

Secondary School Students' Problem Posing Strategies: Implications To Secondary School Students' Problem Posing Performances

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ABSTRACT: In order to enhance problem posing performances, secondary school students should be exposed to a variety of problem posing strategies. In this study, the researchers regarded problem posing strategies as “changing the values of the given data” and “changing the context” to pose other problem after solving the “Original textbook problem”. The purpose of the study was to identify the preferences of problem posing strategies to develop secondary school students' problem posing performances. Analysis of the study revealed that both of the students were using “changing the values of the given data” as their most preference of problem posing strategies in order to develop their problem posing performances.

1.0 INTRODUCTION

In mathematics education research, problem posing had been used both as an instruction method, as well as an activity. For example, English (1999) revealed the substantial developments in (a) children's recognition and utilization of problem structures, (b) their perceptions of, and preferences for, different problem types, and (c) their development of diverse mathematical thinking in contrast to those who do not participate in problem posing program.

Researchers in mathematics education argued that the use of appropriate problem posing approaches can affect students' academic success in a positive way, can be a useful strategy for developing the problem solving ability (e.g., Kilpatrick, 1987; Cai, 1998; English, 1998; NCTM, 2000; Cunningham, 2004; Christou, Mousoulides, Pittalis, Pitta, & Sriraman, 2005), can develop students' mathematical knowledge and understandings (e.g., Gonzales, 1996; Goldenberg, 2003), can illuminate what can be learned from studying how students solve problems and vice versa (e.g., English, 1997; NCTM, 2000; Cai & Hwang, 2002; Brown & Walter, 2005; Costa, 2005), can develop students' problem posing performance (e.g., Abu-Elwan, 2002, 2006), can improve mathematics teaching quality in middle and primary schools (e.g., Lu and Wang, 2005), can effect students' positive attitudes towards mathematics (e.g., Akay & Boz, 2010), as well as can foster a mindful approach towards realistic mathematical modelling (e.g., English, 2003, 2005; Bonotto, 2004, 2007, 2008; Christou et al., 2005).

With regard to this report, the researchers intend to identify the preferences of problem posing strategies to develop secondary school students' problem posing performances.

2.0 RESEARCH OBJECTIVE

This report focuses only on one objective of the entire study, which had been implemented by the researchers, namely to:

- i. Identify the preferences of problem posing strategies to develop secondary school students' problem posing performances.

3.0 METHOD

This study involved the use of qualitative approach in order to identify the preferences of problem posing strategies in developing secondary school students' problem posing performances, especially through student's audio-taped responses.

There is only a type of data collection techniques used to illustrate the above research question, namely semi-structured interview (Nicolaou & Phillippou, 2002, 2007; Roulston, 2010). A copy of each problem is presented and read aloud to the participants by the researchers and each participant is then asked to respond to the question and make a written recording of any working out used in the process. Reading the problems ensures that the participants know what each problem said but in no way assists them especially concerns with the comprehension in terms of the mathematical demands of the task rather than mere decoding of words. Following the completion of each problem, each participant is asked if they had encountered a similar problem before, and to verbally explain what they had done. The researchers ask prompting questions, when and if clarification is required.

A pilot study had been conducted in one of secondary schools in Johor with a number of two out of twenty six participants had been selected purposefully to participate in an interview session. Both of them were moderate achievers, and they were selected purposefully by the researchers in order to illustrate the above research question. Most importantly, the participants were first acquainted with such problem posing tasks (Lowrie, 2002; Christou et al., 2005; Stoyanova, 2005; Ilfi, 2008, 2009; Pelczer, Voica & Gamboa, 2008; Chua & Yeap, 2009). The interview session was being conducted for approximately 45 minutes, after analyzing the results of solving-posing pretests. Secondary school students are targeted because they could be expected to have literacy levels sufficient to understand questions and articulate their posed question processes (e.g., Ilfi, 2008, 2009).

4.0 RESULTS AND DISCUSSION

4.1 Preferences Of Problem Posing Strategies

The researchers then exposed the participants to two types of problem posing strategies, namely 'changing the values of the given data' and 'changing the context' in order to pose other problem after solving the 'Original textbook problem'.

Interviewer: Given two types of strategies in posing problems, namely 'change the values of the given data' and 'change the context'. Which type of problem posing

strategies would you most preferable when posing other problem? Let's try the first question.

Write a formula for each of the following statements.

William bought 5 shirts for RM x each and 8 pairs of shoes for RM y per pair. Construct a formula for the total amount of money M spent.

Interviewer: First of all, what are the informations given and what is asked for question 1?

Participant Z: The informations are '5 shirts for RM x each' and '8 pairs of shoes for RM y per pair'.

Participant A: And what is asked refers to 'the total amount of money M spent'.

Interviewer: So, what is the solution for question 1(a)?

Both participants answered simultaneously.

Participant A and Participant Z: $M = 5x + 8y$

Interviewer: Yes, both of you answer it correctly. For question 1(b), can you find what is asked from the question?

Participant A: We are required to 'pose other problem where the total amount of money N spent was $N = 4p + 6q$ '.

Interviewer: Yes. Let's try the first problem posing strategy, namely 'change the values of the given data'. How are you supposed to begin it? First, changing the values of the solution of the question 1(a) to $N = 4p + 6q$. Second, changing the values of the given information, '4 shirts for RM p each' and '6 pairs of shoes for RM q per pair', as well as changing the values of the asked question, 'the total amount of money N spent was $N = 4p + 6q$ '. So, the other posed question would be:

Write a formula for each of the following statements.

William bought 4 shirts for RM p each and 6 pairs of shoes for RM q per pair. Construct a formula for the total amount of money N spent.

Interviewer: So, what can you say about the pose problem based on the given 'Original textbook problem'?

Participant A: It's quite interesting.

Participant Z: It's easy.

Interviewer: Good. Let's try another problem posing strategy, namely 'change the context'. First, changing the values of the solution of the question 1(a) to $N = 4p + 6q$. Second, changing the context of the given information as required, '4 pens for RM p each' and '6 pencils for RM q each', as well as changing the context of the asked question, 'the total amount of money N spent was $N = 4p + 6q$ '. So, the other posed question would be:

Write a formula for each of the following statements.

Ahmad bought 4 pens for RM p each and 6 pencils for RM q each. Construct a formula for the total amount of money N spent.

Interviewer: Now, what can you say for this type of problem posing strategies then?

Participant A: I need to think more here.

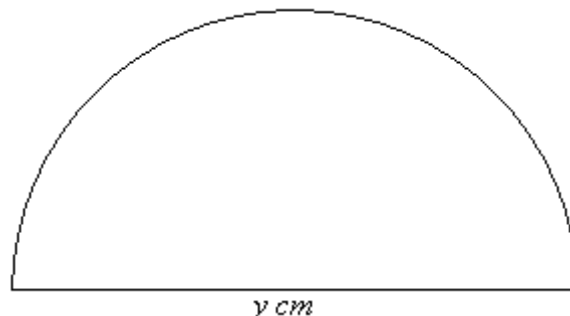
Participant B: It's a bit complicated if compared to the first problem posing strategy.

Both participants then were asked to pose other problems using either 'change the values of the given data' or 'change the context' as their most preferable problem posing strategy. It was found that both of them preferred to use 'change the values of the given data' as their problem posing strategy. This finding affirms Siswono's (2004), Siswono's (2005), Ball, Lewis and Thames's (2008) findings. Siswono (2004) pointed out that students tend to use the geometry type, and Siswono (2005) found out that the high group and the low group initiate the process of constructing theorems by identifying and understanding axioms, making a visual diagram (sketch) or making a conjecture and constructing the "new" theorem, and the modest group begins by understanding information (making a definition), drawing diagrams and calculating the number of lines and parallel lines, then constructing theorems. An example of posed problems as shown below. Ball, Lewis and Thames (2008) concluded that individual's CPFS structure influences the ability of probing into problems is mainly through intuitive reasoning and logical reasoning.

Interviewer: Can you please pose other problem based on Question 2 using either 'change the values of the given data' or 'change the context'?

Solve the problem.

The diagram below shows a semicircle. If the diameter is y cm and the perimeter is P cm, construct a formula for the perimeter P in terms of y . Find the value of P when $y = 28$. (Take $\pi = \frac{22}{7}$).

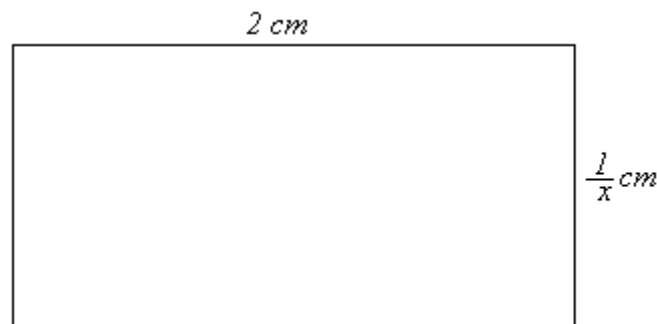


Participant A: For question 2(a), I need to find what are the given informations: (1) Semicircle, (2) Diameter = y cm, (3) Perimeter = P cm. Second, find what is asked: (1) perimeter P in terms of y . Third, the solution of 1(a) would be: $P = \frac{11}{7}y + y$. When $y = 28$, then $P = 72$ cm. For Question 2(b), I would like to pose other problem using 'Change the values of the given data'. First, change the solution of

the Question 1 (a) into $M = \frac{2}{x}$. Then, change the values of the informatios given into (1) Length = 2 cm, (2) Width = $\frac{1}{x}$ cm, (3) Rectangle and change the values of the asked question into (1) 'the area of M in terms of x'. So, the problems:

Solve the problem.

The diagram below shows a rectangle. If the length is 2 cm, the width is $\frac{1}{x}$ cm and the area is M, construct a formula for the perimeter M in terms of x .



Participant Z: For question 3(a), the given informations are an equation, $y = \frac{12}{x} + 4$, $x = -6$, $x = 2$, $x = 5$, and the asked question is find y . So, the answer for Question 3(a) is 3(a)(i) 2, 3(a)(ii) 10, 3(a)(i) 6.4. For Question 3(b), I need to 'change the values of the given information' into $y = 2x + 3$, and the asked question into 'Find the value of y '. So, the pose problem would be:

If $y = 2x + 3$, find the value of y when

(i) $x = -6$

(ii) $x = 2$

(iii) $x = 5$

In relation to the original contribution, the researchers found that both of the participants preferred to use 'change the values of the given data' as their most preference of problem posing strategies in order to develop their problem posing performances.

5.0 CONCLUSION

In conclusion, the findings of the study revealed that secondary school students were able to develop their problem posing performances via the use of 'changing the values of the given data'.

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