Journal of Education and Practice
ISSN 2222-1735 (Paper) ISSN 2222-288X (Online)
Vol.8, No.15, 2017

Problem Solving Strategies among Primary School Teachers

Wun Thiam Yew* Lim Hooi Lian Chew Cheng Meng
School of Educational Studies, Universiti Sains Malaysia,11800 Pulau Pinang, Malaysia

The article was made possible with funding from the Short Term Grant of Universiti Sains Malaysia, Penang, Malaysia.

Abstract
The purpose of this article was to examine problem solving strategies among primary school teachers. The researchers employed survey research design to examine their problem solving strategies. The participants of this study consisted of 120 primary school teachers from a public university in Peninsula Malaysia who enrolled in a 4-year Graduating Teachers Program (*Program Pensiswazahan Guru*) majored in mathematics. Purposive sampling technique was used to select these participants. This article presents the analysis of the responses of the participants related to a particular problem, namely fencing problem. Result of the study suggests that 79.2% of the participants have successfully solved the fencing problem. They employed various problem solving strategies: (i) trial-and-error (also known as guess-and-check), (ii) using algebra, (iii) making tables, charts or systematic list, (iv) drawing diagrams, (v) identifying pattern, and (vi) logical reasoning. Result of the study also suggests that 85% of the participants used same strategy to check their solutions for the fencing problem without being probed. The implications of the results were also discussed.
Keywords: problem solving strategies, primary school teachers, survey research design.

1. Introduction

The goal of the mathematics curriculum in Malaysia is to develop individuals who are able to think mathematically and can apply mathematical knowledge effectively and responsibly in solving problems and making decision (Ministry of Education Malaysia, 2003). Problem solving is the primary focus of the teaching and learning activities of school mathematics. Similarly, problem solving must also be the main focus of the teaching and learning activities of mathematics teachers education program.

Various strategies can be used to solve problems. Among the strategies recommended by the Ministry of Education Malaysia (2003) to be introduced in the school mathematics curriculum are as follow: "trying a simple case; trial-and-error (also known as guess-and-check); drawing diagrams; identifying patterns; making a table, chart, or systematic list; simulation; using analogies; working backward; logical reasoning; and using algebra" (p. 4).

Similarly, in this article, the fencing problem can be solved using various strategies (e.g., making a chart, looking for a pattern, trial-and-error, differentiation method, quadratic function method etc). Sgroi (2001) demonstrated how this problem can be solved using the strategy of making a chart (for the detail of her solution, see (Sgroi, 2001, pp. 181-182)). The finding of Wun and Sharifah Norul Akmar (2012) revealed that three types of strategies were employed by the preservice teachers in their study to solve the fencing problem, namely looking for a pattern, trial-and-error, and differentiation method. The finding of Wun, Sharifah Norul Akmar, and Lim (2013) showed that Beng (a pseudonym) has successfully solved the fencing problem using the looking for a pattern strategy. She used the same strategy, namely the looking for a pattern strategy, to check her solution for the fencing problem without being probed. The finding of Wun, Lim, and Chew (2015) indicated that Suria (a pseudonym) has successfully solved the fencing problem using trial-and-error (also known as guess-and-check) strategy. She used alternative strategy, namely differentiation method, to check her solution for the fencing problem without being probed.

The purpose of this article was to examine problem solving strategies among primary school teachers. Specifically, this article attempted to answer the following research questions: (a) What strategies do primary school teachers employed to solve fencing problem?, and (b) What strategies do primary school teachers used to check their solutions for the fencing problem?

2. Methodology

The researchers employed survey research design to examine problem solving strategies among primary school teachers. The participants of this study consisted of 120 primary school teachers from a public university in Peninsula Malaysia who enrolled in a 4-year Graduating Teachers Program (Program Pensiswazahan Guru) majored in mathematics. Purposive sampling technique was used to select these participants. This article presents the analysis of the responses of the participants related to a particular problem, namely fencing problem.

The task was adapted from Sgroi (2001) (see Appendix A). In this task, participants were required to solve the fencing problem. The objective of this task was to examine strategies employed by primary school teachers to solve the fencing problem. This task was also used to examine strategies used by primary school

teachers to check their solutions for the fencing problem.

3. Results

3.1 Demographic Information

Table 1 shows the distribution of frequency and percent of the participants by gender. 90 (75%) of the 120 participants were primary school female teachers. The remaining 30 (25%) participants were primary school male teachers.

Table 1. Gender

Gender	Frequency	Percent
Male	30	25.0
Female	90	75.0
Total	120	100.0

Table 2 shows the distribution of frequency and percent of the participants by age. 44 (36.7%) and 43 (35.8%) of the participants were from the age groups of 26-30 and 31-35 years respectively. 22 (18.3%) and 10 (8.35) of the participants were from the age groups of 36-40 and 41-45 years respectively. The remaining one (0.8%) participant was from the age group of 46-50 years.

Table 2. Age

Age	Frequency	Percent
26-30	44	36.7
31-35	43	35.8
36-40	22	18.3
41-45	10	8.3
46-50	1	.8
Total	120	100.0

Table 3 shows the distribution of frequency and percent of the participants by state. 56 (46.7%) and 33 (27.5%) of the participants were from the Kedah and Penang states respectively. The remaining 31 (25.8%) participants were from the Perak state.

Table 3. State

State	Frequency	Percent
Kedah	56	46.7
Penang	33	27.5
Perak	31	25.8
Total	120	100.0

Table 4 shows the distribution of frequency and percent of the participants by highest academic qualification. The highest academic qualification for 95 (79.2%) and 23 (19.2%) of the participants were SPM and STPM respectively. The remaining two (1.6%) participants were Diploma holder and other academic qualification respectively.

Table 4. Highest academic qualification

Highest academic qualification	Frequency	Percent
SPM	95	79.2
STPM	23	19.2
Diploma	1	.8
Others	1	.8
Total	120	100.0

Table 5 shows the distribution of frequency and percent of the participants by professional qualification. The professional qualification for 96 (80.0%) of the participants were Malaysian Diploma in Teaching. The remaining 24 (20.0%) participants were Certificate in Teaching holders.

Table 5. Professional qualification

Professional qualification	Frequency	Percent
Certificate in Teaching	24	20.0
Malaysian Diploma in Teaching	96	80.0
Total	120	100.0

Table 6 shows the distribution of frequency and percent of the participants by major in professional qualification. 60 (50.0%) of the participants majored in mathematics for their professional qualification. The remaining half of the participants majored in other subject.

Table 6. Major in professional qualification

Major in professional qualification	Frequency	Percent
Mathematics	60	50.0
Other subject	60	50.0
Total	120	100.0

Table 7 shows the distribution of frequency and percent of the participants by minor in professional qualification. 45 (37.5%) of the participants minored in mathematics for their professional qualification. The remaining 74 (62.5%) of the participants minored in other subject.

Table 7. Minor in professional qualification

Minor in professional qualification	Frequency	Percent
Mathematics	45	37.5
Other subject	75	62.5
Total	120	100.0

Table 8 shows the distribution of frequency and percent of the participants by teaching experience. 62 (51.7%) and 35 (29.2%) of the participants were from the teaching experience groups of 6-10 and 11-15 years respectively. 10 (8.3%) and nine (7.5%) of the participants were from the teaching experience groups of 16-20 and 1-5 years respectively. The remaining four (3.3%) participants were from the teaching experience groups of 21-25 years.

Table 8. Teaching experience

Teaching experience	Frequency	Percent
1-5	9	7.5
6-10	62	51.7
11-15	35	29.2
16-20	10	8.3
21-25	4	3.3
Total	120	100.0

Table 9 shows the distribution of frequency and percent of the participants by teaching experience in mathematics. 44 (36.7%) and 36 (30.0%) of the participants were from the teaching experience in mathematics groups of 6-10 and 0-5 years respectively. 30 (25.0%) and eight (6.7%) of the participants were from the teaching experience in mathematics groups of 11-15 and 16-20 years respectively. The remaining two (1.7%) participants were from the teaching experience in mathematics groups of 21-25 years.

Table 9. Teaching experience in mathematics

Teaching experience in mathematics	Frequency	Percent
0-5	36	30.0
6-10	44	36.7
11-15	30	25.0
16-20	8	6.7
21-25	2	1.7
Total	120	100.0

3.2 Successful and Unsuccessful Problem Solvers

Table 10 shows the distribution of frequency and percent of the successful and unsuccessful problem solvers for the fencing problem. Result of the study suggests that 95 (79.2%) of the participants have successfully solved the fencing problem. The remaining 25 (20.8%) participants were unsuccessful problem solvers for the fencing problem.

Table10. Successful and unsuccessful problem solvers

Fencing problem	Frequency	Percent
Successful	95	79.2
Unsuccessful	25	20.8
Total	120	100.0

3.3 Problem Solving Strategies

Table 11 shows the problem solving strategies employed by the participants to solve fencing problem.

They employed various problem solving strategies: (i) trial-and-error (also known as guess-and-check), (ii) using algebra, (iii) making tables, charts or systematic list, (iv) drawing diagrams, (v) identifying pattern, and

(vi) logical reasoning.

Result of the study suggests that trial-and-error and using algebra was the dominant problem solving strategies employed by the participants to solve fencing problem. Specifically, 50 (41.7%) and 37 (30.8%) of the participants employed trial-and-error and using algebra to solve fencing problem respectively. Subsequently, 17 (14.25) and 13 (10.8%) of the participants employed making tables, charts or systematic list, and drawing diagrams to solve fencing problem respectively. They were only two (1.7%) and one (0.8%) participants who employed identifying pattern and logical reasoning to solve fencing problem respectively.

Table11. Problem solving strategies

Problem solving strategies	Frequency	Percent
Drawing diagrams	13	10.8
Identifying pattern	2	1.7
Making tables, charts or systematic list	17	14.2
Using algebra	37	30.8
Logical reasoning	1	.8
Trial-and-error	50	41.7
Total	120	100.0

3.4 Strategies for Checking Solutions

Table 12 shows the problem solving strategies employed by the participants to check their solutions for the fencing problem. Result of the study suggests that 102 (85.0%) of the participants used same strategy to check their solutions for the fencing problem without being probed. The remaining 18 (15.0%) participants used alternative strategy to check their solutions.

Table 12. Strategies for checking solutions

Strategies for checking solutions	Frequency	Percent
Same strategy	102	85.0
Alternative strategy	18	15.0
Total	120	100.0

4. Discussion and Conclusions

In summary, 79.2% of the 120 primary school teachers have successfully solved the fencing problem. They employed various problem solving strategies: (i) trial-and-error (also known as guess-and-check), (ii) using algebra, (iii) making tables, charts or systematic list, (iv) drawing diagrams, (v) identifying pattern, and (vi) logical reasoning. The result of this study is concurs with the results of previous studies (Sgroi, 2001; Wun & Sharifah Norul Akmar, 2012).

Result of the study suggests that 85% of the participants used same strategy to check their solutions for the fencing problem without being probed. The result of this study is in concurrence with the result of previous study (Wun, Sharifah Norul Akmar,, & Lim, 2013) which found that the participant used the same strategy to check her solution for the fencing problem without being probed.

However, this is only a survey that involved 120 primary school teachers from a public university in Peninsula Malaysia who enrolled in a 4-year Graduating Teachers Program (*Program Pensiswazahan Guru*) majored in mathematics. Moreover, purposive sampling technique was used to select these participants. Thus, the results of this study could not be generalized to other primary school teachers enrolled in the 4-year Graduating Teachers Program (*Program Pensiswazahan Guru*) in this public university, in other programs, or attending other universities and teacher training institutes.

The implication of this study is that mathematics teacher educators need to organize teaching and learning activities that provide opportunity for the preservice and inservice mathematics teachers to solve different types of mathematical problems. Through such activities, preservice and inservice mathematics teachers would be provided opportunity to develop their mathematical problem solving ability. This is in line with the goal of the mathematics curriculum in Malaysia, namely to develop individuals who are able to think mathematically and can apply mathematical knowledge effectively and responsibly in solving problems and making decision (Ministry of Education Malaysia, 2003).

References

Ministry of Education Malaysia (2003). *Integrated Curriculum for Secondary School: Curriculum Specification Mathematics Form 1*. Kuala Lumpur: Curriculum Development Centre.

Sgroi, L. S. (2001). *Teaching elementary and middle school mathematics: Raising the standards*. Belmont,

California: Wadsworth.

Wun, T. Y., & Sharifah Norul Akmar, S. Z. (2012, September). *Mathematical problem solving ability of preservice secondary school mathematics teachers*. Paper presented at the Mathematics and Science Education Colloquium, 12-13 September 2012, University of Malaya, Kuala Lumpur.

Wun, T. Y., Sharifah Norul Akmar, S. Z., & Lim, H. L. (2013, September). *Assessing preservice teachers' problem solving abilities: A case study*. Paper presented at the Seminar Kebangsaan Majlis Dekan Pendidikan IPTA 2013, 23-25 September 2013, Universiti Islam Antarabangsa Malaysia (UIAM), Gombak, Selangor.

Wun, T. Y., Lim, H. L., & Chew, C. M. (2015, September). Assessing primary school teachers' mathematical problem solving ability: A case study. Paper presented at the Seminar Kebangsaan Majlis Dekan-Dekan Pendidikan Universiti Awam 2015, 14-15 September 2015, Fakulti Pendidikan Teknikal dan Vokasional, Universiti Tun Hussein Onn Malaysia, Johor.

Appendix A

Fencing problem (adapted from Sgroi, 2001, p. 181):

A gardener has 84 m of fencing to enclose a garden along three sides, with the fourth side of the garden being formed by a wall. (Assume that the wall is perfectly straight). What are the dimensions of a rectangular garden that will yield the largest area being enclosed?