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A Preliminary Analysis of Students' Problem-Posing Ability and its Relationship to Attitudes Towards Problem Solving

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Abstract: The purpose of this study was to identify students' problem-posing ability and students' attitude towards problem solving. In addition, this study will also determine the relationship between students' problem-posing ability and attitude towards problem solving. The sample consisted of 35 form 4 secondary school students. Two instruments were used: The Mathematical Problem-Posing instrument and the Attitudes towards Problem Solving instrument. The results revealed that students are capable of posing a 'Due Problem "better than" Uno Problem'. Perseverance and confidence were moderate, while the dimensions of willingness were at a high level. The findings also found no correlation between students' problem-posing ability and students' attitude towards problem solving.

Key words: Attitudes, confidence, perseverance, problem posing, willingness

INTRODUCTION

The development of mathematical power for all students requires the mathematics curricula and the environment for teaching and learning different from most current practice. According to Nik (2003), it involves a variety of meaningful experiences, develop habits of mathematical thinking, understand and appreciate the role of mathematics in the development of society and nation. Each student had the opportunity to build mathematical power as high as possible and it is the essence of the vision of a quality mathematics program. One alternative to develop mathematical power in students is through the generation of mathematical problems by the students themselves. NCTM (2000) proposed teachers to provide opportunities for students to think mathematically and develop mathematical knowledge through problem posing in teaching and learning. This approach is capable of connecting the mathematical knowledge and creativity of the students (Pelczer and Rodriguez, 2010). Kilpatrick (1987) states that generating problem is a component of problem solving and it is at the heart of mathematical activities. Polya (1973) himself has identified the experience of generating problems is important in the learning of mathematics.

Bonotto (2010) defines mathematical problem posing "as the process by which students construct personal interpretations of concrete situations and formulate them as meaningful mathematical problems", while Gonzales (1996) and Stickless (2006), explain mathematical problem posing as generating a new problems or uncovering (formulating) again an old problem. In addition, Kilpatrick (1987) and Stoyanova (2005) states that the problem-posing can be viewed as a learning activity in which teachers create math problems to be solved by the students and it can also be seen in terms of learning activities in which students create math problems for different situations such as daily situations.

Problem posing can have a positive impact on attitudes and self-efficacy (Akay and Boz, 2010). This opinion was supported by Brown and Walter (2005) which states that problem-posing may increase students' positive attitudes and students will be more responsible for their mathematics learning. In this study, attitudes towards problem solving include the aspects of perseverance, willingness and confidence. Changes in attitudes depend on the current situation and can happen through their past experience. Students' learning experiences in math problems may encourage a positive attitude towards the subject, and increase confidence in mathematics ability. Study conducted by Craig (1999) showed that attitudes toward mathematics affects the ability to generate mathematical problems. This means that if students have positive attitudes toward mathematics, they will be able to pose problem in mathematics. According to Roslina *et al.* (2010), problem solving is an asset owned by students in preparing them as a progressive human capital. This is because solving problem is able to develop the positive aspects of the students themselves. The goal of Integrated Curriculum for Secondary Schools also states that students must master the skills to solve a problem which involves the step such as interpretation of the problem, solution strategy, implementing the plan and reviewing the correct answer.

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According to a study by Sharifah and Zanzali (2006) students' ability to pose mathematical problems is still limited. There are students who are unable to pose any problem. The majority of students can only generate a mathematical problem involving addition and subtraction operations. Students are not able to generate a more complex mathematical problems involving multiplication and division operations. According to Akay and Boz (2009), the difficulties faced by students in posing mathematical problem is due to the lack of knowledge of mathematics, the students themselves (not confidence and creative) and the nature of the problem-posing itself.

Cai and Hwang (2002) states that students think about the solutions when they generate mathematical problems. This shows that problem posing can increase students' ability in solving mathematical problems (Xia *et al*., 2008; Cifarelli and Sheet, 2009; Priest, 2009). In conclusion, most studies have shown that problem posing can provide a positive impact on students (Abu-Elwan, 2006; Nicolaou and Philippou, 2007; Bonotto, 2008) and there is evidence that developed countries such as Japan began to realize the importance of problem posing and start implementing this element in their education systems. Therefore, it is important for the study to be done within the context of education in Malaysia. Thus, this study seek to answer the following questions:

- What is the students' ability to pose mathematical problems in terms of "Uno Problem" and "Due Problem"?
- What is the attitude of the students towards problem solving?
- Is there a relationship between students' attitude towards problem solving and students' ability to pose mathematical problems?

MATERIALS AND METHODS

A total of 35 students (11 male and 14 female) from a secondary school participated in the study. All of them were science stream students. Their overall mathematics achievement was average. There are two instruments used in the study: Mathematical Problem-Posing (MPP) instrument and the attitude towards problem solving (ATP). Questions for the mathematical problem-posing instrument were taken from Form Four textbook. All instruments have evidence of validity and reliability. In order to determine student's ability to pose mathematical problems, researchers adopt and modify problems of Abu-Elwan (2006) and Ilfi and Nor Bakar (2009). From the math problems presented, students are required to identify the "Condition" i.e., what is the information given and the "Demand" i.e., what is the unknown (Abu-Elwan, 2006). After the students had identified the "Condition" and "Demand", the student is expected to generate "Uno Problem" and "Due Problem". "Uno problem" requires students to add more or new conditions to the original problem then formulate a new demand. While "Due Problem" requires students to remove conditions from the original problem then formulate a new demand. To determine students' ability to pose mathematical problems, researchers use the scoring scheme adopted from Ilfi and Nor Bakar (2009). To ensure the validity of the mathematical problem-posing instrument, the researchers asked two experts teachers of mathematics to review and comment on its contents. The attitudes towards problem solving instrument was adapted and modified from Salleh and Zakaria (2009). This instrument consists of three subscale: (a) willingness (6 items); (b) perseverance (6 items) and (c) self-confidence (8 items). The ATP was a five-point Likert type scale and consisted of 20 items. The rating range from SD = Strongly Disagree, D = Disagree, SLD = Slightly Disagree, A = Agree and SA = Strongly Agree. For positive items, the score range from 1 to 5. Scores for negative items were reverse.

Table 1: Instruments reliability coefficient

Instrument	Cronbach's Alpha
Attitudes towards problem solving instrument	0.86
Mathematical problem posing instrument	0.76

There liability of the instruments is shown in Table 1. According to Majid (2000), alpha values of above 0.6 is acceptable.

RESULTS

Student's ability to pose a mathematical problem was based on the student's ability to pose 'Uno Problem' and 'Due Problem' (Abu-Elwan, 2006). According Ilfi and Nor Bakar (2009), students who scored a '5' is said to be posing a good math problem. From Table 2 and 3, it was found that students were better in posing 'Due Problem' compared to 'Uno Problem'.

For the "Uno Problem, it was found that only 42% was able to pose mathematics problems with a full score of 5, whereas for the "Due problem" only 47% was able to pose mathematics problems with a full score of 5.

Attitudes toward problem solving: The attitude towards problem solving consisted of three subscales: willingness, perseverance and confidence. As shown in Table 4, the mean for willingness, perseverance and confidence were 3.73, 3.52 and 2.88, respectively. Interpretation of the mean scale in this study was based on Pallant (2006). Perseverance and confidence was in the moderate category, while the dimensions of willingness was at a high category.

Relationship between attitudes towards problem solving and mathematical problem posing: The analysis showed that there was no correlation between student's

Table 2: Students' score in posing 'Uno Problem'

Item	Score 0	Score 1	Score 2	Score 3	Score 4	Score 5
1	1	12	0	3	4	15
2	7	17	0	0	3	8
3	13	21	0	0	0	1
4	4	3	0	0	2	26
5	9	1	0	1	1	23
	34(19%)	54(31%)	0(0%)	4(2%)	10(6%)	73(42%)

Table 3: Students' score in posing 'Due Problem'

Item	Score 0	Score 1	Score 2	Score 3	Score 4	Score 5
1	7	6	0	1	1	20
2	9	6	0	0	2	18
3	21	11	0	0	3	0
4	16	3	0	2	0	14
5	3	0	0	1	0	31
	56 (32%)	26 (15%)	0 (0%)	4 (2%)	6 (3%)	83 (47%)

Table 4: Mean of attitudes towards problem solving according to dimension

Dimension	Mean±SD
Willingness	3.73±0.51
Perseveranc	3.52±0.60
Confidence	2.88±0.35

Table 5: Relationship between attitudes toward problem solving and mathematical problem posing

		Problem-posing ability
Attitudes toward problem solving	Pearson correlation	0.094
	Sig. (2-Tailed)	0.592

ability to pose mathematical problems and attitudes towards problem solving (r = 0.094) (Table 5).

DISCUSSION

Results indicated that students are more competent in generating "Due Problem" rather than "Uno Problem." This means that students can pose math problems better by reducing the original information contained in the original text than adding information and generate a new problems. However, these studies do not support a recent study conducted by Ilfi and Nor Bakar (2009). His research found that the students are more capable of posing 'Uno Problem' than 'Due Problem'. In addition, this study also found that only 20% of students pose a good mathematical problem whereas the study by Ilfi and Nor Bakar (2009) found that 66% of students pose a good mathematical problem. Ilfi and Nor Bakar (2009) found that among the difficulties of students in the activity of problem posing is the lack of knowledge about the 'Uno Problem' and 'Due Problem'.

With regard to attitude towards problem solving, willingness is at a high level whereas perseverance and confident are moderate. This means that students have a positive attitude towards problem solving. Such attitude should be maintained to enable the student to succeed in mathematics. This finding is consistent with the findings of a study conducted by Nur `Ashiqin (2005). A study by Syed and Zainuddin (2007) found that perseverance and willingness are at a high level and moderate for confidence. According O'Conell (2000), a positive attitude towards problem solving is essential for the success of a students. The study also found no correlation between a student's ability to pose a math problems and students' attitudes towards problem solving in mathematics. This is in contrast to Cai and Hwang (2003) who states that problem posing have a positive impact on student attitudes and problem solving in mathematics. Also, a study conducted by Akay and Boz (2010) found that problem posing have an impact on students' attitudes toward mathematics and self-efficacy. According to Zakaria (2003), students' attitudes toward mathematics were closely related to their attitude towards problem solving. One of the possibilities for this result to occur may be due to student's background in mathematics, which was average. The students may have a high perseverance and willingness in doing mathematics problems but lack the skills in solving and posing mathematical problems. One limitation of this study is that the sample of 35 students can not meant to be representative of the students in all secondary schools in Malaysia.

CONCLUSION

This study shows that student's ability to pose mathematical problems is still at a low level. The results of this study showed no correlation between a student's ability to pose a mathematical problems and the attitude towards problem solving. NCTM (2000) suggested that teachers implement activities that involve the students themselves to pose mathematical problems. Ilfi and Nor Bakar (2009) states that the ability to pose mathematical problems can be nurtured among the students. Therefore,

it is important to expose students to math problem-posing activities. Teachers should engage students in class to participate in problem-posing in order to improve their problem solving skills. This activity indirectly helps students to think creatively and critically as expected by the Ministry of Education.

REFERENCES

Abu-Elwan, R., 2006. The Development of Mathematical Problem Posing Skills for Prospective Middle School Teachers. Retrieved from: http://math.unipa.it/~grim/EAbu-elwan8, (Accessed on: April 20, 2011).

Akay, H. and N. Boz, 2009. The effect of problem posing oriented calculus-ii instruction on academic success. J. Korea Soc. Mathe. Educ. Ser. D: Res. Mathe. Edu., 13(2): 75-90.

Akay, H. and N. Boz, 2010. The effect of problem posing oriented analyses-II course on the attitudes towards mathematics and mathematics self-efficacy of elementary prospective mathematics teachers. Aust. J. Teacher Edu., 35(1): 57-75.

Bonotto, C., 2008. Realistic mathematical modelling and problem posing. University of Padova, Padova.

Bonotto, C., 2010. Engaging students inmathematical modeling and problem posing activities. J. Math. Model. App., 1(3): 18-32.

Brown, S. and M. I. Walter, 2005. The Art of Problem Posing. 3rd Edn., Mahwah Lawrence Erlbaum Association, NJ.

Cai, J. and S. Hwang, 2002. Generalized and Generative thinking in us and Chinese students mathematical problem solving and problem posing. J. Math. Behav., 21: 401-421.

Cai, J. and S. Hwang, 2003. A perspective for examining the link between problems posing and problem solving. Proceeding of the joint Annual meeting of the PME and PME/NA. University of Hawaii, Honolulu, HI, July 13-18, 3: 103-110.

Cifarelli, V. and C. Sheet, 2009. Problem Posing and Problem Solving: A Dynamic Connection. Sch. Sc. Math, 109(5): 245-246.

Craig, D.S., 1999. Preservice elementary teachers problem posing and it's relationship to mathematical knowledge and attitudes. Retrieved from: http:e-archive.Library.Okstate.edu/dissertations/, (Accessed on: December, 2010).

Gonzales, N.A., 1996. Problem formulation: Insight from generated questions. Sch. Sc. Math., 96(3): 152-157.

Ilfi, N. and M.D. Nor Bakar, 2009. Secondary school students' abilities through problem posing activities. J. Pend. Uni. Tek. Mal., 14: 98-118.

Kilpatrick, J., 1987. Soviet Studies in the Psychology of Learning and Teaching Mathematics. Vol. 1, The Learning of Mathematical Concepts. Chicago: University of Chicago Press. A.C. Vroman, Inc., Pasadena, Calif.

Majid, K., 2000. Kaedah Penyelidikan Pendidikan. [Educational Research Methodology]. Dewan Bahasa dan Pustaka, Kuala Lumpur.

NCTM, 2000. Principles and Standards for School Mathematics. Reston, VA: NCTM.

Nicolaou, A.A. and G.N. Philippou, 2007. Efficacy Beliefs, Problem Posing and Mathematics Achievement. In: Pitta-Pantazi, D. and G. Phillippou, (Eds.), Proceedings of the V Congress of the European Society for Research in Mathematics Education Larnaca, Department of Education, University of Cyprus, Cyprus, pp: 308-317.

Nik, A.N.P., 2003. Syarahan Perdana: Pendidikan Matematik di Malaysia dalam Abad ke-21: Harapan dan Cabaran. Universiti Malaya, Malaysia.

Nur`Ashiqin, N., 2005. Sikap dan Keupayaan Menyelesaikan Masalah Matematik Bukan Rutin di Kalangan Pelajar Matrikulasi. [Attitudes and Non-Routine Problem Solving Ability among Matriculation Students], Unpublished Document.

Pallant, J., 2006. SPSS Survival Manual. A Step by Step Guide to Data Analysis Using SPSS for Windows. Allen & Unwin, Illinois.

Polya, G., 1973. How to Solve it: A New Aspect of Mathematical Method Princeton. Pinceton University Press, NJ, ISBN: 978-0691119663.

Pelczer, I. and F.G. Rodriguez, 2010. Creativity assessment in school settings through problem posing tasks. Mont. Math. Ent., 8(1-2): 383-398.

Priest, D.J., 2009. A problem posing intervention in the development of problem solving competence of underachieving middle year students. MBBS Thesis, Queensland University of Technology.

Roslina, R., T. Subahan Mohd Meerah and E. Zakaria, 2010. Hubungan anatara kepercayaan matematik, metakognisi dan perwakilan masalah dengan kejayaan penyelesaian masalah matematik. J. Pendidikan Malaysia, 35(2): 1-7

Salleh, F. and E. Zakaria, 2009. Non-routine problem solving and attitudes towards problem-solving among high achievers. Inter. J. Learning, 16(5): 549-560.

Sharifah, A. and N.A. Zanzali, 2006. Problem posing abilities in mathematics of Malaysian primary year 5 children: An exploratory study. J. Pendidikaan Uni. Teknol. Malaysia, 11: 1-9.

Stickless, P.R., 2006. An Analysis of Secondary and Middle School Teachers Mathematical Problem Posing. Ph.D. Thesis, University of Indiana. Retrieved from: http://gradworks.umi.com/32/19/3219902.html.

Stoyanova, E., 2005. Problem solvings trategiesused by years 8 and 9 students. Aus. Math. Teach., 61(3): 6-11.

Syed, A.H. and S. Zainuddin, 2007. Ability and attitude to solve non-routine mathematical problems among students level 2 in two schools around Johor Bahru district. M.Ed. Thesis, Universiti Teknologi Malaysia, Malaysia.

Xia, X., C. Lu and B. Wang, 2008. Research on mathematics instruction experiment based problem posing. J. Math. Edu., 1(1): 153-163.

Zakaria, E., 2003. Kesan Pembelajaran Koperatif Ke Atas Pencapaian Matematik Dan Sikap Pelajar terhadap Matematik Dan Penyelesaian Masalah. Prosiding Simposium Kebangsaan Sains Matematikke-XI, Universiti Malaysia Sabah & PERSAMA, pp: 68377.