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Abstract

Critical thinking is one of the essential skills in learning. Malaysia has continuously made an effort to embed critical thinking in the curriculum of secondary school because many subjects in the secondary schools levels involve a vast amount of critical thinking elements. One of the distinguished elements that needed to be enhanced to promote critical thinking is the questioning skills. Currently, many students do not ask appropriate questions during their lessons especially in-depth questions that require critical thinking skills. This is a call to introduce an instructional strategy in the classroom to help students to ask the right questions confidently and at the same time encourage them to be further involved in the active discussion in the class. Problem-posing instructional strategy (PPIS) is one of the strategies used to promote critical thinking among students. This paper will review previously conducted studies to identify activities and approaches used in PPIS and systematically arrange them in order to be used as a strategic management tool to develop critical thinking among students. The purpose of this study is to address the potential of problem-posing instructional strategy (PPIS) as a strategy to develop critical thinking for secondary school students. The key research questions of this study were 1. What are the activities of PPIS commonly used in previous studies? 2. How can PPIS activities be arranged systematically to construct a PPIS model to develop critical thinking? The findings show the activities and approaches employed by previous studies can be arranged in a systematic sequence to construct a model for PPIS. The findings provide teachers with a model to implement PPIS as well as the processes involved in PPIS to promote critical thinking in the classroom.

Keywords: Problem-Posing, Critical Thinking, Problem-Posing Instructional Strategy, Higher Order Thinking Skills, 21st Century Pedagogy.

Introduction

Critical thinking is one of the essential skills in higher order thinking needed in the learning processes to gain a deeper understanding of the topic. By 2016, 75% of items in SPM core subject were questions that measured higher order thinking skills (HOTS) and 50% of the questions for SPM elective subjects were HOTS (Seman et al., 2017). Students gained low

marks in the examination because they failed to answer the HOTS questions. Based on the situation, it was assumed that the secondary students do not have the required skills to answer the HOTS questions and to complete the HOTS tasks during their lessons. One of the reasons is schools teach general critical thinking which focuses on a general set of problem-solving without attached it to the specific subject matter (Mishra & Iyer, 2015). This situation will lead to many students being unable to think critically if the questions concerning the specific subject were presented. As a result, students were incapable of extracting information and integrating the information with prior knowledge to form a coherent mental picture through the examination for a specific subject (Baumanns & Rott, 2021).

In learning, asking questions is very important in learning to gain new knowledge, develop a deeper understanding about the topic and enhance thinking skills (Nardone & Lee, 2010). The ability to ask questions is critical to analyses and in decision making to identify the link between lesson in the classroom and daily life situation (Kontorovich et al., 2012). Asking questions can be considered as one of the critical thinking elements in learning. Students need to be exposed to learning experiences that enable them to construct their own knowledge and promote their thinking skills through questioning (Miri et al., 2007).

Unfortunately, many of our students today do not ask questions because they feel shy, nervous, lack of confidence and lack of prior knowledge about the topic (Ansari et al., 2015). Students ask less than two questions per hour during the lesson in the classroom and more importantly, despite the quantity of the questions ask, the quality of the questions ask by students also affects learning (Duran & Dokme, 2016). Students seem to likely ask shallow questions like who, what, when and where compared to deep questions such as why, how and what-if (Miri et al., 2007).

Government introduces new teaching strategy in the Malaysian Curricula to promote critical thinking. Problem-based learning (PBL), project-based learning (PBL), inquiry-based learning (IBL) and design-based learning (DBL) have been implemented at school to encourage critical thinking among students (Dewitt et al., 2016). However, research has consistently shown that these teaching strategies still focus on students to solve and answer problems or questions provided by teachers, textbooks or activity books (Singer & Voica, 2013). Can the problem-solving strategies be executed with a little twist to promote critical thinking among students?

Learning by problem-posing has been suggested as an effective way to improve students' understanding (Hasanah et al., 2017). In problem-posing instructional strategy (PPIS), students have to generate their own questions or problems in order for them to solve it. Problem-posing is one of these higher-order thinking skills and active-learning tasks that is important for students to possess which suggests the link between higher-order thinking skills, critical thinking and problem-based learning (Kontorovich et al., 2012; Rosli et al., 2014; Ticha & Hospesova, 2013). Through a strategic problem-posing instructional strategy (PPIS), students will be able to develop critical thinking in order to generate their own questions and find solutions to their own questions. However, to date there have been limited studies on how PPIS can be systematically arranged and used in teaching-learning activity in a classroom. This research seeks to address the following questions: 1. What are the approaches and activities of PPIS that have been commonly used in previous studies? 2. How can the

approaches and activities arranged systematically to construct a PPIS model to develop critical thinking?

The Concept of Critical Thinking

Critical thinking is an active process to conceptualize, analyze and evaluate situation or information to find out solution or answers (Choi et al., 2014; Duran & Dokme, 2016). Nevertheless, critical thinking is not only used to solve the problem, it is also used to rationalize one's thinking in making a decision (Nardone & Lee, 2010). It is said to be as well organized and rational method based on evidence prior to any conclusion (Duran & Dokme, 2016). Critical thinking and problem solving are occasionally viewed as entwined abilities, and considered as reflective judgment (Choi et al., 2014). It requires students to be actively engaged in the process of conceptualizing, applying, analyzing, synthesizing, evaluating, and communicating information (Duran & Dokme, 2016). Learning this ability is crucial for students to interpret the knowledge they gain into meaningful learning. Based on the concept of critical thinking, students should be involved in an active learning task (Vidergor, 2017), such as specific process of argumentation, questioning, reasoning, drawing conclusions, and critically evaluating all relevant evidence (Duran & Dokme, 2016) as well as the possible consequences of each decision to promote critical thinking in learning.

Methodology

This study reviewed previous studies to find out the most common activities of problem posing instructional strategies (PPIS) used in previous studies. For the collection of qualitative data in this study, data from the review technique was analysed through thematic analysis deductive coding approach using ATLAS.ti software. Throughout the themes that have emerged upon the analysis of data, this study arranged the themes in relevant, coherent and systematic order to develop the proposed PPIS model. Figure 1 shows the summary for steps taken in qualitative data analysis through this study.

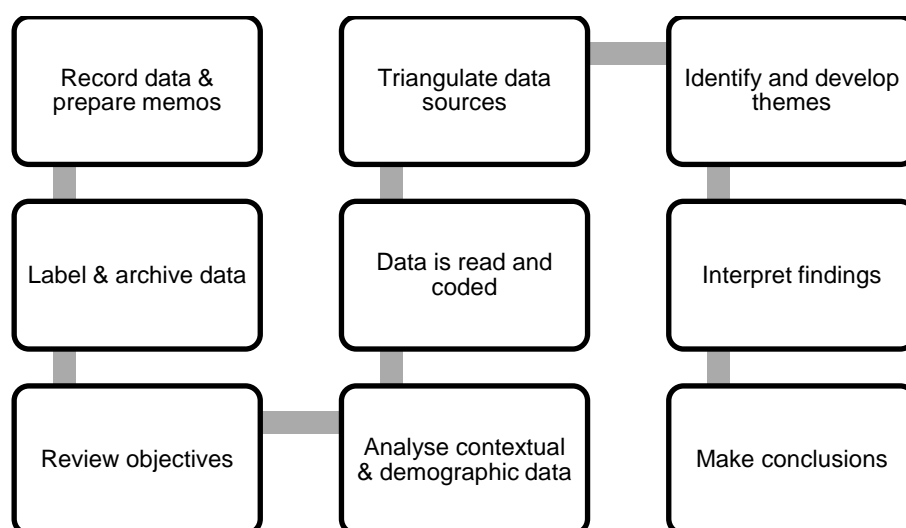


Figure 1 Qualitative Data Analysis

Findings

Problem-posing is an instructional strategy in a classroom that uses critical thinking as a major component (Ticha & Hospesova, 2013). Problem-posing was adapted in education to promote

critical thinking among students based on the problems they created themselves (Kontorovich et al., 2012). Students have to generate their own problems or questions and will find out the answers to their problems or questions (Ticha & Hospesova, 2013). Students also need to be involved in a group discussion with peers to perform an active discussion to find out the solution for their own problems.

PPIS in so many ways is parallel to the 21st century pedagogy because it involves elements of critical thinking, communication, collaboration and creativity in the learning processes (Nardone & Lee, 2010; Rosli et al., 2014; Singer & Voica, 2013). One major difference of PPIS compared to other teaching strategies such as PBL or IBL is, instead of teachers providing questions to be answered by students they make students create their own questions (Kontorovich et al., 2012). The uniqueness of PPIS lies in the originality of the questions. The questions created by students mirror their level of understanding and prior knowledge that they possess about the topic (Hasanah et al., 2017).

Throughout the thematic analysis using the Atlas.ti software, four main themes emerged: critical thinking, communication, collaboration, and creativity. Even though most of the papers are related to teaching and learning Mathematics, the strategies discussed can be modified into a Biology classroom based on similarities among themes. Activities such as creating problems and questions, finding solutions to their own questions and solving problems will require students to think critically. In order to find a solution to their problems, students will engage in meaningful collaboration and will learn how to communicate effectively to complete the task. In addition, posing their questions and answers will force students to use creative thinking skills to reconstruct and restructure their answer to be understood by their teacher and peers. The most common activities used under critical thinking, communication, collaboration and creativity themes based on previous studies are summarised using schematic diagrams in Figure 2, Figure 3, Figure 4 and Figure 5 respectively.

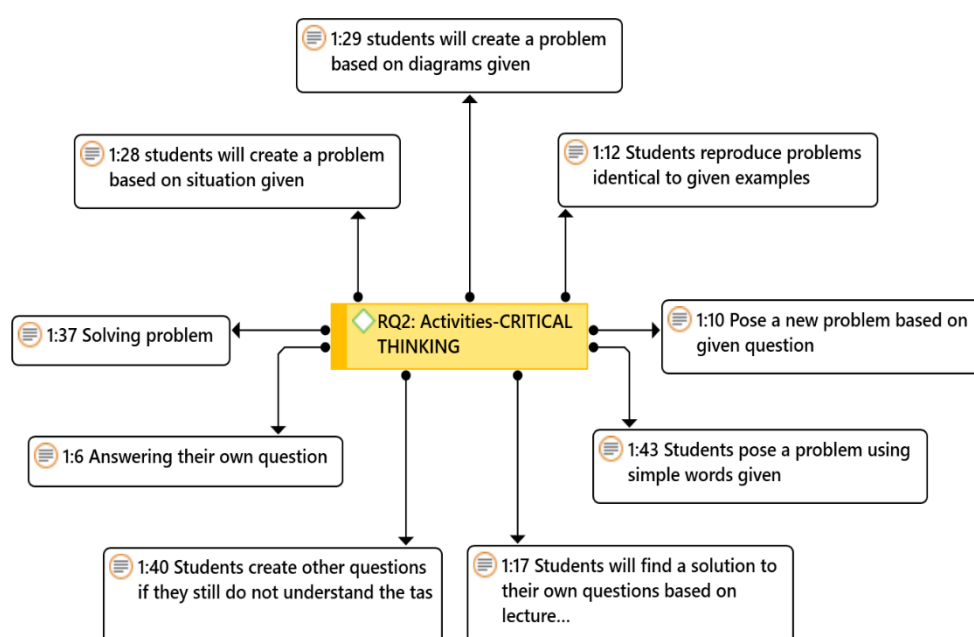


Figure 2. Critical Thinking Theme

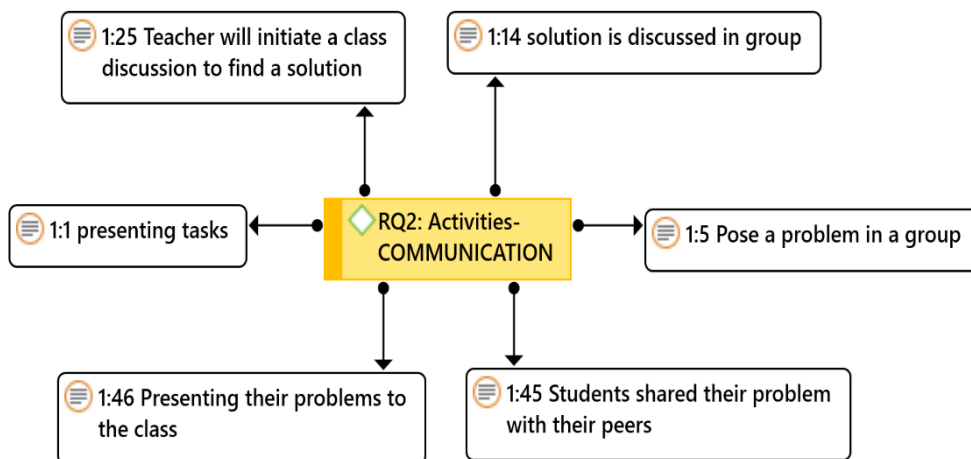


Figure 3. Communication Theme

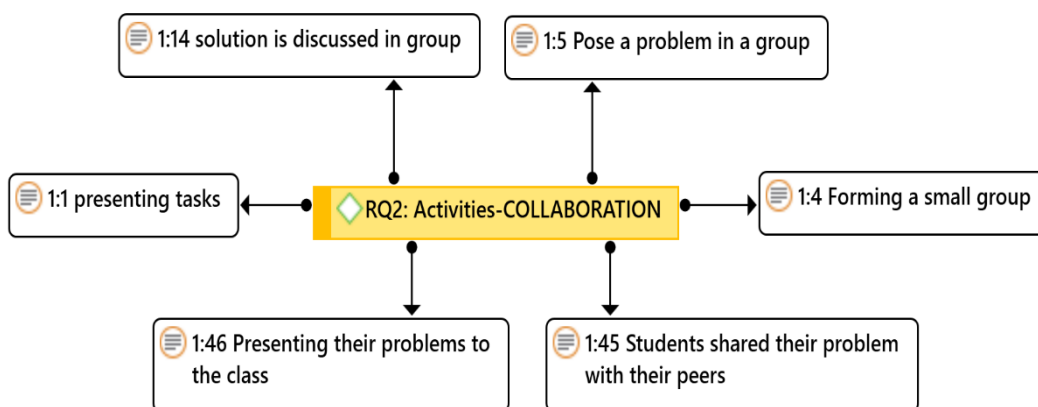


Figure 4. Collaboration Theme

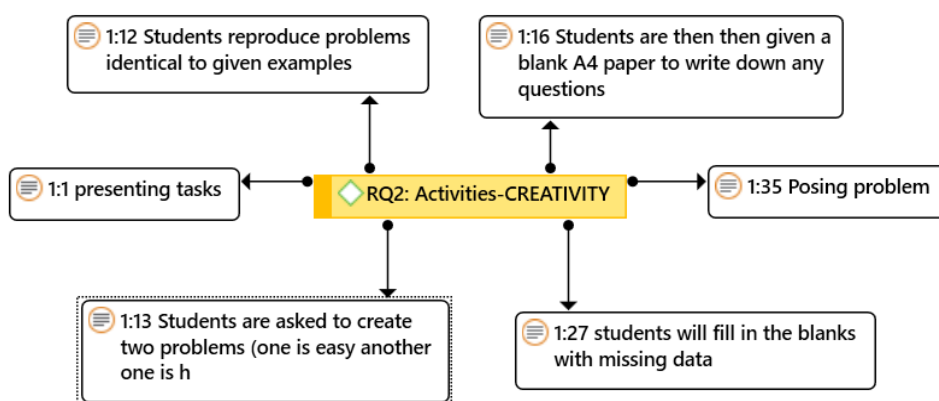


Figure 5. Creativity Theme

A Problem-Posing Instructional Strategy model for Strategic Management

This strategy can be systematically arranged and used as strategic management to develop critical thinking in the classroom. Previous studies have explained several strategies and activities used to implement PPIS in the mathematical domains. However, far negligible

attention has been paid to the implementation of PPIS in other subjects. Through analysis conducted on previous studies, the activities and approaches used are arranged systematically to construct a PPIS model that has a significant potential to be used in many other subjects in the secondary schools.

First, the teachers need to introduce a topic to the students. The transferring of information can be through any medium such as using a multimedia presentation, power-point presentation, lecturing, or text-book depending on the teaching methodology used by the teachers (Rosli et al., 2014). The next stage is the most important where students will gather in a group and will start to communicate and collaborate with their peers to create their own questions (Kontorovich et al., 2012; Singer & Voica, 2013). For students to create good questions, they need to be guided. Teachers will actively engage in the learning processes. Teachers have to provide model questions (Nardone & Lee, 2010) for students to imitate and construct their own; they also have to prompt the students if they are stuck while creating the questions and coach them to refine the questions that they had created (Ticha & Hospesova, 2013).

Once this is established, the students will move to the next stage where they will engage in active discussion to find solutions for their own questions (Nardone & Lee, 2010; Singer & Voica, 2013). Students engagement in argumentation and discussion with their peers is parallel to the zone of proximal development (ZPD) theory developed by Lev Vygotsky. That is to say students tend to reach a deeper understanding of the lesson with the help from their teachers and more capable peers (Karimi-Aghdam, 2017). Finally, students will present their questions and answers in front of their teachers and peers. The presentation mode can be in made using various approaches depending on the students' creativity. Presentations activities will enhance the the students' communication skills and increase their confidence as well (Kontorovich et al., 2012). During the presentations, teachers will straighten out any misconception that the students may have. A PPIS activity is also effective in improving students' motivation in learning (Ticha & Hospesova, 2013) through the encouragement given by their teachers (Akay & Boz, 2010) in order to coach the students to create good questions. The proposed PPIS model construct is illustrated and presented in Figure 6.

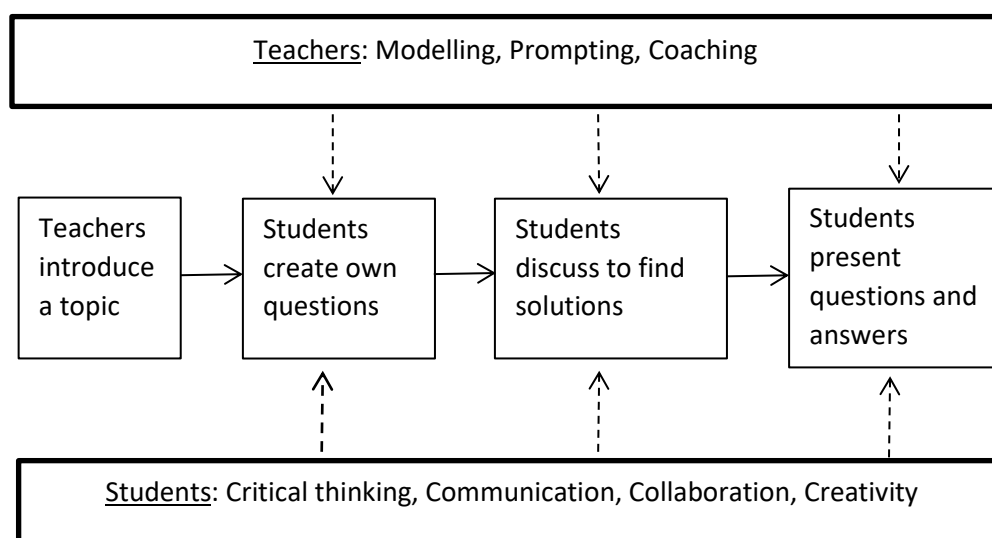


Figure 6. Problem-posing Instructional Strategy Model for Strategic Management

Discussion

The findings provide teachers with a potential strategy through the PPIS model to develop critical thinking among secondary school students. Based on the analysis of previous studies, approaches and strategies have been arranged in a systematic order to construct the PPIS model. A PPIS model provides a systematic process to implement PPIS in the classroom for the purpose of promoting critical thinking. The constructed model clearly indicates that students will be involved in an active learning task which involves critical thinking, communication, collaboration and creativity throughout the PPIS implementation. For students to construct their own questions and find solutions to those questions, the teachers need to engage in the entire lesson through modeling, prompting and coaching (Akay & Boz, 2010). The lesson will persistently occur between teachers and students (Nardone & Lee, 2010; Singer & Voica, 2013) instead of from teachers to students and this resembles the problem-posing theory. The task requires students to think critically in order to create good questions and find solutions to their own questions. They will be involved in the discussion and argumentation with their peers and that indicate further critical thinking elements to complete the tasks and items.

Conclusion

There are four systematic steps to promote critical thinking among students using the PPIS model. With this strategic management model, these four steps are put straightforward and will be very helpful for teachers to accomplish in their classroom. Through PPIS, students need to communicate and collaborate actively with their peers in order to complete the tasks given. Moreover, teachers also need to play an active role to coach and refine students' questions and prompt them if they are stuck while accomplishing the tasks. These processes indicate an active learning will occur throughout the implementation of PPIS in the classroom. Several questions remain unanswered at the present such as the time needed to complete the task for different subjects at school and how often can PPIS be conducted in the classroom due to the time constraint issue. More research needs to be undertaken before the association between PPIS and specific topic in every subject can be implemented during the lesson.

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