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IMPROVEMENT OF MATHEMATIC LITERACY FOR FIRST HIGH SCHOOL STUDENTS THROUGH PROBLEM-BASED LEARNING ASSISTED IN ISLAMIC INTEGRATED GEOMETRY STUDENT WORKSHEETS

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Abstract This study aims to analyze the improvement of students' mathematical literacy through problem-based learning with the help of Islamic integrated geometry Student Activity Sheets. This study is a quasi-experimental study with a non-equivalent control group design. The variable of this research is a problem-based learning model assisted by student activity sheets as the independent variable and mathematical literacy as the dependent variable. The population of this study were students of MTs Surya Buana Malang City with the sample being class IX students. With class IX A as the experimental class and class IX B as the control class. The research instrument used in this study was a description test. The data analysis technique used independent sample t-test. The results of the study concluded that the increase in mathematical literacy of students who received problem-based learning assisted by Islamic integrated geometry student activity sheets was significantly better than students who received conventional learning.

Keywords Problem-based learning; student activity sheets; Islamic integrated geometry; mathematical literacy

A. INTRODUCTION

Mathematical literacy is one of the abilities that students must have in their lives. This ability is important to have because in dealing with various problems in life, an individual is required to reason in solving problems, mastering logical reasoning which is not only focused on understanding arithmetic. Based on the results of the PISA assessment starting in 2000, 2003, 2006 and 2009 in a row, Indonesia ranks in the bottom seven (Balitbang Kemendikbud, 2011). A surprising thing happened in 2012 where Indonesia was ranked 64th out of 65 participating countries. In PISA 2015, Indonesia ranks 69th out of 76 countries (OECD, 2015). Meanwhile, at PISA 2018, Indonesia was again in the 7th lowest rank with a score of 379. The following is a graph of the scores of the PISA survey results on Indonesian mathematical literacy which has decreased.



Picture 1.1. Graph of Indonesian Mathematical Literacy Score Year 2012-2018

Based on the results of the PISA survey, the average score of Indonesian mathematical literacy in international studies has not been satisfactory and is still stagnant at the lowest rank. The context of real-life problems raised by PISA cannot be reached by Indonesian students. Based on the factors causing the low mathematical literacy of students because students are not accustomed to working on contextual questions, need reasoning, argumentation, and creativity in solving these problems (Balitbang Kemendikbud, 2011). This is a separate note for educators and prospective educators, the unfamiliarity of students in dealing with contextual problems, increasingly makes students think that mathematics is detached from everyday problems, and even creates a stigma that mathematics is dry in value and separate from its religious aspects as well. The majority of Indonesian students are used to answering only theoretical and procedural questions (Habibi and Suparman, 2020).

Studying on the results of the PISA analysis in three countries namely Japan, Brazil, and Norway, the main factors that influence the PISA results are students, families and schools. The contributions to mathematical literacy from the three countries are reading literacy activities, attitudes of trust in mathematics, interactions between teachers and students, communication between parents and students, and the last factor is the use of technology in learning mathematics. In line with the results of this study, Sezgin (2017) analyzes the factors that influence mathematical literacy, namely the interaction between students and teachers and students' views on mathematics (Syawahid, 2017). Thus, the interaction between students and teachers is one of the important factors that influence the development of students' mathematical literacy in schools. For this reason, it is necessary to learn mathematics that accommodates and facilitates the development of interactions between students and teachers and fosters positive student perceptions of mathematics, one of the models of learning mathematics is problem-based learning.

Problem-based learning is learning that begins by orienting students to problems. The problem is a contextual problem that is closest to students' lives. For example, if the students are in a religious environment, contextual problems can be approached by providing problems related to the religious context. In this case, for example, to teach the concept of volume of a block, the teacher can present contextual problems in the form of ablution problems if the water is less than two kullah, and so on. Contextual problems that are presented at the beginning of learning are unstructured problems (Tan, 2004: 7). This problem-based learning positions students as self-directed problem solvers through collaborative activities (Herman, 2007: 49). To be able to become an autonomous learner of course needed assistance in the form of student activity sheets that help direct students in achieving the expected learning goals. One of the mathematics material that is considered difficult based on the results of observations in the field and related to the context of everyday life is geometry.

Based on this explanation, researchers are interested in studying more deeply related to increasing mathematical literacy of students at MTs Surya Buana Malang City by experimenting with problem-based learning models with the help of Islamic integrated geometry student activity sheets. The formulation of the problem in this study is whether the increase in mathematical literacy of students who receive problem-based learning assisted by Islamic integrated geometry student activity sheets is significantly better than conventional learning in junior high schools?. The expected

benefits of this research are 1) for students, with this problem-based learning provides motivation for students to improve thinking and reasoning power in solving mathematical problems; 2) for teachers, this problem-based learning model can be used as an alternative participatory humanist learning model that is able to facilitate the development of students' mathematical literacy.

B. METHODS

This study uses a quantitative approach with a quasi-experimental type of research with a non-equivalent control group design (Sugiyono, 2009: 116). The research design is as follows.

Table B.1.
Design Eksperiment of The Nonequivalent Control Group Design

Group	Prettest	Treatment	Posttest
Exsperiment	O ₁	X ₁	O ₂
Control	O ₁		O ₂

This study involved two classes, namely the experimental class and the control class. Both classes are strived to have a balanced mathematical ability. The population of this study were all students of MTs Surya Buana Malang with the sample being students of class IX A and IX B. with class IX A as the experimental class and class IX B as the control class. This research instrument includes a data collection instrument in the form of a description test which consists of two questions related to the cube and block material, observation, and documentation. While the learning instrument is in the form of problem-based learning lesson plans with the help of Islamic integrated geometry student activity sheets. Before using the research, the instrument was tested for the validity and reliability of the instrument. The validity test was carried out with face and content validity through expert judgment, while the reliability test was carried out using Cronbach's Alpha. The data analysis technique was carried out using the t test (independent sample t test) using normalized gain data. The data that has been collected is then analyzed with the help of SPSS 19.00 software and Microsoft excel using the criteria for the level of significance 5%.

C. RESULT & DISCUSSION

This study aims to analyze the increase in mathematical literacy of junior high school students which is significantly better between groups of students who are given problem-based learning models assisted by Islamic integrated geometry student activity sheets or whether groups of students are given conventional learning models. The descriptions of the data from the two data groups are as follows Table C.1.

Table C.1. Description of Research Data

Group Statistics					
	Kelompok	N	Mean	Std. Deviation	Std. Error Mean
Literasi	Kontrol	20	72.3333	6.80123	2.40959
Matematis	Eksperimen	20	83.7143	16.18347	6.11678

Based on Table C.1. From this information, it was obtained that the number of samples for each group was 20 students with the experimental group average being 83.7143 and the control class being 72.3333 with a relatively large standard deviation. The next step is to test the mean difference using the independent sample test statistic, as shown in Table C.2. following.

Table C.2. Output Independent Sampel t Test

		Independent Samples Test								
		Levene's Test for Equality of Variances		t-test for Equality of Means						
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
								Lower	Upper	
Literasi Matematis	Equal variances assumed	2.360	.000	-.306	39	.000	-2.38095	7.78664	-19.51924	14.75734
	Equal variances not assumed			-.316	10.465	.000	-2.38095	7.54052	-19.08160	14.31970

Based on Table C.2. information obtained that with a 95% confidence interval the value of Sig. yaitu $0,000 < 0,005$ (H_0 reject) so it can be concluded that the problem-based learning model assisted by the Islamic integrated geometry student activity sheet improves mathematical literacy significantly compared to conventional learning..

This research has produced several findings based on the implementation of problem-based learning compared to conventional learning. Conventional learning is learning that is usually done by teachers of SMP/SMPN/SMPLB/MTs/MTsN in teaching mathematics so far. In conventional learning, the teacher is the best model that can be imitated by students because all aspects related to the success of student learning are initiated and centered on the teacher. The success of conventional learning is highly dependent on teacher competencies, such as preparation, knowledge, self-confidence, enthusiasm, and the ability to manage classes, etc. (Sanjaya, 2008: 191). The teacher presents the subject matter in finished form. That is, the teacher talks more in terms of explaining the subject matter, providing examples of questions and their solutions, and giving ideas or ideas directly to students (Ibrahim, 2011). Meanwhile, students tend to accept the subject matter then memorize the material and do routine practice questions. Giving practice questions that are routine in nature will affect the construction of students' knowledge or ideas.

To develop mathematical ideas or knowledge that students already have, students must be intensely involved in the problem solving process, as was done in the experimental class in this study. If mathematics is taught by emphasizing rote learning, especially partially, the chances of students having high-level mathematical abilities are small, because basically learning mathematics as a whole is learning to solve problems that require the involvement of higher-order thinking skills. This study concluded that problem-based learning assisted by Islamic integrated geometry student activity sheets was significantly better in improving students' mathematical literacy compared to conventional learning. There are two main things in the implementation of learning activities in the experimental class, namely the use of teaching materials and the process of implementing problem-based learning in accordance with the pedagogical framework that is planned and contained in the lesson plan (RPP). In accordance with the characteristics of problem-based learning, teaching materials are presented in the form of mathematical problems, prepared to trigger and spur multidirectional interactions between communities of students' early mathematical abilities so as to create a conducive and meaningful learning climate.

With meaningful learning, students will feel facilitated to develop their mathematical literacy. Mathematical literacy is an ability to formulate, use and interpret mathematics in various contexts. Included in mathematical reasoning, the use of concepts, procedures and facts (Asmara, et al, 2017). Based on PISA 2015 there are seven basic mathematical skills needed in mathematical literacy. According to Turner, basic mathematical abilities are described as follows (Gunardi, 2017), namely communication, mathematization, representation, reasoning and argumentation, designing problem-solving strategies, using symbols, formal language, techniques and operations, and using

mathematical tools. The basis for this mathematical literacy is QS AL Alaq verses 1 to 5. Al Alaq is the revelation that was first revealed to the Prophet Muhammad SAW who ordered him to read, analyze and create. Thus, the hope is that the student activity sheet can contribute more to the development of the child's cognitive domain.

Teaching materials which are student activity sheets are designed in the form of contextual and unstructured mathematical problems. This student activity sheet is adapted to the daily life of students in the form of daily life and universal values of Islamic teachings and Islamic religious texts. The following is an example of a developed student worksheet. In this integration project activity, students are instructed to carry out these activities in the hope that when there are problems related to *taharah*, students are not only looking for mathematical concepts but also religious concepts.

Proyek Integrasi

Langkah-Langkah Kegiatan

1. Siswa diminta untuk mendokumentasikan bak kamar mandi yang ada di sekolah/madrasah!
2. Siswa diminta menuliskan setiap ukuran dari bak penampungan air tersebut!
3. Siswa diminta untuk mengamati ukuran-ukuran bak mandi tersebut!
4. Siswa diminta menentukan volume bak air tersebut!
5. Siswa menyelesaikan permasalahan berikut ini!



Seorang santri Bernama Umar sedang mengisi bak mandi di Ma'had Sunan Ampel Al-Aly UIN Maulana Malik Ibrahim Malang sampai dengan air penuh. Air tersebut akan digunakan untuk bersuci dari *hadast* dan najis. Diketahui bak mandi tersebut berukuran panjang 70 dm, lebar 70 dm, dan tinggi 70 dm. Setelah Umar selesai bersuci, ternyata tinggi air dalam bak berkurang menjadi setinggi 35 cm.

- a) Berapa banyak air di bak mandi Ma'had Sunan Ampel Al-Aly UIN Malang jika terisi penuh?
- b) Berapakah sisa air pada bak mandi setelah digunakan untuk membersihkan sebagian untuk bersuci?
- c) Bagaimana hukum air sisa tersebut jika digunakan oleh Umar untuk berwudhu? Tuliskan lengkap jawabanmu disertai dengan dalil-dalil Al-Quran/hadist!

Picture C.1. Example of an Islamic integrated geometry student activity sheet developed to facilitate students' mathematical literacy

Teaching materials in the experimental class are designed in the form of contextual and unstructured mathematical problems. Next, the teacher presents a series of mathematical problems to students. The mathematical problem presented by the teacher is a form of initial intervention given by the teacher in the learning process. The problem in its completion contains mathematical concepts related to the material that must be mastered at the meeting. In addition, to attract the attention and interest of students to remain active in problem-based learning which for them is something new, for that the teaching materials designed by the teacher contain problems that, (1) are adapted to students' conditions, in this case need to be considered. students' prior knowledge; (2) related to the material that will be studied by students; (3) the problem given has a solution that requires an explanation, it is intended to train students' mathematical reflective thinking skills; (4) the problems given are made to challenge students, so that students with this can attract students' interest, attention, and motivation to always construct the knowledge they already have to solve new mathematical problems.

Teachers need to plan, create, and prepare carefully, especially teaching materials that can facilitate students and strategies for intervening in such a way that there is interaction between

students and their learning environment. Discussion of small groups of students in problem-based learning, consisting of students with different cognitive abilities. Meanwhile, students' ability to respond to ideas, opinions, or assistance given by teachers or friends, as well as strategies in problem solving are closely related to their cognitive abilities. This requires the teacher to be more careful and careful in providing assistance in such a way that each student gets help or inducement according to the pedagogical framework that has been planned and pays attention to every development that occurs in students. This is reinforced by the findings of research conducted by Suryadi (2009) that the characteristics of students' initial mathematical abilities greatly affect the proportion of teacher interventions given during the learning process. This can lead to the emergence of variations in the development of children's adaptive thinking skills.

Problem-based learning strives for students to learn meaningfully through the active involvement of students in learning and understanding the teaching materials presented. This condition is seen in the improvement of mathematical reflective thinking ability which is better when compared to conventional learning. The success of problem-based learning cannot be separated from the use of teaching materials in the form of problems given to students at the beginning of learning, teacher intervention by paying attention to every development that occurs in students, as well as interactions between students and their learning environment. Thus, the results of this study strengthen and enrich previous studies. Various literacy studies that have been developed are Minrohmatillah (2019), Azrai, et al. (2019), Widiandi and Hidayati (2021) which specifically examine mathematical literacy and student learning styles in learning mathematics.

D. CONCLUSION

Based on the explanation above, the conclusions of this study are as follows: the increase in mathematical literacy of students who receive problem-based learning assisted by Islamic integrated geometry student activity sheets is significantly better than conventional learning in junior high schools.

The suggestions related to the mathematical literacy of grade IX junior high school students are as follows: 1) teachers can train students' mathematical literacy by giving questions whose substance is problems of daily life and universal values of Islamic teachings; 2) for future researchers, they can conduct research that is relevant to this research by linking it to a different context. The importance of mathematical literacy can be taken into account at any level of research subjects.

REFERENCES

- Asmara, A. S., Waluya, S. B., & Rochmad. (2017). Analisis Kemampuan Literasi Matematika Siswa Kelas X Berdasarkan Kemampuan Matematika. *Scholaria*, 7(2), 135–142.
- Azrai, E. P., Ernawati, E., & Sulistianingrum, G. (2018). Ragam Gaya Belajar Siswa SMA Menurut David Kolb dalam Pembelajaran Biologi. *JURNAL AL-AZHAR INDONESIA SERI HUMANIORA*, 4(4), 251.
- Gunardi, E. (2017). Analisis Kemampuan Literasi Matematis Siswa Kelas VIII A SMP PANGUDI LUHUR MOYUDAN TAHUN AJARAN 2016/2017. *Skripsi*, 4, 9–15.
- Habibi, & Suparman. (2020). Literasi Matematika dalam Menyambut PISA 2021 Berdasarkan Kecakapan Abad 21. *JKPM (Jurnal Kajian Pendidikan Matematika)*, 6(1), 57–64.
- Herman, T. 2007. Pembelajaran Berbasis Masalah untuk Meningkatkan Kemampuan Berpikir Matematis Tingkat Tinggi Siswa Sekolah Menengah Pertama, No. 1 Vol. 1 Januari. *Educationist*.
- Ibrahim. 2011. Peningkatan Kemampuan Komunikasi, Penalaran, dan Pemecahan Masalah Matematis serta Kecerdasan Emosional Melalui Pembelajaran Berbasis Masalah Pada Siswa Sekolah Menengah Atas. Disertasi UPI. Bandung: Tidak Diterbitkan.
- Mansur, N. (2018). Melatih Literasi Matematika Siswa dengan Soal PISA. *Journal Unnes*, 1, 140–144. <https://journal.unnes.ac.id/sju/index.php/prisma/%0A>
- Minrohmatillah, N. (2019). Kemampuan Literasi Matematika Siswa SMA Dinjau dari Gaya Belajar Siswa Kelas X IPA B MA Darul Hikmah Tulungagung. In *IAIN TULUNGAGUNG*.
- OECD. (2012). *PISA 2012 Results in Focus*. OECD.

- OECD. (2015). PISA2015-Vol-1: Vol. I.
- OECD. (2019). PISA 2018 Results. Combined Executive Summaries. I, II, I. www.oecd.org/about/publishing/corrigenda.htm.
- Sugiyono. 2007. Statistika untuk Penelitian. Bandung: Alfabeta
- Suherman, E. 2001. Strategi Pembelajaran Matematika Kontemporer. Bandung: JICA UPI
- Tan, O. S. 2004. Cognition, Metacognition, and Problem-Based Learning, in Enhancing Thinking through Problem-based Learning Approaches. Singapore: Thomson Learnin
- Widianti, W., & Hidayati, N. (2021). Analisis Kemampuan Literasi Matematis Siswa SMP pada Materi Segitiga dan Segiempat. JPMI (Jurnal Pembelajaran Matematika Inovatif), 4(1), 27–38.