"Online Learning" Potential in Socratic Learning Methods to Empower Higher Level Thinking

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Abstract – The ability to think is a complex process as it requires us to use our mental capacity to resolve a problem. Malaysian Secondary school students involved with the assessment of Trends in International Mathematics and Science Study (TIMSS) 2011 and Programme International Student Assessment (PISA) in 2012 could not meet the standards that have been set by the Ministry of Education (MOE) seeing as Malaysia's position is below the international average according to a report issued by the MOE. The new era of rapid technology has now made the learning process easier. Previous studies found that learning through Socratic Method can improve critical thinking skills, specifically that of higher-order thinking. With the use of technology such as "online learning" in learning Socratic Method, the learning process can be done optimally, whereby it is not limited to only the classroom. This paper will look at the potential of "online learning" technology combined with Socratic Method of learning in improving higher-order thinking.

Keywords – Socratic Learning; Creative Thinking; Critical Thinking; Technology in Socratic Method; Online learning

I. INTRODUCTION

This rapid technological era has created many favourable impacts in the field of education. The effects can allow both teachers and students to experience better teaching and learning process. According to [1], technology can support learning activities and can make learning more interesting and meaningful [2]. Furthermore, referring to the Education Development Plan 2013-2025 (EDP), one element of the EDP is that education is more focused towards the High-Order Thinking Skills (HOTS) to get better results in future TIMSS and PISA. In addition, there are six key features required of each student to be able to compete on the global stage; i) General knowledge, ii) Thinking skills, iii) Leadership skills, iv) Bilingual skills, v) Ethics and abilities, vi) National identity.

One of the characteristics of the six features is thinking; which refers to higher order thinking. This thinking skill is what is needed for students to master the HOTS questions contained in the TIMSS and PISA questions. To achieve the intentions expressed by the EDP, a suitable learning method needs to be implemented to attract students and increase their involvement in their comprehension which enables students to adapt the content of lessons learned. The appropriate learning method to improve HOTS is the Socratic Method of learning because [3] states that this method of learning can build HOTS. This is because when a student has mastered the content of a lesson, they will be able to diversify the methods for finding the solution of a problem which is in line with the requirements of HOTS. However, previous studies did not focus in the application of the Socratic Method through learning via technology (online) and mostly used it in oral lessons. Therefore, the role of technology in making this learning method successful is necessary because according to [4], the learning environment will be even more fun with the use of technology, especially online. Thus this paper aims to examine the role of technology and its application in implementing the Socratic Method of learning.

II. BACKGROUND

When Malaysia was involved in the TIMSS assessment before the "Y2K" in 1999; their first time participating, Malaysian students had an average marks score that was higher than the international average in both mathematics and science. Upon returning to Malaysia in 2011 TIMSS found that the performance of students in Malaysia plunged to below the international average making Malaysia's position much lower when compared with the neighbouring Asian countries. It becomes more distressing when they only scored 35% for Mathematics and 38% for the Science. Malaysian students failed to achieve the minimum level of skills in the TIMSS assessment in 2011 when given the same assessment in 1999, the percentage of students who failed in similar subjects are respectively 7% and 13% for mathematics and science. This shows a significant reduction of two to four times compared to previous entries. It shows that students who have a mastery of the basic concepts of mathematics and science subjects are very limited.

Malaysia's participation in PISA for the first time in 2009 was also very disappointing when Malaysia ranked at the bottom one-third of 74 other participating countries. These results also caused Malaysia to fall under the international average indicating that 60% of students aged 15 who were involved in the PISA assessment failed to meet the minimum skill level in math, 44% in reading, and 43% in science. In comparison, the average scores for students 15 years of age for Asian countries such as Singapore, South Korea, Hong Kong and Shanghai showed that they are three
years ahead of Malaysia calculating the number of points scored with a year of schooling.

Based on these problems, the main cause of Malaysian students not achieving the desired results and, sadly, their inability to master the minimum level of skills is due to the cognitive performance of students who have not mastered their thinking skills, what more higher-order thinking skills. Higher-order thinking skill is one of the components of the questions contained in the TIMSS and PISA assessments. For higher-order thinking skills, students should be exposed to strategies that enhance critical thinking. However, Malaysia is already far behind their neighbouring countries, therefore a paradigm shift is required in our learning strategies to accelerate the transformation of our education. What we can observe here is that today’s fast pace technology has the potential to be a medium for the implementation of the much talked about educational transformation.

III. LITERATURE REVIEW

The literature review will discuss previous studies which are divided into four parts. Firstly, it will discuss higher-order thinking skill. Secondly, it will discuss critical thinking, which is one aspect of higher-order thinking skills. Thirdly, this paper will discuss the Socratic Method of learning in which this method can improve critical thinking. Finally, this paper will discuss the role and potential of technology that can be applied in Socratic Method of learning.

Higher-Order Thinking Skills (HOTS)

Higher Level Thinking Skills (HOTS) is an agenda for improving the degree of education in Malaysia. HOTS involves critical, logical, meta-cognitive and creative thinking skills. This thought will trigger itself when a person is faced with rare problems, or seeks to solve difficult problems and whilst in a state of dilemma [5]. HOTS also involves higher-order cognitive skills as a result of Bloom's Taxonomy adaptation as reported by [6], which includes the skill to analyse, synthesise, evaluate and generate a new idea [7]. One of the branches emphasized by the Ministry of Education (MOE) in HOTS is critical thinking which is previously known as Creative and Critical Thinking Skills (CCTS). The program implemented by the Ministry of Education to improve HOTS; focusing mainly on critical thinking, is the i-THINK program. This program aims to use thinking skills in the classroom in line with the desire to improve the critical thinking of students.

From the viewpoint of the MOE, HOTS has 5 main elements to be implemented in the class which are (i) reasoning, (ii) inquiry, (iii) questioning techniques, (iv) creativity and (v) problem solving, (See Figure 1). Reasoning in terms of HOTS means encouraging students to comprehensively explore their state of mind. The element of inquiry refers to a deep curiosity about a certain phenomenon. The third element of questioning is a technique that is very important to build students ’critical thinking; therefore this technique should be implemented in an appealing manner so as not to create a boundary for students’ ideas. Next, the element of creativity means the ability to create something new from the existing knowledge and have been reworked and updated [8],[9]. The final element emphasizes problem solving, which means a cognitive process that involves achieving a goal with appropriate methods [10].

![Figure 1: HOTS Elements from the MOE Perspective (Source: MOE 2013)](image)

In the five elements, questioning techniques are associated very closely with the i-THINK (innovative Thinking) program because for one to think, it requires a question to be resolved. Questioning techniques are also considered important because it is through questioning it will create a meaningful interaction between teachers and students. The most valuable outcome in the process of question and answer is that one is able to generate and digest ideas. Through this process, the questions will encourage students to analyse, synthesise and evaluate skills and encourage students to communicate. Among the main purpose of using questioning techniques in the teaching and learning process is; i) To detect the existing level of students’ knowledge, ii) To motivate students to think in a creative, innovative, logical and critical thinking, and iii) To encourage students to organize arguments and explain the arguments that has been put forward to strengthen the answers given. Innovative Thinking Program (i-THINK) is a collaborative program between the Ministry of Education (MOE) and the Malaysian Innovation Agency (AIM). This program aims to encourage students to think and create something new from a concept to be learned. Through this program, students will undergo eight thought processes as shown in Figure 2, where the thought process is an important element of high level thinking skills. The thought process is (i) Defining the context of a circle map, (ii) Explaining through Bubble Map, (iii) Comparing differences through Double Bubble Map, (iv) Making Classification by using Tree Map, (v) Relating the whole idea through the Brace Map, (vi) Creating a sequence through the Flow map, (vii) Finding the cause and effect with a Multi-Flow Map, (viii) Creating analogy (similar relationship, finding relating factors) via a Bridge Map.
Implementation of the i-THINK in class requires a method to attract students and also does not limit the student's response. The appropriate method for implementing this program is through the Socratic Method of learning. This study focuses on the methods of questioning in presenting a concept. Teachers do not give direct answers instead of students provide the answers to the questions by creating a concept that is more understandable. The importance of implementing the i-THINK program is to foster students’ critical thinking.

Critical Thinking

There are many aspects in HOTS when viewed as a whole and one of them is critical thinking. Critical thinking is introduced to mean an attitude and skill to apply logic in problem solving [11]. Further opinion states that critical thinking means that students develop a logical concept based on the phenomenon that they have experienced [12],[13],[14], however, critical thinking can actually be learned, or it can be built from the motivations and natural preferences of a person. Critical thinking requires a person to apply suppositions, knowledge, competencies and abilities in their thinking. When critical thinking skills are used, the individual should be able to make a reflection of the quality of the thinking that has been made [15]. According to [16], the process of critical thinking involves scrutiny, comparison and evaluation of an information to make a reflection and subsequently forming the right conclusions. Critical thinking also takes into account the arguments given in depth when presented with the conclusions [17].

According to [18], there are three levels of thinking which are Lower, Middle and Higher order. Higher-order thinking described here involves three main elements, namely (i) Analysing, (ii) Evaluating, (iii) Creating. Two of these three elements will be the main basis for the critical thinking which are Analysing and Creating. Therefore critical thinking is very closely related to higher-order thinking skills.

Referring to Figure 4 which shows the basic elements of critical thinking, there are six elements and two of which are closely related to higher-order thinking skills. According to [19], thinking critically is vital for the future of the student as they will constantly reflect on their thinking when making a decision which will indirectly strengthen the comprehension of a concept deeply. Students will also be able to evaluate all the decisions that they have made in the past. In fact, according to [20], students who think critically can be deemed responsible as they are used to thinking thoroughly, openly and imaginatively before making a decision. The ability to think critically is vital because in our daily life, all of us, not just students, will face a situation whereby we have to make a thoughtful decision that can determine whether the outcome is favourable or otherwise.

Socratic Method of Learning

The Socratic Method originated from Socrates, a Greek philosopher who lived circa 470 – 300 BC and was well known for his thinking through questioning and always providing a reason with his answers. The main concept in learning via Socratic Method is that teachers put forth multiple questions whereby this learning via Socratic Method of learning is to motivate students to think and build constructs upon learning something. When a student repeatedly thinks, it will indirectly mould them into becoming inquisitive, or to be more precise, have a high level of curiosity [21].

One method that is often used in Socratic learning is the dialogue. The purpose of a dialogue is to discuss a problem to find a variety of solutions whereby this learning is more towards independent learning [22]. Often the dialogue is an interaction between two individuals, but when there is learning in the classroom, the teacher changes the dialogue to a group interaction. The role of the teacher is to facilitate the group and ensure that the group is always in a dialogue with one another until all concerns are resolved [23]. All the arguments raised will be synthesized constructively to achieve an optimal solution. The same
concept is also available in a Socratic seminar, whereby a series of questioning techniques with logical answers are given to construct an argument and conclusions. This technique will stimulate the mind to think more critically [24]. By using the dialogue, each member in the dialogue would feel compelled to either give an opinion or to ask a question. This activity will ignite critical thinking as question after question would arise and stimulate students' brains to think.

Socratic Method is not a just a matter of asking question and having the answer given by the teacher, but it is a method that requires the review of reading, thinking and reasoning that can lead to answering the questions given [25]. There is a significant difference between dialogue and debate because both go through different processes. Dialogue is a process of knowledge sharing whereas debate is championing one’s personal opinion. Socratic Method of learning is not a common method in class discussions; where by eventually the teachers will provide answers after the students get stuck, but it is a process of interaction between teachers and students that allows students to be more involved than teachers. Once you reach a point where students cannot respond, the teacher will help by providing questions that can open the minds of students to think [26]. Socratic Method can also make students more active, which is in line with the student-centered Active Learning concept [27]. [27] also adds that there are a few important roles of teachers when conducting this Socratic learning method. Among them are:

i. Ask students to provide answers by giving relevant examples
ii. Gain support or acquiescence of the members of the group with an opinion or answer from a student
iii. Propose an example similar to the actual situation
iv. Give an analogy in explaining a concept

Role of Technology in Education

The use of technology in teaching and learning gives a positive impact on students to some extent [2]. When explaining the virtual concept for example, the use of technology can show virtual process by using a virtual video animation so it would be visible, attractive and easily understood by students. Indirectly, the use of technology will attract students to learn the subsequent process of learning without feeling tired and bored. In addition, the learning process will become more active and will create a fun learning environment. Furthermore, the use of Internet in learning has been widely used currently which has allowed the technology to grow rapidly. With the Internet, teachers and students can interact without actually seeing each other. Through the Internet students can receive whatever the teacher provided be it learning materials, knowledge or understanding [28]. Additionally, with the use of information technology, teachers and students can get the latest information quickly and efficiently to create a faster teaching and learning process.

The role of technology in education is to act as a medium for delivering input in any form of learning either directly or indirectly [29]. [29] also noted that there are many sources of knowledge that can be produced in the form of technology because it is more easily stored, managed and made available in various forms of medium. For example a whole bookcase could fit into a compact disc or an “e-book” without reducing the slightest word in it making it easy to store and does not take a lot of space.

Although the use of technology has a positive impact on teaching and learning, using it without control, restrictions and limits will result in a negative impact. Among the negative effects of the use of technology in education is when students use computers in learning, but at the same time they do other activities, or access other than their educational software. Those other activities include surfing the social websites to chat with other friends, watching videos and listening to music online and also playing computer games. However, these negative effects can be prevented by the presence of teachers when using technology in schools and the attendance of parents when the student is learning at home.

DISCUSSION

Using Technology in a Socratic Method Learning Environment can build critical thinking

The researcher’s rationale for using Socratic Method of learning is to achieve the aim to develop critical thinking skills in students. There are several elements that are important in shaping critical thinking which includes an interpretation of the concept, analysis, evaluation and inference from a context or observation [30]. Opinion [24] says that critical thinking is more focused on using logic to explain or to answer a problem as well as providing relevant evidence as a reference. Socratic Method makes an effective process of managing class discussions and students can get valuable experience when they participate in the discussion. According to a study by [31], they say that the Socratic Method, students are able be tolerant in the reflective activities such as the dialogue activities. Reflective in the Socratic aspects mean active thinking, beliefs and assumptions that could lead fellow students to master problematic issues [32]. Reflective activities such as dialogue indirectly encourage students to think critically where students initially were forcing themselves to think. In addition, students’ confidence in answering questions will
encourage other students to be more motivated to think critically because peer influences often provide students with an indirect boost.

The Socratic Method Learning Environment may involve the use of technology as the present era of technology is booming. The purpose of technology is to make the students more motivated to engage in learning [33]. Involvement of students in the teaching and learning process (TnL) is a very important matter to be taken into account. If student engagement is not satisfactory, indirectly TnL objectives will not be successfully achieved. Therefore, when the online Socratic Method Learning Environment can be implemented, students can participate simultaneously (together) compared to routine learning environment which is implemented on a rotational basis. Learning environment will become even more attractive and will also encourage students to give opinions without restraint.

![Figure 6: Correlation of Socratic learning and technology in improving HOTS](image)

Based on Figure 6, the researcher provides a concept map that explains when critical thinking found in the Socratic Method Learning element can be implemented with the involvement of technology; students will be able to dominate the High-Order Thinking Skills, particularly in the field of Science and Mathematics. Referring to the study by [34], he states that the research aims to develop students' critical thinking in a large class and he suggests and recommends that research be continued after this to see how students interact and how the level of critical thinking occurs in the process of solving problems. Therefore, this study will also look at the interaction between the students while they discuss, give opinions and do whatever activities in the Socratic Method Learning Environment. However, [34] study were found to only discuss "asynchronous online" which refers to the indirect process, therefore, this study will also focus on the "synchronous online" which focuses on the direct process.

Interaction process is a pattern that shows how students can master HOTS after going through the process of learning in an online Socratic environment. Researchers estimate that various types of interactions will be identified to show how students apply critical thinking in learning HOTS. Socratic Method of learning through technology can be seen as having great potential to encourage, stimulate and motivate students in participation, thinking and self-confidence.

**CONCLUSION**

Based on the description above, it clearly shows the presence of technology in education has become a priority to encourage, stimulate and motivate students while learning. With the use of technology, previous studies concluded that the learning process can be done more easily by teachers, particularly to monitor, respond and communicate any information to students. According to the study, when critical thinking can be learned then it will be extended to students who have problems in creating thought because not everyone has the same level of thinking and it can be developed through Socratic Method of learning as discussed.

However, a dominant part of learning is in presenting a concept, while technology is a medium that helps to ensure the success of such learning. Compared with previous studies where Socratic Method was applied in person, this study aims to combine the Socratic Method of learning with technology which can be implemented on-line. At the same time, the interactions that occur during the learning process is also an important factor to be considered as the researcher will be able to see the students' cognitive developmental process while studying and also when answering the questions that lead to higher-order thinking. This researcher hopes this paper will help teachers and students understand the relationship between critical thinking and the benefits of Socratic Method of Online Learning to improve HOTS and to achieve better results in TIMSS and PISA as expected by MOE.

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**REFERENCES**


[16] Banning M., Measures that can be used to instill critical thinking in nurse prescribers. Nurse Education in Practice, 6, 98-105, 2006.


[34] Yang, Y. T. C., A catalyst for teaching critical thinking in a large university class in Taiwan: Asynchronous online discussions with the facilitation of teaching assistants. Educational Technology Research and Development, 56(3), 241-264, 2008.