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# Primary School Mathematics Teachers' Perspectives about Problem Posing Activity

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**Abstract:** Problem posing is a cognitive activity that has started gaining attention worldwide for cultivating student' thinking in Mathematics teaching and learning. Besides aiming to improve students' conceptual knowledge of a Mathematics topic, problem posing activities also have the potential to enhance higher order thinking skills and creativity among students. Given that this new activity was introduced in Primary School Mathematics textbooks since 2012, a study was conducted to review the perspectives of 60 primary school Mathematics teachers about problem posing activity related to its implementation and its impact on student learning. The select teachers answered a questionnaire that consisted of 20 questions on 5-point Likert scale. The issues faced by teachers were also explored in this study. The findings showed that teachers have a positive attitude towards these activities but there are some constraints that render them difficult to implement problem posing in the classroom.Implications of the study are discussed.

**Key words:** Perspectives, primary school Mathematics teachers, problem posing ,cognitive activity

## INTRODUCTION

In Malaysia, problem posing activity is known as story building activity was first introduced in the Primary School Curriculum Standard (KSSR) which was launched in 2012. Through Mathematics textbook 3rd year and 5th year, teachers and students began to be exposed to the story-building activity in some titles such as whole numbers, fractions, mass, liquid volume and length. The problem posing activities involve creating problems in the form of a story or verse from given stimulation such as sentences, diagrams, tables and other appropriate stimulation. It does not require a person to solve the problem built like the problem solving activity that had long been practiced in Mathematics education.

Since, this activity is new to Malaysia, it has not received widespread attention among researchers and educators. Existing studies are more focused on the ability of teachers and school students to develop problems,for example study done by Zakaria and Salleh (2012). However, there are vast studies have been done worldwide. The researchers looked into problem posing from various angles such as the benefit of problem posing activities (Arikan and Hasan, 2014; Cunningham, 2004; Ucar, 2009), analysis of errors made when generating the problem (Isik *et al*., 2011) as well as the ability of teachers, teacher trainers and students in generating problems (Cai and Hwang, 2003; Chen *et al*., 2011; Cildir and Sezen, 2011; Grundmeier, 2003; Isik *et al*., 2011; Kesan *et al*., 2010; Kilic, 2013). Studies were also being carried out to see what kind of problems built by teachers, student teachers and school students such as the study by Barlow and Cates (2006), Crespo and Sinclair (2008), Patakova (2013) and Stickles (2006). In addition, there were also studies that examined the problem posing model (Stoyanova and Ellerton, 1996).

However, there are not many studies that reviewed teacher's perspectives towards problem posing activities whether inside or outside the country. In fact, up to 2015, there is no study done in Malaysia to explore views or perspectives of teachers regarding problem posing activities. Akay and Boz (2009) and Kilic (2013) were among the researchers who reviewed the perspectives of teachers regarding problem posing activity. The two studies found that teachers have positive perspectives on problem posing. In addition to providing a real understanding for the students, it also encourages creative thinking in producing problem, based on the stimulation provided. Through this activity, the teacher believes that students can see how math can be connected to real life, promote active learning, allows two-way evaluation to be conducted and provide a more interesting learning sessions.

Thus, through this study, the researchers were interested in exploring Malaysian Mathematics teachers' perspectives of posing problems in terms of the benefit it

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offers to students learning and the issues in implementing the activity. This study is important to improve the implementation of problem posing in Malaysia. The research questions are:

- What are Mathematics teachers' perspectives of problem posing?
- What are the issues of integrating problem posing during Mathematics instruction at the primary school level?

**Literature review:** When problem posing activities started gaining attention from researchers, it is seen as a good beginning to change the landscape in Mathematics education. Instead of memorizing facts through drilling and calling card as well as procedural skills, the teacher believes problem posing more activities are geared to build knowledge and enhance conceptual understanding (Barlow and Cates, 2006; English, 1997; Kilic, 2013). Students can make discovery and reflections for each story generated repeatedly (Cunningham, 2004). This allows them to develop knowledge well. This aspect is important for students to apply Mathematical ideas in any situation. Teachers in the study by Akay and Boz (2009) also support this idea as problem posing requires a proper understanding of the topic.

In addition, teachers also felt that problem posing activity can improve thinking ability of students (Kilic, 2013). It is also supported by the respondents in the study by Chapman (2012) that stated that these activities require thinking over rote memorisation. This is because they have to challenge their existing knowledge to create an association in generating a Mathematical story (Cildir and Sezen, 2011; Cunningham, 2004; Kesan *et al*., 2010; Kilic, 2013). Students will be involved in the investigation process, formulation, representation and reasoning during building the stories or issues (English, 1997). All of this will provoke the thinking processes of students towards higher, critical, creative and flexible level (Akay and Boz, 2009; Barlow and Cates, 2006; Cunningham, 2004; Zakaria and Salleh, 2012; Kesan *et al*., 2010; Kilic, 2013). Even in the study Rosli (2013), preservice teachers said problem posing activities allow one to think of a problem outside the context of the ordinary.

Not only thinking skills but also the evaluation and reasoning skills can be nurtured through activities of problem posing. According to Contreras (2007), students can always reassess theproblem and make modifications to the information or the circumstances in generating new problems. The process involves students in the process of investigation and reasoning and improving students in analysing (English, 1997; Kesan *et al*., 2010). Majority of the teachers in the study by Barlow and Cates (2006) and Chang (2007) said that they can assess students' understanding through this activity. The same also applies to the students when they evaluate their own problems or the problems generated by their partners.

Problem posing can also increase a person's problem-solving skills in everyday life. This is because in the problem posing activities, students can make connections between Mathematical ideas (Akay and Boz, 2009; Cildir and Sezen, 2011). In fact, Cunningham (2004) argued that the abilityof making reasoning between Mathematics and real world can be built through problem posing activities. A significant positive relationship between the ability to generate problems and problem solving skills have also been demonstrated in the study by Chen *et al*. (2011), Contreras (2007) and English (1997).

In addition, problem posing activities canchange the atmosphere of learning in a Mathematics classroom to one that ismore fun and engaging. This is because when generating the problem, the level of student engagement in the classroom will increase (Akay and Boyz, 2009). Thus, student curiosity is naturally built into problem posing (Cunningham, 2004). The ability to communicate verbally can also be improved (Kesan *et al*., 2010) along with motivation which together can improve students' confidence through involvement in activities of posing a problem (Barlow and Cates, 2006). The feeling of satisfaction while conquering Mathematics during generating story activities of problem-posing can be even more interesting to explore (Barlow and Cates, 2006). In fact, this type of activity can improve students' attitudes toward Mathematics which was previously considered a 'killer subject'.

However, there are some issues raised by teachers in carrying out problem-posing activities. The issue of lack of time is one factor that is often described by teachers Kilic, 2012, 2013; Cunningham, 2004). In addition, teachers in these studies also stated that the content of problem-posing in textbooks is still inadequate. Similarly, the integration of problem posing in Mathematics instruction is sparseand the issue of rote learning in the educational systems make it more difficult to change. Rote learning only makes students memorize formulas to solve Mathematical problems without understanding the meaning behind the symbol in question (Akay and Boz 2009). The issue of teachers not understanding problem posing also contributes to their abilities and skills in carrying out this activity. Kilic (2012), found that teachers having no experience made it difficult to conductproblem posing activities in classrooms. This is evidenced in many studies such as those by Harel, Stickles (2006), Isik *et al*.

(2011), Osana and Royea (2011) and Rosli (2013) in which preservice teachers were not able to generate an effective problem for a given task.

## MATERIALS AND METHODS

A survey was used to explore perspectives, views and opinions of individuals on a policy or matter (Creswell, 2005). Thus, this design is appropriate for the purposes of this study which was to gather the perspectives of Mathematics teachers related to the activities of problem posing. It was conducted on a small scale to obtain preliminary information for further research regarding the ability of teachers to generate problems involving multiplication of whole numbers. The participants were Mathematics teachers in the district of Hulu Langat while the respondents were teachers who taughtin primary schools in a zone in the area. The zone was selected purposely because most schools in this zone have an average grade of school performance which is higher than other zones. Table 1 shows a summary of the survey respondents' demographic information.

The survey data were collected using a questionnaire that contained two sections. Part A is the demographic information of the respondents and 2 closed questions asking whether teachers know about and conduct problem posing activities. While part B had 20 items that weretranslated and adapted from Kilic (2013) and Akay and Boz (2009). Items used a 5-point Likert scale, which were strongly agree, agree, uncertain, disagree and strongly disagree. These instruments were reviewed and verified by an English teacher and a lecturer in Mathematics at an institution of higher learning in Malaysia.

Table 1:Summary of survey respondents' demographic information

| Characteristics | Frequency | Percentage |
|---|---|---|
| **Gender** | | |
| Male | 21 | 35.0 |
| Female | 39 | 65.0 |
| **Grade taught** | | |
| Primary 1 | 13 | 21.7 |
| Primary 2 | 7 | 11.7 |
| Primary 3 | 6 | 10.0 |
| Primary 4 | 11 | 18.3 |
| Primary 5 | 14 | 23.3 |
| Primary 6 | 9 | 15.0 |
| **Teaching experience (years)** | | |
| 0-10 | 29 | 48.3 |
| 11-20 | 24 | 40.0 |
| 21-30 | 6 | 10.0 |
| 31-40 | 1 | 1.7 |
| **Has seen problem posing activity** | | |
| Never | 5 | 5.3 |
| Yes | 55 | 91.7 |
| **Has conducted problem posing activity** | | |
| Never | 9 | 15.0 |
| Yes | 51 | 85.0 |
| **Has attended problem posing courses** | | |
| Never | 53 | 88.3 |
| Yes | 7 | 11.7 |

The questionnaire was distributed to several schools in a zone in the district and recollected to be analysed using SPSS Version 22.0. The analysis of data involved frequencies, mean and standard deviation and was performed for each item. The value of Cronbach alpha internal consistency of the instruments was 0.904. Part C contained an open question about the issues faced by the sample in implementing the activities of problem-posing. From the responses provided, the researchers classified all response into themes identified using the software QDA Miner. Researchers then compared these with the issues faced by teachers in a number of previous studies in the discussion of the study.

## RESULTS AND DISCUSSION

Mathematics teacher perspectives on problem-posing activities for improving students' learning in Mathematics are displayed in Table 2. Based on the values shown, most of the respondents agreed with the statement regarding the impact of problem-posing activities to the students. Among the important perspectives was the construction of a mathematical concept that can be obtained through problem posing activities. There are two statements that support this perspective, items 1 and 15 demonstrate high mean values. This finding is consistent with many previous studies that were conducted such as English (1997), Kilic (2013), Barlow and Cates (2006) and Akay and Boz (2009). Through these activities, teachers agreed through item 20, in which teaching and learning strategy that is based on rote memorization before this will change. This is because proper understanding of the concept can help students make connections between mathematical ideas to solve everyday problems. This is consistent with studies by Chen *et al*. (2011), Contreras (2007) and English (1997). In fact, they no longer have to memorize mathematical procedures and tips according to the type of exam questions.

In addition, teachers strongly agreed with the statements 2, 4 and 14 which were related to thinking skills through this problem building activity. The high mean values indicated show that teachers agreed and supported the findings of previous studies by Kilic (2013), Chapman (2012), Kesan *et al*. (2010), Cildir and Sezen (2011), Cunningham (2004), English (1997), Zakaria and Salleh (2012), Akay and Boz (2009), Barlow and Cates (2006) and Rosli (2013). The biggest challenge for students' thinking was when they tried to make connections between theory learned and the issue to be

Table 2: Primary Mathematics teachers' perspectives on the activities of problem-posing

| Variables | Strongly agree | Agree | Not sure | Disagree |
|---|---|---|---|---|
| Problem posing activities can show the students' knowledge level | 18 (30) | 42 (70) | - | - |
| Problem posing activities can encourage students to think | 27 (45) | 33 (55) | - | - |
| Problem posing activities can enhance students' problem-solving skill | 23 (38) | 33 (55) | 4 (7) | - |
| Problem posing activities contributed to the development of students' creativity | 24 (40) | 35 (58) | 1 (2) | - |
| Problem posing activities help students to assess themselves | 16 (27) | 32 (53) | 12 (20) | - |
| Problem posing activities help students to understand the everyday problems they face | 16 (27) | 35 (58) | 9 (15) | - |
| Problem posing activities train students' estimating and reasoning skills | 19 (32) | 36 (60) | 5 (8) | - |
| Problem posing activities give students the opportunity to be independent | 16 (27) | 35 (58) | 9 (15) | - |
| Problem posing activities show the students' mathematical perspectives | 13 (22) | 46 (77) | 1 (2) | - |
| Students have problems in story-building activities | 21 (35) | 30 (50) | 5 (8) | 4 (7) |
| Problem posing activities make Mathematics more interesting to students | 17 (28) | 33 (55) | 7 (12) | 3 (5) |
| Problem posing activities help students to relate ideas in Mathematics | 15 (25) | 41 (68) | 4 (7) | - |
| Problem posing activities improve students' language knowledge | 17 (28) | 40 (67) | 3 (5) | - |
| Story-building activity encourages students to think critically | 20 (33) | 36 (60) | 4 (7) | - |
| Problem posing activityimproves the real understanding in mathematical ideas | 17 (28) | 37 (62) | 6 (10) | - |
| Problem posing activity changes the students' views on Mathematics | 12 (20) | 35 (58) | 10 (17) | 3 (5) |
| Problem posing activity helps student's evaluation skills | 11 (18) | 38 (63) | 9 (15) | 2 (3) |
| Problem posing activity gives opportunity for students to see Mathematical ideas from different angles | 16 (27) | 39 (65) | 5 (8) | - |
| Problem posing activity makes learning more active for students | 16 (27) | 37 (62) | 4 (7) | 3 (5) |
| Problem posing activity is far from learning through rote memorization | 21 (35) | 28 (47) | 5 (8) | 6 (10) |

produced. This is because students needed to think about the situation and the appropriate solution at the same time. Thus, if teachers can carry out problem-posing activities in the classroom effectively, certainly higher order thinking skills, creative, reflective and innovative thinking promoted in the Primary School Curriculum Standard (KSSR) can be achieved. It can also provide students with the skills to think as part of 21st century skills. Other perspective expressed by teachers was a change in the learning environment of using problem-posing activities that are very different from previous Mathematics learning. It can be seen through the statements in 16, 19 and 18, where teachers agreed that they could observechanges in the behaviour of the students. Positive changes in behaviour of the respondents were evidenced such as students becoming more active, providing more out of the box ideas and being independent changes the atmosphere in Mathematics classrooms. This finding is consistent with the findings of Barlow and Cates (2006), Akay and Boz (2009) and Kilic (2013). Barlow and Cates (2006) also stated that problem-posing was the best medium for students to communicate about math.

Teachers also agreed with the statement related to assessment and reasoning skills as shown in the mean of statements 5 and 17. The evaluation process takes place before, during and after building of the story. This is because students will evaluate the information provided before translating ideas into the mathematical form of the story, assess possibilities and evaluate the progress of the story and their friends' stories. This continuous assessment process can improve skills in making a proper assessment. This assessment process supported the findings of Contreras (2007), Barlow and Cates (2006), Kesan *et al.* (2010), Chang (2007) and English (1997). However, despite manypositive perspectives that can be seen, the teachers also recognized that students also have difficulties when constructing a story based on simulations given in the classroom. This item supports research findings by Kilic (2013) and future research should examine the perspectives of students in Malaysia about the level and nature of the difficulties faced by them in the performance of these activities. For open questions in section C, researchers located10 themes from 50 responsesfrom the teachers using the software QDA Miner Lite. The 10 themes were the student (skills, exposure and mastery), teachers (skills and exposure), external factors (time, environment and reference/support) and other factors which were not issues of problem posing as displayed in Table 3. For teacher factors, among the responses voiced, there were no exposure courses organized causing them to be less skilled and have fears about conducting the problem posing activities in their classrooms. They admitted to having no idea and not knowing the proper techniques for practicing problem posing. In fact, there were individuals who are not conducts the activities of story building in the classroom for fear of making mistakes. This finding wassupported by Akay and Boz (2009). For the students' factor, teachers

Table 3: Issues raised in the implementation of problem-posing activities

| Factors | Themes | Responses |
|---|---|---|
| Teacher | Skills | 5 |
| | Exposure | 4 |
| Students | Skills | 10 |
| | Exposure | 1 |
| | Mastery | 8 |
| | Attitude | 4 |
| External | Time constraints | 3 |
| | Lack of support materials/reference | 4 |
| | Environment | 1 |
| Others | Not issues of problem-posing | 10 |

said that problem-posing was inappropriate for weak students and students who did not master the skills of reading and writing. This perspective was found to be contrary to some previous studies related to the construction of mathematical concepts among students, such as English (1997), Kilic (2013), Barlow and Cates (2006), Akay and Boz (2009) and Kesan *et al.* (2010). The difference in perspective isseen to be associated with a lack of exposure received by the teachers' causing them to be unaware of the real potential of story-building activities. However, the teachers did not deny that it could improve students' language knowledge as indicated in statement 13. This is because teachers were likely to see this statement in terms of the construction of the story orally.

Such an interesting finding when the attitudes of students who do not want to be part of this activity have also become an issue. The researcher believes that it is the teachers that actually have to play a role to make this an exciting activity to be carried out. This opinion is supported by Chang (2007) who stated that the role of teachers as designers was to attract students and use materials that are compatible with their needs. Zakaria and Salleh (2012) also noted that problem posing was not an easy task. This is because it required planning, skill and strength of an individual called a teacher. Should teachers be negative, then it will also impact on teaching and learning process (Barlow andCates, 2006). However, as already mentioned, the teachers themselves have less exposure causing them to not feel obliged to conduct these activities.

External factors expressed were in terms of time constraints. This was because the teachers were busy completing their syllabi and story-building activities often took a long time to implement. This was supported by previous researchers (Cunningham, 2004; Kilic, 2012, 2013). Teachers also felt a lack of support and reference for carrying out this activity. They relied heavily on textbooks that providedonly a few examples of these activities. Thus, they had difficulties producing and creating materials for carrying out these story-building activities in the classroom. Other external factor such as the number of students has also become an issue in carrying out this activity. Among there were many themes derived from the responses of teachers, other factors mentioned by the teachers were not an issue of problem-posing. This is noteworthy. Most teachers were confused between activities of story-building/problem-posing with problem-solving activities when they said, “students are confused by the keywords”, “students do not understand the story told”, “students do not want to understand and solve a given problem” and other multiple responses.

These types of responses clearly showed that teachersdo not have sufficient information related to the activity of problem-posing and that they cannot distinguish problem-solving and problem-posing.

## CONCLUSION

Overall, as previous studies have found, teachers have a positive view of the story-building activities. The biggest issue they face is the lack of direct exposure regarding these activities, which caused them to face a number of other issues that are intertwined with each other. Lack of exposure has led teachers to be less proficient in performing these activities and this affects students' skills in building stories. Teachers, as the main planners in teaching and learning, should be given the opportunity and support as teachers in the study of Flores *et al.* (2005) to gain experience inproblem posing. This is because teachers in these studies found that there was an increase in terms of their understanding of the concept of difficult topics in Mathematics, such as fractions and multiplication. Stickles (2006) also stated that the experience will affect the ability of teachers to generate problems. This impression shows the importance of the support and exposure before teachers undertake story-building activities in the classroom.

Thus, the educators involved need to open their eyes to the issues raised by the teachers in this study. Efforts must be made to ensure that these activities are implemented to obtaina more meaningful Mathematics education program for students. Exposure courses for teachers are the most important key because teachers are the individuals who play a key role in implementing the story-building activities. In addition, these activities should be carried out and expanded consistently so that this type of activitycan bring about positive changes in Mathematics education classroom across Malaysia.

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