Teachers Beliefs in Problem Solving in Rural Malaysian Secondary Schools

Shalini Palraj [1], Dorothy DeWitt [2], Norlidah Alias [3]

[1] Department of Curriculum and Instructional Technology,Faculty of Education,
University of Malaya 50603 Kuala Lumpur, Malaysia
shalinipalraj7590@gmail.com,

[2] Department of Curriculum and Instructional Technology,Faculty of Education,
University of Malaya 50603 Kuala Lumpur, Malaysia
dorothy@um.edu.my,

[3] Department of Curriculum and Instructional Technology,Faculty of Education,
University of Malaya 50603 Kuala Lumpur, Malaysia
drnorlidah@um.edu.my

ABSTRACT

Problem solving is the highest level of cognitive skill. However, this skill seems to be lacking among secondary school students. Teachers' beliefs influence the instructional strategies used for students' learning. Hence, it is important to understand teachers' beliefs so as to improve the processes for teaching problem solving. The purpose of this study is to investigate beliefs of secondary school teachers in rural schools on problem solving in teaching. The sample were teachers selected from secondary schools in two rural districts in Malaysia. A survey of 75 secondary school teachers was done using the Learning Skills Questionnaire formulated for this purpose. The findings indicate that rural school teachers are aware of the usefulness of problem solving but still emphasize memorization of facts and concepts for learning. These might be because they are unaware of how to teach problem solving. Hence, further research is required in developing instructional strategies for teaching problem solving skills among rural school teachers. Further research could be done to determine whether there was a difference in beliefs among urban school teachers.

Keywords: *problem solving, teacher's beliefs, learning skills*

INTRODUCTION

Today, more than in the past, one of the most important objectives of education is to foster students' competences related to problem solving (Barak, 2013). Problem solving is important in honing students' thinking, flexibility and creativity. It also encourages cooperative skills, and is a useful in allowing students to apply the knowledge learnt to different situations.

Problem solving is also an important skill for employability as employers require workers who are able to solve problems. Malaysian employers rank problem-solving skills as most important after speaking and writing in English (Hamid, Islam, & Manaf, 2013). Problem solving is also a higher level cognitive skills. In Gagné's hierarchy of learning, problem solving is at the highest level of complexity of learning, after discrimination, concept learning and rule learning (Gagne, 1971). Hence, problem solving is a higher order thinking skill.

The National Education Philosophy (NEP) of Malaysia emphasizes the holistic development of the individual balanced in the intellectual, spiritual, emotional and physical domains (Ministry of Education (MOE), 2008). In line with Vision 2020, the education system not only aspires to produce a generation that is competitive, but also well-equipped with problem solving skills to face issues and challenges.

However, problem solving skills seem to be lacking among Malaysian students. The lack of problem-solving skills among graduates may be a contributing factor to graduate unemployment. According to the National Graduate Employability Blueprint 2012-2017, employers perceive that 25.9% fresh graduates do not demonstrate the ability to solve problems (Ministry of Higher Education Malaysia, 2012). Results from international assessments such as the Programme of International Student Assessment (PISA) and the Trends in International Mathematics and Science Study (TIMSS) have also indicated a declining trend, indicating that

students in secondary schools also seem to lack problem-solving skills (Abdullah & Peters, 2015).

In response to this, one of the shifts of the Malaysia Education Blueprint 2013-2025 (Preschool to Post-Secondary Education) is to provide equal access to all students to an education system of an international standard (MOE, 2013). This is required in the aspiration to produce students who are able to compete globally, and who possess both the knowledge and thinking skills (MOE, 2013). This means that the curriculum will be upgraded placing an emphasis on problem solving and thinking skills (MOE, 2013). This focus on thinking skills is also in the Malaysia Education Blueprint 2015-2025 (Higher Education) and is for students to have thinking skills as they are able to appreciate diverse views, to think critically and be innovative, have problem-solving initiative, and an entrepreneurial skills.

Nevertheless, the development of problem solving and thinking skills among students depends on teachers' instructional approach. Students develop when they are able to practice problem solving skills when given the opportunity to acquire these skills during instruction. Hence, teachers' epistemological beliefs on what knowledge is and how knowledge is delivered will determine what students learn (Pajares, 1992). Beliefs are important as they will affect the teachers' behavior (Pajares, 1992). Hence, understanding that beliefs influences practice makes it important for the teaching process to be understood (Xenofontos & Andrews, 2012; Smith, 2014).

Beliefs are the "individual's judgment of the truth or the falsity of a proposition, a judgment that can only be inferred from a collective understanding of what human beings say, intend, and do" (Pajares, 1992). This intention is influenced by substructures, such as educational beliefs, which are connected in a system. These substructures may be difficult to change when it has been incorporated long in the belief structure, and may be influenced by others who contribute to the beliefs in the system (Pajares, 1992).

In this paper, teachers' beliefs in problem solving are investigated to determine if problem solving was being implemented in rural schools. Most rural schools are far from the state education departments and may not be involved in programmes that are organised at the State level. Hence, there is a need to determine the beliefs of the teachers in rural schools on problem solving. The following research questions are investigated:

    i   What are the beliefs of teachers on problem solving skills?

    ii   To what extent are teachers in schools implementing problem solving in teaching?

The reason this research is needed is that although there has been much research on how teachers' beliefs affect students learning and their achievement, very little has been done on the teachers' perspective from a multi-disciplinary approach. Even less research has been done on rural schools when teachers from these school might require even more support. Past studies on problem solving seem to focus on teachers from a mathematical or scientific background (Thompson, 1992). Hence, this study will reduce the research gap by determining to what extent teachers, in general, practice problem solving skills in their teaching.

Problem solving

According to Jonassen, (2000), problem solving is considered the most important cognitive activity in everyday life. Problem solving is the process an individual experiences when the individual encounters an unknown, sees no immediate solution and is required to carry out several tasks or explore different approaches to achieve the solution (Xenofontos & Andrews, 2012). Learning environments which focused on problem solving seems to bring about more learning as it encourages students to utilize existing knowledge and explore possible solutions to a problem (Anderson, 1982). According to Merrill (2002), the problem-solving process allows the students to gain new knowledge and to relate new knowledge with previous knowledge.

Early definitions on problem solving defined a problem as having three components: the 'givens', the

'goals' and the 'obstacles' (DeWitt & Alias, 2015). The givens in a problem is provided at the onset, and is a certain state with certain conditions, objects, and pieces of information; the goals are the desired or terminal state which is achieved by transforming from given to the goals; and the obstacles are the ways of changing the given state to achieve the goal of the problem (Mayer, 1983). However, this definition is limited to problems in the school curriculum and does not cover complex and ill-structured problems (DeWitt & Alias, 2015). A more current definition would be that problem solving is a process in finding a goal which is of value socially, culturally and intellectually (DeWitt & Alias, 2015)

According to the PISA's 2012 results, Malaysian students scored below average and Malaysia was ranked 52nd out of 65 countries in Mathematics, Science and reading (Mozihim, 2014). In PISA 2009, Malaysia ranked 39 out of 44 countries on creative problem-solving (Abdullah & Peters, 2015). This results showed that Malaysian students' performance has deteriorated over the years. When Malaysia first participated in TIMSS in 1999, its average student score was higher than the international average in both Mathematics and Science. In TIMSS 2011, Malaysia's ranking in Mathematics fell from 20th in 2007 to 26th in 2011 while its ranking in Science dropped from 21st in 2007 to 32nd in 2011 (Ng, 2014). The TIMMS and PISA results identified our students as possessing inadequate mastery of basic mathematical and scientific concepts (Saifulbahri, 2014).

The results from these international assessments are enough to prove the struggle of Malaysian students in problem solving. Andreas Schleicher, acting Director of Education and Skills at OECD said "Today's 15-year-olds with poor problem-solving skills will become tomorrow's adults struggling to find or keep a good job" (OECD, 2014). She is proven right by the current low graduate employment rate in Malaysia. In order to become a developed nation and improve the quality of our human capital, we need to immediately equip our students with problem solving skills.

Bishaw (2011) investigated beliefs in teaching problem solving. He examined mathematics teachers' beliefs and the application of their beliefs in their lessons. The study included 26 mathematics teachers teaching grades 9 and 10. The study showed that teachers have low level beliefs on problem solving and that there was a high correlation between teachers confessed beliefs and their actual classroom practices in applying problem-solving for teaching.

Another study by Van MerriëNboer (2013) aimed to clarify problem solving and to provide a preliminary answer to the question of how real-life problem solving is best taught. It categorizes problem solving as a goal, a method, and a skill. This study disagreed with the concept that problem solving is not suitable for weak learners (New Zealand Ministry of Education, 2010). Van MerriëNboer (2013) stated that support in the early stages of problem solving was most important for assisting novice learners to develop problem-solving skills. These learners may take a longer time and find problem solving complex but they will eventually be able to solve problems.

Teachers face difficulties when teaching problem solving (New Zealand Ministry of Education, 2010). Firstly, there is teacher discomfort in teaching problem solving to students (Roberts, 2010). Some teachers do not really understand the concept of problem solving and they believe that they need to be first taught problem solving skills through a course before they themselves can teach it to students. Besides that, teaching problem solving brings about student insecurity (New Zealand Ministry of Education, 2010). When students are first introduced to open ended questions and expected to answer them with minimal scaffolding, students tend to feel insecure and less confident of their answers. Finally, there is also more preparation involved when teaching problem solving. Educators will have to experiment and come up with teaching strategies that best suit their students. The strategies and the questions to be discussed with the students must challenge them but not intimidate them. Gillies (2011) found that if teachers want to encourage higher order thinking and problem solving among their students, then must carefully pick, plan and scaffold their questioning and teaching strategies for optimum results. To do this, teachers need to design collaborative tasks for problem solving and this requires more class-time for discussions.

In Malaysia, the Ministry of Education Malaysia replaced the centralized assessment, *Penilaian Menengah Rendah* (PMR), with *Pentaksiran Tingkatan* 3 (PT3) in 2014. The questions set by the Examinations

Board, Ministry of Education in previous years did not emphasize problem solving. However, in the first year of PT3's implementation, a significantly higher number of problem solving questions were included, causing a drop in performance in a majority of schools (DeWitt & Alias, 2016). The drop in performance of the first year's PT3 examinations results might seem to reflect poorly on the teachers' problem solving skills and practice. This is because there was a huge difference between the last PMR results and the first PT3 results. However, it should be noted that the performance could also be due to other factors such as the communication structure, the lack of time and preparation by the administrators, teachers and students (DeWitt & Alias, 2016). However, these results might also be an indicator that Malaysian secondary school teachers need to be equipped with instructional skills for teaching problem solving skills. This is because most teachers seem to dread problem solving and do not allow their students to explore on their own, synthesize information and find solutions to questions with minimal guidance their teachers. Hence, in order to encourage teaching of problem solving, teachers need to be confident in incorporating problem solving skills into teaching and learning.

There are many advantages in using problem solving for learning. Problem solving methods allows students to map their existing knowledge onto real-life situations (Hoxha, 2016; Kalaivani & Ahmad Tarmizi, 2014; Mustaffa, Ismail, Tasir, & Said, 2016). Besides that, problem solving in education promotes self-directed learning (Ibrahim, Arshad, Rosli, & Shukor, 2017; Peen & Arshad, 2013). These studies show that teachers who use problem-solving methods in their teaching produce students who are able to explore different alternatives and make better decisions. Thirdly, problem solving gives students a chance to practice and apply their content knowledge (Hoxha, 2016; Zhao, Zhang, & Du, 2017).

Teachers' beliefs

Teachers' beliefs influence teachers' pedagogy. In a case study on first-language English teacher's approach to teaching writing, it was also found that beliefs play an important role in influencing pedagogy in specific areas of the curriculum (Watson, 2015). This was exemplified when teachers who were observed while they were teaching were asked to explain their thinking processes and the impact of their belief on their teaching practice. The implication is that teachers' beliefs must be taken into account when designing a contextualized approach to teaching.

The nature of knowledge and its influence on the beliefs of three New Zealand generalist primary teachers was studied by Anderson (1998). The study involved a total of 174 teachers in 40 schools who were surveyed to determine their beliefs. The results of his study indicate teachers' beliefs in science teaching and learning strongly influence teachers' practice and knowledge.

The beliefs of the teacher influenced classroom practices in second language reading. In a case study of teachers' classroom practice, observations of teachers' practices over a period of four weeks showed a relationship with their beliefs (Farrell & Ives, 2015). This was confirmed when the teachers were allowed to express their beliefs during the interviews. Although the results of this study cannot be generalized, there seem to be a relationship between teachers' beliefs and their practices.

Lera & Piquet (2014) carried investigated cases of teachers in Spain and found that their beliefs on problem solving were closely related to the teachers' training programs received (during their first education stage), and their teaching experience. This again indicates that teachers' beliefs strongly influence teaching practice. This is exemplified by Zheng (2009) who also noted that teachers' beliefs are influenced by the teacher education experience which had a great effect on how these teachers taught. Therefore, teachers might have been teaching the way they were trained to teach initially, without reflecting on the consequences of their instructional practices.

METHOD

The study is a survey of beliefs of secondary school teachers' in rural schools on problem solving. The sample of teachers were selected from was two regions in Malaysia, the northern region and the southern

region. The rural districts were selected based on the distance from the State Education Department. Both districts were more than 50 kilometers from the Departments. In the northern region, the district selected was considered rural as the schools were on an island, while in the southern district, the district was considered a rural and in the hinterlands of Peninsular Malaysia.

The instrument used was the Learning Skills Questionnaire, which comprised of 20 items. The items had a 4-point Likert scale for teachers to indicate their response on a scale. The scale was "1 = don't know", "2 = not true", "3 = true" and "4 = very true". Each statement was followed by a scale "Problem solving is only used for mathematics". There was one open-ended question in the instrument which questioned whether teachers were able to use problem solving activities in their teaching. The questionnaire was bi-language and the teachers were free to answer in either Malay language or English.

The instrument was distributed to secondary school teachers in the district through the Teacher Activity Centres. The participation of the teachers were voluntary and no equality of gender was emphasized. There were a total of 75 questionnaires returned. The data from the survey was analysed according to means and standard deviation. The responses from the open-ended questions were coded and analyzed using thematic content analysis.

RESULTS

The respondents' demographic related to subjects, the highest levels taught and years of teaching experience is shown in Table 1. From a total of 75 teachers who were involved in the survey, more than half of the respondents (66.6%) were science and mathematics teachers while about 12 (16%) were teaching social science subjects such as History, Islamic Studies, Malay Literature, Geography, Integrated Living Skills, Health Education and Visual Arts Education (see Table 1). These teachers were mainly teaching at upper secondary level while 14.7% taught both Lower Secondary and Upper Secondary students, and 2.6% of the teachers taught pre-university students or Form 6 students.

About a third (36.3%) were novice teachers with up to 5 years of teaching experience, and another third (33.3%) were teachers with 6 to 10 years of experience. The rest had mostly 11 to 20 years' experience teaching (22.7%) with 8% of the respondents having more than 20 years teaching experience.

Table 1. Respondents' demographic

Teachers' demographics	Numbers	Percentages (%)
Subjects taught/ teaching		
Biology/Chemistry/ Physics	28	37.3
Mathematics	22	29.3
Languages	19	25.3
Others	12	16.0
Highest Level taught		
Upper Secondary	54	72.0
Lower Secondary	34	45.3
Primary	0	0.0
Others	2	2.6
Number of years in teaching		
0-5 years	27	36.0
6-10 years	25	33.3
11-20 years	17	22.7
More than 20 years	6	8.0

Most of the teachers evaluated themselves as being skilled in computers (73.3%), followed by averagely skilled (21.3%), while only 4% evaluated themselves as very skilled. The distribution of respondents in With regards to frequency of use of technology in teaching, it appears that more than half the teachers (61.3%) reported using technology for teaching once a week or more often, while 21.3% reported once in two or three weeks, 10.7% once a month, 2.7% for once in 6 months and 4% almost never used technology in their teaching.

In order to answer the research question on the teachers' beliefs in problem solving skill, the data was analyzed by computing the mean score and standard deviation (SD) (see Table 2). In general, teachers highly agreed that problem solving is needed for everyday life, with the highest mean score (mean = 3.51; S. D. = 0.52), followed by problem solving is a useful skill (mean = 3.49; S. D. = 0.53), provides a purpose for learning (mean = 3.40; S. D. = 0.52) and knowledge learnt through problem solving is remembered better (mean = 3.27; S. D. = 0.60). Although problem solving is useful for everyday life and for learning, many teachers seem to associate problem solving with mathematics (mean = 2.49; S. D. = 0.64).

In addition, although teachers believed that problem solving was important for learning and construction of knowledge, there were a large number who believed that memorizing facts (mean = 2.99; S. D. = 0.60) and concepts (mean = 2.96; S. D. = 0.60) were important for learning.

Table 2. Computed means for statements beliefs in problem solving

No	Statements	Mean	SD
1	I solve problems in my everyday life.	3.39	0.52
2	Problem solving is needed for everyday life.	3.51	0.50
3	Problem solving gives a purpose for learning.	3.40	0.52
4	Problem solving is a useful skill.	3.49	0.53
5	Problem solving is only used for mathematics.	2.49	0.64
6	I need to think when I solve problems.	3.45	0.53
7	Learning facts are important for getting knowledge	3.32	0.60
8	Memorizing facts are important for learning	2.99	0.60
9	Memorizing concepts are important for learning	2.96	0.60
10	Applying concepts to other situations are important for learning	3.37	0.54
11	I can usually find an answer when I use problem solving	3.12	0.61
12	I enjoy problem solving activities	3.12	0.57
13	Learning through problem solving is more meaningful than learning facts	3.17	0.62
14	Learning through problem solving is more effective	3.31	0.54
15	Knowledge learnt through problem solving is remembered better	3.27	0.60
16	Knowledge used for problem solving can be transferred easily to other problems	3.20	0.59
17	Knowledge that is constructed while solving problems becomes more meaningful	3.36	0.48
18	Knowledge that is constructed while solving problems is deeper	3.39	0.49
19	Problem-based learning results in higher levels of understanding than traditional teacher-centered instruction	3.17	0.64

In order to determine to what extent teachers' in rural secondary schools are implementing problem

solving in teaching, an open-ended question was used. Out of the 75 survey respondents, 59 teachers (78.7%) answered the question on their ability to use problem solving in their teaching. Only 3.4% of teachers responded that they were unable to integrate problem solving into their teaching due to the lack of time and students' high dependency on teachers to provide answers: "*students attitudes: lazy to think and too dependent on teacher for answers*". Several themes have emerged from the responses of the 96.6% teachers who responded that they are able to integrate problem solving in their lessons: real world relevance, promotes self-directed learning, gives students opportunities to practice and apply their knowledge and it also makes teaching enjoyable. Their responses are presented in the Appendix. Hence, this indicates that the teachers are aware of the advantages of problem-solving and the need to use problem solving strategies in instruction. However, it is not known if they were implementing these strategies.

DISCUSSION

This study explores the beliefs of secondary teachers in two rural districts on problem solving skills and to what extent these teachers in schools are implementing problem solving in teaching. In this study, the majority of the respondents were science and mathematics teachers (66.6%). This might have an influence on the results as mathematics and science teaching were more likely to have been trained in problem solving and to have used problem solving in their instruction.

It was also possible that most of the teachers had attending training in the use of technology in instruction. This was because 80.0% of the teachers were mathematics, science and language teachers. This meant that a large number probably would have been involved in the Teaching of Mathematics and Science in English and were trained to use technology for instruction. Further, a third of the teachers (36.0%) were young teachers who might have been exposed to training in using thinking maps and problem solving strategies for instruction. Hence, the beliefs towards problem solving and use of technology might be influenced by the background of the respondents surveyed.

People's beliefs strongly affect their behavior and beliefs cannot be directly observed or measured but must be inferred from what people say, intend, and do (Pajares, 1992). Hence, the findings of the study seem to indicate that teachers believe that problem solving was a useful skill for life and could assist learning. The responses form the open-ended questions indicated that students would be engaged and interested in lessons which emphasized problem solving, and that there was opportunity to apply the knowledge learnt, and that teaching would be more rewarding (see Appendix).

However, from the survey it could be seen that a number of teachers agreed that problem solving was confined to learning mathematics. This was surprising as problem solving when problem solving was considered a skill which could be applied in all subject areas.

There were still respondents who agree that memorizing needs to be emphasized for learning facts and concepts. This may indicate that teachers preferred a traditional teacher-centered approach rather than allowing their students to construct knowledge from the problems that they encountered in life. Although there was agreement on the importance of application of concepts and meaningful problem solving as well, but the average level of agreement on the importance of memorization is disconcerting. This might be because these teachers experienced discomfort in teaching for problem solving (Roberts, 2010).

This finding is surprising considering that most of the respondents were younger teachers with less than 10 years' experience and should have undergone training on thinking skills and use of constructivist methods of instruction. However, their beliefs had influenced the perception of instructional practice (Farrell & Ives, 2015). As teachers, they should be more concerned on understanding and acquiring concepts rather than memorizing, and encourage their students to build new knowledge structures. So, there needs to be a change in the belief structures of the teachers.

It is not known to what extend the teachers surveyed implement problem solving in their teaching and could only be studied from the extent of their intention and practice (Pajares, 1992). Only 63.2% of the

respondents seem to indicate that problem solving was used in their class, and 2.6% claimed they did not use problem solving. Most likely the remainder of the respondents (34.2%), did not use problem solving as they did not want to respond negatively. This is supported by the fact that these teachers seem to believe that memorization of facts and concepts were important. Although there were a lot of positive effects of problem solving mentioned in the open-ended responses, there were also some important points. Some teachers admitted that they could not integrate problem solving in their teaching while other responses indicated the students' attitudes and insecurity which prevented them from using problem solving (New Zealand Ministry of Education, 2010).

Hence, it is believed that when problem solving was done in class, it was more likely a prescriptive approach where the students applied the facts they memorized to derive a solution. In this study, the age of the teacher did not seem to be an influence of the belief in problem solving as the respondents were spread across different age groups.

It is important to investigate teacher beliefs in problem solving as their beliefs may influence their practice in teaching (Anderson, 1998; Farrell & Ives, 2014; Lera & Piquet, 2014). Hence, there might be some problem solving activities carried out by the teachers which might have been influenced by the teacher training programmes attended (Lera & Piquet, 2014; Zheng, 2009). However, the training receive did not seem to ensure constructivist methods of instruction were being used. Hence, further studies could be done to determine to what extend teachers' training programmes influence the practice of implementing problem solving in schools. In addition, the philosophy and beliefs of teachers who graduated from preservice teacher training needs to be investigated to determine whether these programs encouraged development of constructivist teaching strategies and problem solving.

The perception that problem solving is confined to mathematics education needs to be changed. Teacher training for teaching problem solving skills among students needs to be extended to subjects other than mathematics, so as to further strengthen teachers' beliefs in the use of problem solving (Peen & Arshad, 2013; Ibrahim et al., 2017). Instructional models and strategies for teaching problem solving skills in other subjects is required for teachers in rural schools to be confident and apply these strategies in the classroom.

The benefits of integrating problem solving are reflected in the teachers' responses. Teachers have said that problem solving methods offer real-world relevance whereby "students are able to understand the concept better when it is associated with their lives" (Kalaivani & Ahmad Tarmizi, 2014). In line with previous studies, teachers have also reported that problem solving promotes self-directed learning and offers students the opportunity to apply their knowledge (Peen & Arshad, 2014; Hoxha, 2016). Hence, teachers seem to be satisfied that teaching using problem solving methods more satisfying and rewarding for not only the students, but the teachers themselves. However, further studies to determine whether there was correlation between the teachers' beliefs and practice needs to be done (Zheng, 2009).

Problem solving is required to ensure that our graduates would be able to think critically and compete globally (MOE 2013, MOHE, 2012). It is hoped that this could be reflected through improved PISA and TIMMS results (Abdullah & Peters, 2015). As the centralized national examinations such as *Pentaksiran Tingkatan* 3 (PT3) will incorporate progressively more questions for higher order thinking each year, there is a need to equip teachers with instructional models and strategies to teach problem solving, not only in mathematics and science but in all subjects. This is because problem solving skills could produce graduates who make better decisions in life (Ibrahim et al.,, 2017; Peen & Arshad, 2013).

There are several limitations to this study. The sample of the teachers is small and limited to only two districts in two states in Malaysia and may not be representative of all teachers in Malaysia. In addition, the sample was not specific to a particular subject. The results of this study may only represent the teachers' belief for that particular point in time when they had the necessary knowledge to answer the questions (Anderson, 1998). In addition, it is assumed that the teachers responded to the statements honestly (Wolf, 1997). Teachers' beliefs may change in future depending on training they have received and other external factors in the school and administrative environment. However, these findings are also useful as it provides an indication of the beliefs of teachers on problem solving and provides baseline for future research.

CONCLUSION

Secondary school teachers in Malaysian rural schools seem to indicate that they believed problem solving skills were useful for life. However, there were contradictions in their beliefs as teachers still emphasize the memorization of facts and concepts for learning. In addition, it is not known to what extent in which rural school teachers were implementing problem solving in teaching. Results from both the national examinations such as PT3, and international assessments such as TIMMS and PISA seem to indicate a need for the Malaysian education system to be improved for our students to be at par with students of other countries (Abdullah & Peters, 2015).

These findings only provide an indication of the beliefs among rural school teachers. Further research could be done to determine if secondary school teachers in urban schools had similar beliefs. A comparative study of beliefs among teachers in rural and urban schools could also be done. The findings of this study provide implications for policy makers, researchers and educators. There is a need to consider improvements to teacher training programmes, and preparation of teachers for teaching problem solving. An instructional model focusing on developing problem solving skills needs to be developed to help the teachers teach problem solving skills. In turn, a holistic education where students are taught problem solving skills for everyday life from a young age, instead of only in the secondary schools, is required. This would produce wholesome individuals who are skilled, and a knowledgeable society who will be able to solve problems in life and at the workplace, in line with the National Philosophy of Education in Malaysia.

ACKNOWLEDGMENT

REFERENCES

Abdullah, A., & Peters, R. F. (2015). Malaysia's post-PISA 2012 direction. *International Journal of Culture and History, 1*(1), 15-20.

Anderson, J. (1998). Determining teachers' problem-solving beliefs and practices in K-6 mathematics classrooms. *Proceedings of the 28th Australian Association for Research in Education (AARE) 1998 Conference.* Adelaide: AARE. Retrieved from https://www.aare.edu.au/data/publications/1998/and98308.pdf

Anderson, J. R. (1982). Acquisition of cognitive skill. *Psychological review, 89*(4), 369 - 406.

Barak, M. (2013). Impacts of learning inventive problem-solving principles: students' transition from systematic searching to heuristic problem solving. *Instructional Science,, 41*(4), 657-679.

Bishaw, A. (2011). Teachers' beliefs and actual practice of problem solving approach in teaching mathematics (with particular reference to grades 9 and 10 in West Gojjam). *Ethiopian Journal of Education and Sciences*, *6*(1), 73-87.

DeWitt, D. & Alias, N. (2015). The principles of learning for problems solving. *Proceedings in Seminar Kebangsaan Majlis Dekan-Dekan Pendidikan Universiti Awam.* Batu Pahat, Johor, Malaysia: Universiti Tun Hussein Onn Malaysia.

DeWitt, D. & Alias, N. (2016). Pentaksiran Berasaskan Sekolah: Isu dan cabaran dalam Pelaksanaan Pentaksiran Tingkatan 3 (PT3). In Hussein Ahmad & Mohamad Sani Ibrahim (Eds.). *Transformasi Pendidikan Nasional: Antara Aspirasi dan Anjakan*. Kuala Lumpur, Malaysia: University of Malaya Press

Farrell, T. S., & Ives, J. (2015). Exploring teacher beliefs and classroom practices through reflective practice: A case study. *Language Teaching Research*, *19* (5), 594-6101-17.

Gagne, R. (1971). *Learning hierarchies.* Englewood Cliffs, NJ: Prentice Hall.

Gillies, R. M. (2011). Promoting thinking, problem-solving and reasoning during small group discussions. *Teachers and Teaching: theory and practice, 17*(1), 73-89.

Hamid, M. S., Islam, R., & Manaf, N. H. (2013). Enhanching malaysian graduate employability skills: Quality function deployment approach. P*roceedings of the 12th International Symposium on the Analytic Hierarchy Process for Multicriteria Decision Making*. Kuala Lumpur, Malaysia: Creative Decision Foundation.

Hoxha, M. (2016). Project-based learning:"Teens' Magazine"- A case study in an English Language classroom in Albania. *Academic Journal of Interdisciplinary Studies, 5*(3), 73-78.

Ibrahim, M. M., Arshad, M. Y., Rosli, M. S., & Shukor, N. A. (2017). The roles of teacher and students in self-directed learning process through blended problem-based learning. *Sains Humanika,* 9(1-4).

Jonassen, D. H. (2000). Toward a design theory of problem solving. *Educational technology research and development, 48*(4), 63-85.

Kalaivani, K., & Ahmad Tarmizi, R. (2014). Assessing thinking skills: a case of problem-based learning in learning of algebra among Malaysian form four students. *Journal of International Academic Research for Multidisciplinary, 2*(3), 166-173

Lera, C. G., & Piquet, J. D. (2014). Knowledge and beliefs on problem solving of in-service and pre-service mathematics teachers. *Bolema: Boletim de Educação Matemática, 28*(48), 191-208. doi:10.1590/1980-4415v28n48a10

Mayer, R. E. (1983). *Thinking, problem solving, cognition.* New York, NY: W. H. Freeman & Co. .

Merrill, M. D. (2002). First principles of instruction. *Educational technology research and development, 50*(3), 43-59.

Ministry of Education Malaysia (2008). *Education in Malaysia: A journey to excellence*. Putrajaya, Malaysia : Educational Planning and Research Division (EPRD), Ministry of Education Malaysia.

Ministry of Education Malaysia (2013). *Malaysia education blueprint 2013-2025 (Preschool to post-secondary education.* Putrajaya, Malaysia : Ministry of Education Malaysia.

Ministry of Higher Education Malaysia (2012). *The national graduate employability blueprint 2012-2017*. Putrajaya, Malaysia : Ministry of Higher Education Malaysia.

Mozihim, A. K. (2014, April 18). PISA 2012 Highlights deteriorating education performance in Malaysia. *Scientific Malaysian.* Retrieved from http://www.scientificmalaysian.com/2014/04/18/pisa-2012-deteriorating-education-performance-malaysia/

Mustaffa, N., Ismail, Z., Tasir, Z., & Said, M. N. H. M. (2016). The impacts of implementing problem-based learning (PBL) in Mathematics: A Review of Literature. *International Journal of Academic Research in Business and Social Sciences, 6*(12), 490-503.

New Zealand Ministry of Education (2010). Why teach problem solving? *New Zealand Maths.* Retrieved from http://nzmaths.co.nz/why-teach-problem-solving# Benefits_of_Problem_Solving

Ng, E. (2014, December 25). Fewer as in PT3 show ministry 'manipulated' PMR results, says education group. *The Malaysian Insider*. Retrieved from

http://www.themalaysianinsider.com/malaysia/article/fewer-as-in-pt3-show-ministry-manipulated-pmr-results-says-education-group

OECD PISA. (2014, April 1). Singapore and Korea top OECD's first PISA problem-solving test [Blog post]. Retrieved from http://www.oecd.org/pisa/singapore-and-korea-top-first-oecd-pisa-problem-solving-test.htm

Pajares, M. F. (1992). Teachers' beliefs and educational research: Cleaning up a messy construct. *Review of educational research, 62*(3), 307-332.

Roberts, S. K. (2010). The Important Thing about Teaching Problem Solving. *Mathematics Teaching in the Middle School, 16*(2), 104-108. e

Peen, T. Y., & Arshad, M. Y. (2013). Collaborative and self-directed learning processes: A case study in Malaysian Chemistry PBL lesson. Paper presented at the 2nd *International Seminar on Quality and Affordable Education* (ISQAE 2013) Universiti Teknologi Malaysia, Johor.

Peen, T. Y., & Arshad, M. Y. (2014). Teacher and student questions: A case study in Malaysian secondary school problem-based learning. *Asian Social Science, 10*(4), 174.

Saifulbahri, H. A. (2014). *Teachers' understanding on brain-based teaching and learning approach in mathematics classroom.* (Unpublished master's thesis). Universiti Malaysia Sarawak, Sarawak, Malaysia

Smith, K. (2014). *How teacher beliefs about Mathematics affect student beliefs about Mathematics.* (Unpublished Honors Thesis). University of New Hampshire, Durham, New Hampshire. Retrieved from http://scholars.unh.edu/cgi/viewcontent.cgi?article=1194&context=honors

Thompson, A. G. (1992). *Teachers' beliefs and conceptions: A synthesis of the research.* New York, NY: Macmillan

Van MerriëNboer, J. J. G. (2013). Perspectives on problem solving and instruction. *Computers & Education, 64,* 153-160

Watson, A. (2015). The problem of grammar teaching: a case study of the relationship between a teacher's beliefs and pedagogical practice. *Language and Education, 29* (4), 332-346.

Wolf, R. M. (1997). Questionnaires. In J. P. Keeves (Ed.), *Educational research, methodology, and measurement: An international handbook.* (pp. 422-427). Cambridge, UK: Pergamon.

Xenofontos, C., & Andrews, P. (2012). Prospective teachers' beliefs about problem-solving: Cypriot and English cultural constructions. *Research in Mathematics Education, 14*(1), 69-85.

Zhao, K., Zhang, J., & Du, X. (2017). Chinese business students' changes in beliefs and strategy use in a constructively aligned PBL course. *Teaching in Higher Education,* 22(4):467-482

Zheng, H. (2009). A review of research on EFL pre-service teachers' beliefs and practices. *Journal of Cambridge Studies, 4*(1), 73-81

APPENDIX.

Teachers' responses on the use problem solving in teaching

Themes	Responses
Real-world relevance Some teachers reported that using problem solving in their teaching helps students relate what they learn to real-life.	Helps students understand real life situation The learning is applicable to students' daily lives Helps students relate their learning with reality Offers real-world relevance and students are able to understand the concept better when it is associated with their lives Allows students to apply the learning in other situations besides classroom
Promotes self-directed learning Some teachers noted that using problem solving strategies maintained students' engagement throughout the lesson and improved students' interest in the subject.	Reduces students' boredom during the lesson Attracts students to respond to the given questions Students participate more actively during the teaching and learning session Students show more active participation in the classroom Students seek their own answers to the given questions Students retain the knowledge learnt for a longer time A student-centered learning environment is encouraged"
Offers students the opportunity to apply their knowledge Many teachers responded that problem solving methods gives students lots of opportunities to practice and apply their knowledge.	Train students to solve difficult and complex questions Provides an opportunity for students to explore various solutions to problems Gives students the opportunity to resolve the question by using a variety of hots methods Provides a space for students to be able to explore ways of solving the problem in greater depth Gives students the opportunity to find solutions to any questions/ problems given
Makes teaching more fun and rewarding Problem solving not only brings benefits to the students, but it also makes teaching more enjoyable and satisfying for the teachers. Teachers claim that they are also able to learn together with their students.	Helps both the teachers and the students to familiarize themselves with HOTS to solve questions Teaching and learning more meaningful for both the teachers and the students