stakeholders as to how the program had been implemented, teachers' and students' response rate to it and its impact on students' performance and HOTS. A total of 40 articles were reviewed. These reviews involved studies on 0.055% of the secondary school students from a total of 1.15% secondary schools. Additionally, studies were also conducted on 0.027% of primary school students from a total of 1.22% primary schools, and about 0.21% of the total teachers taught at both the primary and secondary schools in Malaysia (The data on the number of students, schools, and teachers were supplied by the Malaysian Educational Statistics, 2018). This proved that the number of completed, reported and published research did not do justice to draw accurate and precise conclusions on what is happening in schools regarding the i-Think program. Scholarly interest in this subject remained static due to the inexistence of pattern

change in the number of articles published each year after 2016. Therefore, much has to be done so that an informed decision can be made to further enhance the development of HOTS among primary and secondary school students in Malaysia. The following discussion is on the insights we had gained from the scoping review done and further suggestions for future research.

There is a huge gap between what is known and what is transpired in schools regarding the i-Think program. Teachers were trained or supposed to be trained to use the i-Think maps simultaneously with HOTS questions to develop HOTS. However, there is no clear picture provided or no rich description of what has occurred in the classrooms. The reviewed articles did not clearly show whether teachers had asked students to organize the data taken from the text given and then represent the data using i-Think maps or students were challenged to make conclusions on their own based on the shreds of evidence given by teachers and then organize their ideas using the i-Think maps. The former used LOTS questions to gauge students' understanding of the given texts while the latter used HOTS questions to provoke higher-level thinking.

All the articles stated that all the teachers asked LOTS questions except for one English teacher who used the Reader-Response technique to elicit students' HOTS. One study found that teachers lacked the understanding of how to use the i-Think maps correctly (Woo et al, 2017). However, the number of participants involved in the studies were too small, which the overall picture of the i-Think implementation cannot be made. Therefore, more qualitative studies that provide rich data on the implementation of i-Think should be conducted whereby researchers will be able to use multiple data sources to ensure the validity of the collected data. A valid and reliable measurement scale should be developed to gather a large pool of data so that a conclusion on the status of the i-Think implementation in schools can be made. Therefore, the insights are needed to take appropriate actions so that the i-Think program can achieve its aims.

The majority of the participants involved in the three cross-sectional studies had a positive attitude to i-Think maps with regards to teachers' acceptance of the i-Think program. Moreover, they were ready to implement the given directives with good materials, training as well as the support from the school administrators. However, the studies were conducted in Sarawak and Kuala Lumpur only. This means the information on other teachers from the other states in Malaysia are needed to better understand teachers' readiness and their attitude towards the i-Think program. Even though teachers had a high level of readiness and positive attitude, the majority of the teachers in Sarawak were non-users, and they had no concern about implementing the i-Think maps for they did not see the correlation between the maps and the students' achievement and HOTS. This was a result of the teachers' lack of understanding, lack of i-Think maps' knowledge and skills. Therefore, future studies should look also into teachers' knowledge and skills in the i-Think maps as well as skills in asking the HOTS questions.

The inquiries as to why the trainee teachers were very enthusiastic about i-Think maps as a tool to stimulate creativity, revealed that the collaboration and engagement between students and teachers should be made to learn from methods of training used in the Teacher Education Institute. Researchers should also evaluate the methods of in-service training given to teachers to ensure teachers grasp fully the concept and implementation of the i-Think maps. A practical and effective investigation of the support system should be conducted to help the teachers, and also consider the environment, which they work in. In relation to the students' views of the i-Think maps, the reviewed articles reported mixed findings. Some students were highly motivated to use the maps and they embraced the idea of the i-Think maps quickly and some students displayed indifference. They were uncertain whether to use or not to use because they argued that the thinking maps would only have moderate effects on their achievement (Mohd Zikri Ihsan et al., 2019). On the other hand, the other students had no interest at all and they thought that the i-Think maps had no impact on their achievement (Chiew & Lim, 2015). Additionally, some students had good knowledge and some had poor knowledge of the i-Think maps and their functions. These inconsistent findings warrant further investigations. The students who had poor knowledge rarely used the i-Think maps.

This was also needed to be addressed to find out the factors of disregarding the i-Think maps —they did not use therefore, they have poor knowledge or they have poor knowledge, therefore, they did not use. Interestingly, students who could identify the maps and their functions correctly may not necessarily know how to apply the maps correctly. In a nutshell, more research has to be done since the number of students and schools involved in these studies were so small that an overview of the students' knowledge and the acceptance of i-

Think maps cannot not be made. The majority of the articles in this scoping review reported that quasi-experimental studies, case studies, and action research were conducted to examine the impact of the i-Think maps on students' achievement.

The articles reported that the i-Think maps significantly enhanced students' achievement. However, most of the studies investigated the impact of i-Think maps in the process of teaching and learning Malay Language, specifically Malay Literature's impact on students' achievement. Therefore, future research should focus on other subjects such as English Language, History, Mathematics, and Islamic Studies. Additionally, researchers also should investigate and compare the implementation of i-Think in language classrooms to other subjects to determine why studies have focused on the use of the i-Think maps in the teaching and learning of the Malay Language. Furthermore, more data is necessary to conclude that the i-Think maps are more suitable to be implemented in the teaching and learning of language. Future research should also identify barriers that hinder other subject teachers from using i-Think maps. MOE implemented i-Think maps for the purpose of developing HOTS among primary and secondary school students. There was no article reported on the impact of i-Think maps on students' HOTS. However, six articles claimed that i-Think maps enhanced students' HOTS without providing any empirical evidence to support the claim (Abdul Rasid, Martini, & Azhar, 2017; Ainon & Intan Shafinas, 2016; Ainon, Haniff, & Goh, 2016; Kavita, 2015; Muhammad Faez, Wan Muna Ruzanna, & Melor, 2018; Normah et al., 2018). These articles published the claim because i-Think maps were effective in increasing students' examination marks. However, the increase in the examination grades was wrongly equated to the increase in the students' level of HOTS.

None of the studies used any measurement scale to measure students' level of HOTS or present pieces of evidence of the increase in students' ability to answer the HOTS questions correctly. Therefore, rigorous studies that collect data and empirical shreds of evidence of the impact of the i-Think maps on students' HOTS should be conducted. This is vital because after five years, the curriculum will be reviewed based on these research findings. However, firstly, researchers must make sure that teachers have implemented i-Think maps according to how they have been trained by the experts. This is because, if the teachers implement the i-Think maps otherwise, then any claim on the effectiveness or ineffectiveness of the maps cannot be made.

4. Conclusion

Malaysia had implemented the i-Think program to develop HOTS among students in primary and secondary schools nation-wide for almost six years. However, up to this date, we have a very vague picture of how the i-Think program had been implemented in schools, and whether it had achieved the aspired set of objectives. Therefore, this scoping review had shed some light on the research activities pertaining to implementation of i-Think maps' Malaysian schools. It has revealed a huge gap between what is happening in schools and what is known through reports published in reputable publications. After examining 40 articles, this paper had synthesized evidence from the articles so that insights on the effectiveness of the i-Think maps to develop HOTS can be obtained and shared for further actions including future research. Even though this review focused on the link between the i-Think maps and HOTS, data on how the i-Think maps were implemented, teachers' and students' knowledge, and their acceptance were also gathered to ensure that the findings were reciprocal to the results of applying the i-Think maps. Findings of this scoping review revealed that the i-Think maps' research activities maps cannot create a link between i-Think maps and HOTS Gaps in the literature that warrant further research were also identified and conveyed in this paper.

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