

AL-SHAJARAH

JOURNAL OF ISLAMIC THOUGHT AND CIVILIZATION
OF
THE INTERNATIONAL ISLAMIC UNIVERSITY MALAYSIA (IIUM)

SPECIAL ISSUE:
EDUCATION

2018

AL-SHAJARAH

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TEACHING ISLAMIC VALUES THROUGH PROBLEM SOLVING IN MATHEMATICS: A CASE STUDY¹

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Abstract

This paper presents the findings of a study which was performed to develop students' Islamic values through a series of problem solving activities, incorporated in the teaching of mathematics. Students were presented with mathematical problems that allow discussions on some moral predicaments, posed into a problem of the day lesson. This pre-experimental design study involved a combined Year 4 class of 35 students from one international school as research participants. Two teachers participated directly in the study, while some others acted as observers. Both qualitative and quantitative data in the form of observation field notes, interview data (from both students and teachers), tests, questionnaires and observation checklists results were collected. The data were used to answer the research questions on changes in students' performance and attitude, both in the mathematics topics taught and also on their moral reasoning. The results show increased but non-significant scores in mathematics. There are also improvements in moral reasoning based on students' written answers of some moral questions, which is also supported by the interview data. The observation data display a gradual improvement of students' in-class behavior in terms of their attitudes towards each other and towards the tasks and activities given. This study implies the possibility for students to learn about morality and values in a mathematics class through careful planning of tasks and activities. It highlights the belief that values can be

¹ Article received: August 2018; Article submitted: November 2018; Article accepted: December 2018

learned across the curriculum, which is one of the important factors in building a nation of caring and civil society.

Keywords: Mathematics and Islamic values; Akhlaq, morality and values; Problem Solving; Values across curriculum.

Introduction

While more people than ever are getting education, the world is not becoming a better place. The people are not becoming better people or getting happier. What could be the reason? Generally, education no longer emphasize on transmission of values, but more on the transmission of information. Values, whether it is Universal or Islamic values, are what distinguish the moral character of a person. Prophet Muhammad (S.A.W) emphasized this by saying that “the best among you are those who have the best manners and characters” and the prophet himself is a shining example of perfect moral behavior. In a hadith he mentioned that “I was only sent to perfect good *akhlaq*” which is an Arabic term for the practice of virtue, morality and manners (ethics). The term norm, value, moral and ethics are used interchangeably and they refer to a set of elements or values accepted by a society.² Masduki, Rita and Sri Sutarni³ listed the Islamic values of *sabr* (patience), *shidq* (honesty), *jihad* (struggle), *tafakkur*, *tadabbur* (reflecting and thinking), *istiqomah* (consistency) and *tasamuh* (tolerance) as being the values that can be inculcated in learners to enable them to grow with good moral character. Islamic values highlighted in this article include those values mentioned in the *Quran* and *hadith* which encompass common or universal values.

² N A. Kamri, “Implementation of Islamic Ethics in Organizations: Malaysian Experience,” (proceedings, 2010 International Conference on Humanities, Historical and Social Sciences (CHSS 2010), Singapore, 26-28 February, 2010).

³ Masduki et al., “Integrating Islamic Values in Mathematics Learning: A Strategy of Developinf Student’s Character,” (preceedings, International Conference on Research, Implementation and Education of Mathematics and Sciences 2014, Yogyakarta State University, 18-20 May, 2014).

Values in School Curriculum

Many western countries perceive mathematics as neutral and value free, hence mathematics in school in those countries are taught in a value neutral way. However, the situation is different in a number of other countries such as Malaysia. The emphasis on the development of values can be found in the Malaysian Education Blueprint 2013 – 2025⁴ where one of the eleven shifts in the education system is to develop values-driven Malaysian. The success of this move will produce students with leadership skills, and also strong universal values such as integrity, compassion, justice, and altruism, to guide them in making ethical decisions. It was suggested that the school curriculum at both primary and secondary levels will be revised to embed a balanced set of knowledge and skills such as creative thinking, innovation, problem-solving, and leadership. Additionally, this curriculum will still stress student-centered and differentiated teaching, but with a greater emphasis on problem-based and project-based work, a streamlined set of subjects or themes, and formative assessments.

Education is about values inculcation and thus education cannot escape from dealing with values. In the Malaysia Education Blueprint 2013-2025 values is included as one of the important purpose of education in Malaysia:

“The purpose of education in Malaysia is to enable Malaysian society to have a command of the knowledge, skills, and values necessary in a world that is highly competitive and globalized, arising from the impact of rapid development in science, technology, and information.”⁵

Different aspects of curriculum development and implementation was assessed so that it emphasizes knowledge, skills and values inculcation in the classroom. Since instruction and assessment are closely related, the “Examined curriculum” include students’

⁴ Ministry of Education Malaysia, *Preliminary Report: Malaysia Education Blueprint 2013-2025*, accessed September 16, 2016, <https://www.moe.gov.my/images/dasar-kpm/PPP/Preliminary-Blueprint-Eng.pdf>

⁵ *Ibid.*, 22.

knowledge, skills, and values tested, either in summative national examinations such as the UPSR, PMR, and SPM, or through formative assessment. Note the word ‘value’ that keep appearing in the document assures the readers of how serious Malaysia considers about values. At the primary level, integrated curriculum is recommended to enhance the mastery of 4R (Reading, wRiting, aRithmetic and Reasoning) with focus on knowledge, skills, values, critical, and creative thinking. Six pillars - communication, spirituality attitude and values, humanities, science and technology, physical and aesthetic development, and self-efficiency has been identified (compared to only three pillars in the old curriculum) shall be focused in order to make the curriculum more holistic and integrated.

We have seen the importance of values in the school curriculum especially in Malaysia. However, values education, although quite well defined, can be a challenging concept to effectively integrate explicitly into teaching and learning practices in schools.⁶

Values in Mathematics Education

Mathematics and science are usually put under the same category because of its nature. Stephen Gould, a biologist who made significant contribution to evolutionary biology, famously argued that religion covers questions of meaning and moral value, but science deals with empirical facts. Thus, the study of values in classrooms is not a major focus of research in science or mathematics education.⁷ Researchers are more interested to research the cognitive side of mathematics and science education,⁸ while affective perspective including beliefs, attitudes and emotions⁹ started to gain popularity

⁶ A. Mergler, “Making the Implicit Explicit: Values and Morals in Queensland Teacher Education,” *Australian Journal of Teacher Education* 3 (2008): 1–10.

⁷ A. J. Bishop, “Values in Mathematics and Sciences Education: Similarities and Differences.,” *The Montana Mathematics Enthusiast* 5, no. 1 (2008): 47-58.

⁸ A. Sfar, E. Forman and C. Kieran, “Learning Discourse: Socio-cultural Approaches to Research in Mathematics Education,” *Educational Studies in Mathematics* 46 (2001): 1 – 12.

⁹ R. Zan et al., “Affect in Mathematics Education: An Introduction,” *Educational Studies in Mathematics* 63 (2006): 113-121.

only later. Among subjects offered in schools, mathematics has not enjoyed as much academic/research attention in affective issues as some other subjects, such as the languages, literature studies and physical education.¹⁰ It started gaining researchers' attention around the 1990s.

At schools, mathematics is often presented in a traditional manner because it deals with abstract entities and ideas, and application to real-life situations is only dealt with at the end of each topic. However, according to Peng and Nyros,¹¹ mathematics education can be designated as social practices where the teaching and learning of mathematics actually occur. Mathematics is deeply rooted in many particular culture, hence cultural values in mathematics education cannot be removed from the environment with which the values are held.

"Values in mathematics education are the deep affective qualities which education aims to foster through the school subject of mathematics and are a crucial component of the classroom affective environment".¹² In this paper, values are defined as principles or standards of behaviour or one's judgement of what is important in life which determine one's conduct.¹³ The teaching of values mentioned in this paper is more towards the teaching of Islamic (*akhlaq*, *adab* and virtue) and universal values, in order to make students more aware of a particular issue in a lesson where they are able to discuss and reflect upon them later. Hopefully, with the

¹⁰ N. Aplin and J. Saunders, "Values and Value priorities of Singaporean and Australian Swimmers," *Australian Association for Research in Education*, (March 14, 1996), <http://www.swin.edu.au/aare/conf96/APLIN96.422>; M. J. Lee and M. Cockman, "Values in Children's Sport: Spontaneously Expressed Values Among Young Athletes," *International Review for the Sociology of Sport* 30 (1995): 337-349; L. Murray, "Value Categories for Australian Sport," *International Review for Sociology of Sport* 12, no. 3 (1977): 97-105.

¹¹ A. Peng and M. Nyros, "Values in Effective Mathematics Lesson in Sweden. What do They Tell Us," *The Mathematics Enthusiast* 9, no. 3 (2012): 409 – 430.

¹² A. J. Bishop et al., "Values in Mathematics Education: Making Values Teaching Explicit in the Mathematics Classroom.," (presentation, 1999 Australian Association for Research in Education conference, 1999), 1, <http://www.swin.edu.au/aare>.

¹³ M. Khalid, "Framework for Inculcating Islamic Values through Problem Solving in Mathematics and Lesson Study Approach," *Special Issue Education, Al-Shajarah* (2017): 197-218.

awareness that they have about on issues in Islamic values, then they would be a better Muslim. Therefore, the teaching of values in this research is more explicit rather than implicit. Bishop, Clarkson, FitzSimons and Seah¹⁴ mentioned their concern that although values teaching and learning inevitably happen in all mathematics classrooms, they appear to be mostly implicit. This research presented mathematics problem to students with explicit themes on values.

Problem Solving in Teaching Values?

Problem solving is a teaching method that helps teachers to develop students' thinking skills because it enables them to apply conceptual knowledge to real life situations. It is one among many methods employed by our Prophet Muhammad (S.A.W) in teaching about the religion of Islam. In addition, 'the problem solving approach develops moral skills in students and teaches them to be responsible for their education in searching for information, analyzing the problem and presenting the best solution'.¹⁵

Problem solving can be employed effectively to educate students about life by promoting interest and context, developing thinking and common sense and giving students the power to strategize. This approach encourages flexibility, the ability to respond to unexpected situations and also helps to develop perseverance in the face of failure. A problem-solving approach can provide a medium for students to construct their own ideas about what they are learning and to take responsibility for their own learning. Problem solving skills also help to expose pupils to values education that is essential to their holistic development. It is not surprising then that problem solving is considered as one of the most important skills in the 21st century that a student should possess.

Problem solving in mathematics education is defined as "engaging in a task for which the solution method is not known in advance".¹⁶ In the process of problem solving, Students utilize their knowledge in finding a solution to a problem in the process to solve

¹⁴ Ibid

¹⁵ Ibid., 208.

¹⁶ Ibid.

the problems and this leads to new mathematical understandings. Other traits that students could acquire include, “ways of thinking, habits of persistence and curiosity, and confidence in unfamiliar situations that will serve them well outside the mathematics classroom”.¹⁷ Therefore, problem solving is an integral part of mathematics learning. Other benefits of problem solving include 1) It makes learning mathematics interesting and enjoyable; 2) Mathematics is learned in a new way with greater understanding; 3) It produces positive attitudes towards mathematics; 4) It teaches thinking, flexibility and creativity; 5) It encourages logical reasoning; 6) It encourages mathematical communication; 7) It teaches general problem solving skills; and 8) It encourages cooperative skills. Taplin¹⁵ listed three types of problems to which students should experience in the classrooms:

- i. “Word problems, where the concept is embedded in a real-world situation and the student is required to recognize and apply the appropriate algorithm/rule (preparing pupils for the challenges of life)”
- ii. “Non-routine problems which require a higher degree of interpretation and organization of the information in the problem, rather than just the recognition and application of an algorithm (encouraging the development of general knowledge and common sense)”
- iii. “Real problems, concerned with investigating a problem which is real to the students, does not necessarily have a fixed solution and uses mathematics as a tool to find a solution (engaging pupils in service to society)”.¹⁸

In the Islamic tradition, the obligatory rituals has prompted its scholars to research for solutions of practical problems in the community. Sciences and learning in Islam, especially for mathematics and its diverse branches, need to have a purpose, and it

¹⁷ NCTM (2000) as cited from D. D. Samo, Darhim, and B. G. Kartassmita, “Culture-Based Contextual Learning To Increase Problem-Solving Ability Of First Year University Student,” *Journal on Mathematics Education* 9, no. 1 (2018): 81-94.

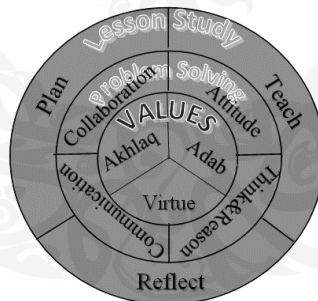
¹⁸ M. Taplin, “Teaching Values Through A Problem Solving Approach to Mathematics, accessed May 9, 2016, http://www.mathgoodies.com/articles/teaching_values.html

is the practical knowledge that produces results and leads to virtue, the object of the Muslim's prayer: 'O God grant us knowledge that is useful and beneficial'.¹⁹ Hence, Muslim science in particular, is said to allow itself to be carried away by empirical rules and practical aims,²⁰ unlike Western science, which paid particular attention to theoretical foundations in its origins as well as in the era of classical modernity.²¹

The Study

This study was conducted to examine the effect of teaching Islamic values that was posed through problem-solving sessions in the subject of mathematics on students. The participants in this study are made up of thirty-five Year 4 students from two classes in an Islamic International School in Selangor. The two classes were combined due to the request made by the two mathematics teachers teaching these two classes, so that they can team-teach. Besides the two class teachers, two other officers – a head teacher and the deputy principal for the elementary level of the school were also involved in team-teaching the classes. This study uses the framework presented in Khalid²² in terms of how the problems and the learning environment was designed as in Figure 1 below.

Figure 1: The framework used to guide the study.



¹⁹ Ismail R. Al-Faruqi and Lois Lamy Al-Faruqi, *The Cultural Atlas of Islam* (New York: Macmillan, 1986), 230.

²⁰ R. Rashed, *The Development of Arabic Mathematics: Between Arithmetic and Algebra* (Boston: Kluwer Academic, 1994), 338-339.

²¹ *Ibid.*, 338.

²² *Ibid.*, 213.

However, the lesson study suggested by the outermost layer of the concentric circle was not implemented

Khalid²³ defined Islamic values as being made up of three categories, that is

- 1) akhlaq, which refers to the duties and responsibilities set out in the shari'ah and Islamic teachings
- 2) adab, which refers to manners associated with good breeding, and
- 3) virtue – the qualities and character possessed by a good Muslim, following the example of the prophet Muhammad.

She continues by stating that “Yusuf Al-Qaradhawi further divided akhlaq or moral values into six categories of relationship: self, family, society, the animal world, the physical world and the creator. On the other hand, adab means “good manners” and finally, virtue (which include sincerity, responsibility, humility, kindness, helpfulness, etc.)”.²⁴ Due to time constraint and difficulty in getting everybody together to collaborate on the design of the lesson plan, implementation of research lesson and reflection session, the lesson study suggested by the framework could not be incorporated. The head teacher and deputy principal for elementary level were only able to attend two lesson implementation and hence, in the end only the researchers collaborate with the two teachers in approving the lesson plan, and in the reflection part, where comments are given.

The lesson plans were written according to the topic in the syllabus so that the syllabus are covered duly and not interrupted by the study. The two teachers wrote problems by referring to the textbooks and surfing the internet for ideas. The study was implemented in the duration of four months, with four main lessons being implemented. All lessons were video-recorded. Meanwhile, the teachers also tried to incorporate values in other lessons taught in between. The topics being taught are presented in Table 1.

²³ Ibid., 211.

²⁴ Ibid., 204

Table 1: The dates and topics taught on those days with the focus inculcating Islamic values via mathematical problem solving

Date	Lesson Number	Topic Covered
29/11/2016	Lesson 1	Measurement: Time
28/02/2017	Lesson 2	Measurement: Distance
14/03/2017	Lesson 3	Bar Graphs
28/3/2017	Lesson 4	Area and Perimeter

Research Questions

Three research questions were developed to guide this research, based on the objectives of exploring changes in students' mathematical knowledge and values, and how students perceive the way it was taught.

1. Do students improve their mathematical knowledge through learning via problem solving?
2. What changes in terms of values do students perceive?
3. Does problem solving method of teaching influence students' values and morality?

Design of Study

The design of the study conducted was the pre-experimental design where treatment was applied between the pre and post-tests. Students were tested on their knowledge of each topic before every lesson of the topic was conducted. Then, by the end of the study, a post test for all four topics was conducted. The data collected was a mix of quantitative and qualitative data. The quantitative data were collected through tests, observation checklist and questionnaire while the qualitative data was collected through interviews and field notes.

Instrument

Several instruments were designed for this research, in order to make sure that all important data are collected.

Pre-test and Post-test – The pretest and posttest was designed to examine students' knowledge of the four topics specified in Table

1, before and after they learn these topics in the class. Each topic test consists of four to five short answer questions. Meanwhile the posttest was developed parallel to the pretest, so that it can be used to determine the amount of learning that students have acquired.

Observation checklist – The observation checklist was meant to be used by the observers to record students' behaviour during the problem solving process. It was designed to monitor students' problem solving framework components emphasized in the research, which consist of thinking and reasoning, communication, attitude and collaboration as in Figure 1. Each component consists of six items and each item describes a desired behaviour or values of a problem-solving component and sample items are shown in Table 2. Observers are required to circle any number from 1 to 5 where 1 = 'not at all', 2 = 'low', 3 = 'moderate', 4 = 'high' and 5 = 'very high' behavior. After each of the statement, a space is provided for observers' comments.

Questionnaire – A questionnaire was designed to gather students' perception of how they perform in the problem solving class during intervention time. Their perception was collected after the intervention were over. Students were supposed to circle numbers from 1 to 5 where 1 = 'strongly disagree', 2 = 'disagree', 3 = 'neutral', 4 = 'agree' and 5 = 'strongly agree' and students were guided by the teacher to complete the questionnaire. The sample items are shown in Table 2.

Interview Protocol – An interview protocol, which consists of 10 questions was prepared for students' interview in order to inquire students' feeling about the intervention classes. Among the questions asked were whether they think the intervention has help them in learning about mathematics as well as whether they have developed a good attitude after discussing about values in the problems posed. Finally, three male and three female students of were selected for interview.

Quality Criteria

Certain measures were taken to ensure the reliability and validity of the data collected. First, the project took about one year from the inception until the end of the intervention period, which is enough

time for material preparation and intervention to satisfy the criteria of prolonged engagement with the teachers and students. The questionnaire and observation checklist were tested for reliability and the Cronbach's alphas were 0.71 and 0.86 respectively, which are acceptable. Content validity was maintained by three different lecturers from the Kulliyah of Education, who checked the content suitability of each instrument. The two instruments together with the tests and the interview protocol were pilot tested to ensure their suitability and usability. The qualitative data also went through some processes to establish credibility criteria such as triangulation, member checking, peer debriefing and negative case analysis.²⁵

Table 2: Components of problem solving in the checklist and questionnaire and their sample items

Problem-solving Components	Checklist Sample items	Questionnaire Sample Items
Thinking and reasoning	1. Able to find systematic solutions to problem. 2. Attempts to select information and develop ideas to the task given 3. Interpret and critically evaluate the task.	1. I can find the best solution method. 2. I understand more about the concept. 3. I easily gather the information to solve the task given
Communication	Communicate ideas to the whole class and with each other Discuss things related to the topic. Display confidence while presenting	I can discuss the topic well together with my friends I listen when others talk I do my presentation confidently
Attitude	Obey the rules and regulation in class. Pay attention and focus consistently Respect other group members	I Obey the rules and regulation in class I accept my friends' idea and answer I respect other group members.

²⁵ Y.S. Lincoln and E. G. Guba, *Naturalistic Inquiry* (Newbury Park, CA: Sage Publication, 1985).

Collaboration	Participate in setting ground rules for group work. Take roles and share responsibilities as a group member. Cooperate in building on ideas of others.	I participate in group work I respect my friends' opinions I cooperate with my friend to complete our task.
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Classroom Chain of Events

Lesson plans were written by the two teachers involved in the study, and then checked by the researchers. The class usually starts with a short recall of previous lessons and immediately after with the problem of the day, which was handed out to the students in the form of a worksheet. Questions were posed in the worksheet to guide students' learning and focus (see Appendix for sample worksheet). The different values highlighted in each lesson was chosen depending on the suitability of the mathematics topic. Table 3 shows the lesson number, topics and values highlighted in each discussion, moderated by the class teachers. To clarify the classroom experience that the students went through, Lesson 4 will be narrated via the vignette below. Narrative has become a way of providing educators and researchers with special access to understanding the lesson taught. Students were given about thirty minutes to discuss and complete the worksheet collaboratively in groups. This is followed by presentation of solution as well as whole class learning process.²⁶ This narrative was transcribed based on the researchers' notes and confirmed by the videotaped version of the lesson.

Table 3: Lesson number, topic and values highlighted in each lesson.

Lesson No.	Topic	Values
1	Measurement: Time (adding and subtracting)	Punctuality, meaningful routines and <i>barokah</i> , <i>adab</i> , prayers.

²⁶ K. Casey, "Chapter 5: The New Narrative Research in Education," *Review of Research in Education* 21, no. 1 (1995): 211.

2	Measurement: Distance (Estimation)	Amanah, making good judgement and decision
3	Bar Graphs	Financial Planning, water conservation, spending time beneficially
4	Area and Perimeter	Care for Environment - Composting, cleanliness, optimization (saving).

Narrative (A snapshot of Lesson 4)

It was Tuesday, 28th of March, 2017. The class was scheduled at 10.00 – 11.00 am. Students came from two different classes, hence they took more than five minutes to settle down with constant reminders from the teachers to get ready to start. Wow... they can be noisy. The students were seated in six different groups of about five and six members each. Finally, the teacher began the class with a few quick questions on how to find the perimeter and area of a rectangle. A few students answered and the teachers were satisfied with their answers.

The teachers then quickly distributed 24 pieces of sponge measuring 10cm x 5 cm x 5 cm to each group of students, to be use as manipulatives (teaching aids) in solving the problem of the day. Then the worksheets were distributed. The teachers asked the students to read the problem quietly. After 5 minutes, the students take turns to read the problem aloud and was asked by the teacher if they understand it. Some students asked the meaning of compost and organic and the teacher invited other students to give their answers while she guided the students by interjecting once a while. Then the students were asked to work on the problem.

Each group started to arrange the sponge into rectangular shapes. There were many different ways of building the rectangle (i.e. some joined the sponges lengthwise or some breadthwise) and at the same time they try to answer the questions in the worksheet. Some groups seemed to forget that the problem asks for maximum area. One student asked which area they should calculate, the inner area or the outer area. To make it consistent, the teacher decided to ask the students to calculate the outer area after some discussion with

the researchers. Twenty minutes later, the students were asked to present their group's answers in front.

During presentation, students showed how they found the dimensions of their compost plot. The answers given by each group are in Table 4. Only 1 group was able to give the dimensions that will produce the largest area for the plot. Two groups gave the same answer because it was as in the picture shown in the worksheet. The teacher then arranged the answers in a table and asked them to observe and comment on the pattern. Students observed and stated that the more the rectangle resembles a square, the larger the area. Hence the largest area is when the plot is a square.

They then discuss about composting, which led to the importance of preserving the environment and the role of each individual in making the world a more livable place. This led to their role as a student in keeping the environment clean especially at school. The class ended with everybody pledging to do their best in preserving the environment and in a small part, at least keeping their classroom clean.

Table 4: Students' answers for area and perimeter according to group.

Group No.	Dimension (Length x Breadth)	Area	Perimeter
1	105 cm x 25cm	2625 cm ²	260 cm
2	85 cm x 45 cm	3825 cm ²	260 cm
3	95 cm x 35 cm	3225 cm ²	260 cm
4	105 cm x 25 cm	2625 cm ²	260 cm
5	65 cm x 65 cm	4225 cm ²	260 cm
6	75 cm x 55 cm	4125 cm ²	260 cm

Interpretive commentary

Students in this class are active and can be bored or lost interest in learning if the lesson is not interesting or challenging. The problem of the day is both interesting and challenging to gain their attention and interest. The problem was also open enough for students to come

up with many answers. However, to be able to come up with these kind of problems, teachers need to read and surf the internet so that they can acquire some ideas on how to design suitable tasks for the lesson. It will later come naturally once they are used to it. In this case, the researchers help the teacher to design the problem. Hence, due to it not being an original idea from the teachers, it was observed that the teachers were not able to guide the students well enough, as can be seen from their hesitation in many instances that need quick decision and clarification. This research skipped the lesson study part of the framework, as was mentioned earlier due to time constraint and the not so encouraging number of teachers who participated. Lesson study is important because it also act as a professional development programme²³, which is worthy in upgrading teachers' pedagogical content knowledge.

Main Findings

The findings will be presented based on the research questions stated above.

Answering Research Question 1 – whether students improve their scores in mathematics by learning via problem solving. This question will be answered using data from the post and pre test.

Table 5: Paired sample t-test for pre and post test

Paired Samples Statistics				
	Mean	N	Std. Dev.	Std. Error Mean
<i>percentpre</i>	79.900	35	10.606	1.793
<i>percentpost</i>	85.143	35	21.638	3.657

Paired Samples Test								
	Paired Differences				<i>t</i>	<i>df</i>	Sig. (2-tailed)	
	Mean	Std. Dev.	Std. Error Mean	95% Confidence Interval of the Difference				
				Lower	Upper			
<i>percentpre - percentpost</i>	-5.243	24.064	4.068	-13.509	3.023	-1.289	34	.206

The data above show that students scored a mean of 79.9 in the pretest and 85.143 in the posttest. It can be observed that students improve by 5.243%, which is however, not statistically significant.

Answering Research Question 2 – whether there is any change in terms of perceived values gained by the students, and this question will be answered through students’ written answers and interview to related questions, as well as observation of classroom episodes. Data from students’ written answers and interview were analyzed and emerging themes were noted as in Table 6

Table 6: The questions asked for students to answer in written form and the themes that emerged

	Questions	Themes
1	Why do we need to respect other people?	Islamic reasons, mutual respect, good thing to do
2	Why do you need to help your mother?	Islamic reasons, mutual help/repay , natural thing to do
3	Why do we need to save money?	Islamic reasons / cannot waste, for other things/for future,
4	Why would you choose the shortest possible way to go anywhere?	Save time and money, best & more efficient way

From the analysis of the interview transcription, two or three emerging themes were extracted from each questions. About half of the students respect other people because of Islamic reasons – because Allah and the prophet encourage it or because they want to get the reward from Allah. Others said that it is a mutual thing to do – if we respect other people, then they will respect us in return. Then there are some (not that many) who said that respecting people is just something good and should naturally be practiced. As to why they help their mother, there are a few who gave reasons because they want reward from Allah, while about half said that since their mothers have work hard for them, gave birth to them, then they should help their mothers (repaying her good deeds). Many also said that helping their mother is a natural thing since they love her – so that she can rest since she works too hard. A few also said that

another reason is simply because she is their mother. As to the question why they save money – some gave Islamic reasons such as for zakat and sadaqah, many said that they save for the future – to buy more important things or to use it when they need the money. The theme about saving money is also evident in the answers to question 4 where most of the students say that they will take the shortest way to save time and money on fuel, etc. A few answered that it is the best and most efficient way unless the shortest route is flooded or under repair – so that they can reach their destination early and have more time to do other things, such as spending time with family.

Subsequently, the in-class observation also shows that, teasing between students is less as compared to the beginning of the study. Students were also more serious and pay more attention to their classwork. Their manners also improved during the class discussion – i.e. they listen and consider their friends' ideas and opinions attentively.

Answering Research Question 3 – whether problem solving improve students' values and morality. This will be answered using data from the questionnaire, observation and interview.

Table 6 shows the mean score for each component of problem solving that was emphasized during teaching in order to improve students' values and morality.

Table 7: Mean and SD for the questionnaire and final observation data

	Questionnaire Data		Observation Data	
	Mean	Std. Dev.	Mean	Std. Dev.
meanTAR	3.992	.6341	3.335	.6123
meanCOM	3.910	.6997	3.211	.5145
meanATT	4.192	.7804	3.322	.6565
meanCOLL	4.092	.8295	3.425	.7125
Overall	4.045	1.13	3.323	.6243

Overall, the questionnaire score is around 4 which shows the student agree that the lessons have improved their thinking and reasoning,

communication, attitude and collaboration skills, which are considered as main characteristics for the success of improving students' values through problem solving. Upon closer inspection, it was found that students scored high (between 4.15 to 4.30) in being able to get the information and develop ideas to the task given, listen when others talk, pay attention and focus consistently and participate in group work for the domains of thinking and reasoning, communication, attitude and collaboration respectively. The observation data shows lower scores given by the observers. The mean scores are around 3.3 which are moderate levels of thinking and reasoning, communication, attitude and collaboration exhibited by the students.

The interview data which was intended to support the two kinds of data above was transcribed and classified according to the emerging themes. Overall, students agree that they prefer learning through problem solving in a collaborative way. The tasks have made them think more about values and morality, about how to behave and to be always be ready to do their part in any circumstances. They have learnt to accept their friends' ideas and suggestions, conduct in good manners when collaborating and discussing with their friends, learn to value their friends' effort. Some of their parents have notice the change in them – they are more helpful at home and are more obedient.

Discussion and Conclusion

This whole study had produce mixed outcomes as findings. Firstly, when the post and pre-test scores were compared, the gains in the post test were not high enough to be significant. Students seemed to know the topics well even during the pre-test since they already scored about 80% in pre-test. Hence, the increase was not that high. On the other hand, the data from written test on values, interview and observation seemed to indicate that students learnt about values in the classroom.

Their written test and interview seemed to indicate that they are aware of getting rewarded by Allah if they do good deeds. Besides that, they seemed to be aware that respect is mutual – someone should show respect if he wants to be respected. The answer

to the second question indicated that they also help their mothers because their mothers have done a lot for them and it is part of their duty to reciprocate. What is more encouraging are answers that show them respecting others and helping their mothers because it is the right thing to do, without them thinking of themselves in the equation, which shows maturity and high level of *iman* on. The Islamic reasons were also evident in their answer to the rest of the questions where saving money and not wasting is encouraged in Islam and the extra money can be turned into *zakat* or *sadaqah*. The savings can also be used for future or other useful things, according to some of them. They would also find the most efficient or shortest route in order to save money and time, which are all good Islamic values.

Observation during the lessons shows that students gave good answer and ideas during the discussion about some moral situations such as about punctuality, *amanah*, cleanliness, care for the environment, etc. It will be interesting to find out if they will still feel this way and exhibit this in the form of action after six month of the date the research ended.

On the issue of whether problem solving method as adopted in this study improved students learning of values or morality, it can be implied that the data, (especially the interview data) seem to show some connection. In general, students agree that the lessons do contain the elements of problem solving shown in the framework, while the observers rated students slightly better than the moderate level in terms of their behaviour in the components of problem solving. The interview data seemed to confirm that students learned about values through problem solving. Most of the students interviewed agree that they like the discussion on values in the problem presented. According to them, the discussion has made them think better for them to reflect on the right way to behave in the situations post by the problem. They all wish that they have more time for the discussion.

The study showed that any attempt to inculcate values across the curriculum should be encouraged. However, the teacher factor is very important in the success of such study. Teacher needs to look for interesting, challenging and stimulating problems to make it into

suitable problems of the day. The problems chosen needs to be discussed, looked at from different angles and planned very well in advance. The earlier problem presented especially in Lesson 1 emphasize more on Islamic rituals rather than universal values. Basic values connected to importance of cleanliness and preserving the environment were only dealt with in the last lesson after several requests from the researchers. The inability of the study to incorporate lesson study as teachers' professional development platform has made it not quite successful in terms of teachers' planning and implementation of the lesson. There were weaknesses in this study regarding teachers' pedagogical content knowledge, which can be addressed by lesson study.²⁷ The cooperation and commitment of all parties especially the school administrators and teachers is also important for the success of lesson study or any study of this nature, since the knowledgeable other (which is important in lesson study) will be present to guide the implementation of the curriculum.²⁸

Teachers' values that are espoused during their mathematics teaching have a powerful influence (negative or positive) on students' affect. Hence it is also important for the research of this nature to look for teachers with positive values. Other recommendations for future research would be for the school to include 'lesson study' emphasizing on values as their main theme, in their school calendar. Another suggestion is for the teachers to employ philosophy for children method of teaching for value inculcation in mathematics problem solving. By this, *Insyah Allah*, education will be more meaningful and hence produce enviable *ummah* with Islamic manners. If the whole Muslim population presented themselves in this manner, then the reputation of a Muslim would be far too virtuous to allow the misdeeds of a few to tarnish the image of other Muslims.

²⁷ M. Khalid, "Fostering Problem Solving and Performance Assessment Among Malaysian Mathematics Teachers," *Sains Humanika* 9, no. 1/2 (2017): 51-55.

²⁸ Ibid.

Appendix

Name: _____

Class: _____

PERIMETER AND AREA OF COMPOST PLOT



The picture shows a compost plot made from bricks. Compost plot is used as a natural way to get rid of organic rubbish, such as leftover food, cut grass, etc. so that we can reduce our waste, reduce the use of plastic bags and help save the planet of too much rubbish. Many things are added to the compost so that the organic rubbish break down and become part of the soil. Compost can be used as fertilizer.

You are given 24 pieces of bricks (each with length 10 cm, width 5 cm and height 5 cm) to build the plot which will have the height as high the brick. You may arrange your bricks so that you get the maximum area for the plot.

Questions:

1. What is the perimeter (in cm) of your plot?

2. What is the area (in squared cm) of your plot?

3. If you are now given 36 pieces of bricks, what is the maximum area that you can build from the bricks? What is the perimeter?

4. What will happen if you don't compost your waste?

5. What do you think of using plastic bags to get rid of your rubbish?

6. What is your suggestion to make your classroom and school clean?

AL-SHAJARAH

Special Issue

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WoS-Indexed under *Arts & Humanities Citation Index, Current Contents/Arts and Humanities* and **Scopus**

ISSN 1394-6870



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