# Improving Madrasah Students' Numerical Literacy Using Drawing Strategy on Story Questions

Maryam Faizah[1,*] Akhmad Ridwan[2]

[1] *Department of Madrasah Ibtidaiyah Teacher Education, Universitas Islam Negeri Maulana Malik Ibrahim Malang, Malang, Indonesia*
[2]*Teacher of Madrasah Ibtidaiyah, MIN 1 Malang, Malang, Indonesia*
[*]*Corresponding author. Email: maryam_faizah@pgmi.uin-malang.ac.id*

**ABSTRACT**
Understanding, communicating and problem-solving skills are the most important parts of Mathematics Skills. Most studies on these concepts state that there is a gap among students in story questions. This study aims to describe students' mathematical abilities through drawing strategies. The research method employed a quasi-type of experimental with nonequivalent control group design. The sample of this study was 64 students consisting of 30 experimental classes and 34 control classes. The data obtained were analyzed by Independent Sample t-test. The results indicate that there are significant differences in learning outcomes before and after implementing the drawing strategy to the experimental class and control class.

***Keywords:*** *Ability of mathematic, Drawing strategy, Numerical literacy.*

## 1. INTRODUCTION

The learning process is the core of the educational process [1]. Learning activities are carried out by two actors, namely teachers and students [2]. Teacher behavior is teaching and student behavior is learning [3]. The relationship between teachers, students, and teaching materials is dynamic and complex. To achieve success in learning, several components can support, namely the objective component, the material component, the teaching and learning strategy component, and the evaluation component [4].

Education and learning strategies need to specifically pay attention to the development of students' potential [5] so that they have extraordinary (superior) abilities and intelligence, namely by organizing learning programs that can develop these advantages, both in terms of potential intellectual and special talents that are gifted and talented [6].

The results of research in Indonesia show that the level of mastery of students in mathematics at all levels of education (SD to PT) is still around 34% [7]. This is very concerning for many parties, especially those who pay attention and interest, especially among students. Mathematics is still a difficult subject, confusing, and even very feared by most who study it [8]. Mathematics curriculum can only be followed by 30% of students [9]. Teaching in schools tends to be dominated by the process of transfer of knowledge and does not provide opportunities for students to determine which direction they want to explore and find the knowledge that is meaningful for themselves [10].

The ability to make problems needs to be possessed by a teacher. Teachers are required to be creative in providing a problem (question) that will be done by students. In the field of mathematics, we can say as the ability to apply mathematical problem (mathematical problem posing) [11].

The importance of having mathematical problem posing skills is illustrated in the statement that the development of mathematical abilities requires mathematical creative imagination skills which, among other things, develop when raising new questions, creating new opportunities, and looking at old questions [12]. The ability to generate and create mathematical problems is also said to be an important part of learning activities.

The purpose of Mathematics subjects in the Standard Content of Elementary Mathematics Subjects (2006) is implied that reasoning, problem solving (problem solving) and communication (communication) is a competency that must be mastered by students [13].

Seeing this reality, during mathematics learning activities; the teacher needs to apply a learning strategy that can accommodate and serve all the different characteristics of students so that teachers can develop the potential of students optimally in learning. Therefore, in the end the objectives of learning mathematics can be achieved effectively and efficiently.

Theories of learning focus on three reasons for the positive effects of constructing drawings on performance: 1) Generating a drawing helps to organize and structure the information given in the problem, 2) Students have more capacity in their working memory, and they can more easily make solution-related inferences when they generate a drawing beforehand, and 3) The implicit information can be made visible in a drawing, and this information can be included as a further consideration while solving a problem [21-22].

Generating a drawing is known as one of learning strategies. Learning strategies comprise cognitive and behavioral activities during the learning process [14]. *Drawing strategy* is one of the strategies in solving problems related to making sketches or doodles [15] to make it easier to understand the problem and make it easier to get an overview of the solution [16,17].

The use of problem-solving strategies by making pictures also allows students to visually construct the problem. The use of the drawing strategy relies more on pictures, rather than words. Thus, students have the opportunity to find mathematical concepts in the process of thinking mathematically [20].

Taking into account the background described above, the application of the drawing model has a contribution and can be used as an alternative solution to various problems that have occurred in mathematics learning so far. For this reason, in-depth research is needed to what extent it is implemented in schools that have implemented the drawing strategy. So, the research wants to know how the mathematical ability (student understanding ability, student communication ability, and student problem solving ability) on story questions through drawing strategy at MIN 1 Malang.

## 2. METHODS

This study used a quantitative paradigm and the type of research is an experiment to find the influence between the independent variable and the dependent variable [19]. Research data on a quantitative approach in the form of numbers and analysis using statistics [20]. As for the type, this research is quasi-experimental research using a non-equivalent control group design (non-equivalent control group) [18-19]. From this concept, this study looks for the influence of the independent variables namely Drawing Strategy and with the dependent variable namely Mathematics Ability.

In this experimental study, 2 groups were determined to be studied after meeting the homogeneity criteria. One group was used as the experimental group and the other group was used as the control group (comparison). Using 2 groups to study because the independent variable in this study is the use of 2 different teaching methods, the experimental group would be taught using a *drawing strategy*, while the control group (comparison) would be taught using a conventional teaching model (teacher).

In this a quasi-type of experimental study, a non-equivalent control group design pattern (pre-test-post-test which is not equivalent) was implemented. The implementation of this experimental research used two classes, the experimental group was represented by class V-C and the control group represented by class V-G.

The dependent variable to be studied is the ability to understand concepts, understanding communication, and understanding problem-solving. Other variables were controlled so as not to affect the results of this study, including subject matter, teaching teachers, and learning time, while the teaching strategies were made differently.

The analysis technique of this research was done quantitatively. The analysis used some models, such as mathematical models, statistical models and econometrics. The results of the analysis are presented in the form of numbers which are then explained and interpreted in one description [23]. Questionnaire and observation sheet were used as the research instrument.

## 3. THEORETICAL REVIEW

In Indonesian Great Dictionary (KBBI), there are several meanings of strategy, namely: (1) the science and art of using all national resources to carry out certain policies in war and peace, (2) careful planning of activities to achieve specific goals. Linguistically, strategy can be interpreted as tactics, tips, tricks, or method [24]. In this context the term strategy is used with the aim of obtaining success and success in achieving goals [25].

The purpose of mathematics subjects in the Standard Content of Elementary Mathematics Subjects is implied that reasoning, problem solving (problem solving) and communication (communication) is a competency that must be mastered by students [13].

Understanding mathematical concepts is one of the skills or mathematical skills that are expected to be achieved in learning mathematics, namely by showing understanding of the mathematical concepts they are learning, explaining the relationships between concepts and applying concepts accurately, efficiently, and precisely in problem solving [26].

Mathematical communication is defined as a dialogue event or mutual relationships that occur in the classroom environment, where there is a transfer of messages and it

contains the mathematical material being studied at that time [27].

Problem solving is a very important part of learning mathematics [28]. The importance of mathematical problem-solving skills to be possessed by students is also stated that the possession of problem-solving abilities in students is important, because problem solving abilities are the goal of teaching mathematics, even as the heart of mathematics [29].

## 4. RESULTS AND DISCUSSION

The subjects were students of *Madrasah Ibtidaiyah* (Islamic State Elementary School) Malang 1 for sixth grade of class C with 32 students as the control class, sixth grade of class G with 30 students as the experimental class, and sixth grade of class A with 34 students as the test class for the instrument *pre-tests*. The implementation of learning was divided into 2 activities, namely pre-experimental activities and learning process activities

### *4.1. Pre-Experimental Activities*

The first step that the researcher took before the experiment was to make a plan. Some of the things that researchers did at the pre-experiment stage were as follows:

1) Creating a learning scenario in the form of a lesson plan (RPP) for comparison materials using a *drawing strategy* for the experimental class and conventional learning models for the control class.
2) Make a test grid of *pre-test questions.*
3) Make test sheets both *pre-test* and *post-test*.
4) Create group worksheets and student worksheets.

The lesson plan (RPP) and the instrument were then consulted with the supervisor. As a first step, the researcher conducted a test instrument test, namely 30 essay questions on comparative material. Test this instrument to determine or to find out whether the instrument was suitable for use or not. The instrument was tested with validity and reliability tests. In this case, the researcher uses the technique *Pearson's product-moment correlation* with Microsoft Excel, then compare the r count of each question item, with n = 34 of the number of students in sixth grade class A, namely: 34 children and the significant level reviewed is (α) = 0.05 or 5% (if n = 34, then r table = 0.329). If assuming that r count ($r_{xy}$) from r table, then the item is **valid**.

The test class for the instrument *pre-test* was the students of sixth grade class A *Madrasah Ibtidaiyah* 1 Malang, totaling 34 students, with the reason that the class had received the material to be given to the experimental class, namely comparison. Instrument testing was conducted to find validity and reliability. The results of the instrument trial for validity are known that some items numbered 1 to 30 are valid and some are invalid. Of the 30 questions, 20 items would be selected for the *pre-test* in the control class and the experimental class. This research is an experiment intact-group comparison, so the next step was for researchers to prepare two groups, namely the experimental group and the control group. In mathematics learning, the experimental group uses a drawing strategy, while the control group used conventional learning, namely learning that was generally carried out by teachers, namely a learning approach that was carried out by combining various learning methods.

### *4.2. Learning Process Activities*

#### *4.2.1. Experiment Class*

Implementation of learning in the experimental class was divided into 5 meetings. In the first meeting, the Master partner carried out the learning process by following the Learning Implementation Plan (RPP). The activity was continued by holding a *pre-test* by the researcher to determine the initial state of the students. Based on the results of the *pre-test*, the mathematics subject of sixth grade of class G *Madrasah Ibtidaiyah* Malang I before being given the treatment of learning *drawing strategy* in the experimental class, mathematics learning achievement was still far from the expected KKM standard, which is more than 75%.

Based on the above results, the results of student achievement before and after applying the drawing strategy increased from the average class 52 to 92 with an increase of 40%.

**Table 1.** Result of pre-test and post-test

| Pre-test | Post-test | Increase |
|---|---|---|
| 52% | 92% | 40% |

Based on the results of the *post-test*, mathematics subject for sixth grade class G *Madrasah Ibtidaiyah* Malang I after being treated with learning *drawing strategy* in the experimental class, mathematics learning achievement has met the expected KKM standard, which is more than 90%. This was evidenced by an average of 92 classes and students who otherwise completed as only 29 students or by 96.67% obtained from the number of students with grades ³ 80, while unresolved by 1 student or of 3.33% were obtained from students with a value of <80.

For the average value of concept understanding ability to get 90, the average communication skill to get 95, and the average problem-solving ability to get 92. Based on the above results, the results of student achievement by applying *drawing strategies* in subjects Mathematics on comparison has increased so that 97% of all students achieved grade completeness with a score of 80.

**Table 2.** Result of mathematical ability

| Understanding Concepts | Communication | Problem Solving |
|---|---|---|
| 57.67 | 66.7 | 44.7 |
| 90 | 95 | 92 |

### *4.2.2. Control Class*

Based on the results of the *pre-test*, Mathematics subjects for sixth grade class C *Madrasah Ibtidaiyah* Malang I in the control class, mathematics learning achievement is still far from the expected KKM standard, which was more than 70%.

This is evidenced by the average class 56 and students who were declared complete as many as only 9 students or 28.13% obtained from the number of students with a score of 80, while those who had not completed as many as 23 students or 71.87% obtained from the number of students. students with a score of <80. For the average value of concept understanding ability, 70, the average communication ability was 66, and the average k-problem-solving ability was 49.

**Table 3.** Result of pre-test and post-test

| Pre-test | Post-test | Increase |
|---|---|---|
| 49% | 48% | - |

Based on the results *post-test*, the Eye-Mathematics lesson in sixth grade class C *Madrasah Ibtidaiyah* Malang I in the control class, mathematics learning achievement has not met the expected KKM standard, which is less than 75%. This is evidenced by the average class 62 and students who are declared complete as many as 14 students or 43.75% obtained from the number of students with a score of 80, while 18 students who have not completed or 56.25% obtained from students with values <80. to the average value of the ability to understand the concept of getting 69, the average communication skills to get 69, and the average gain problem-solving abilities 48.

**Table 4.** Result of mathematical ability

| Understanding Concepts | Communication | Problem Solving |
|---|---|---|
| 70 | 66 | 49 |
| 69 | 69 | 48 |

### *4.2.3. t-test*

1) The difference in the increase in scores between the pre-test and post-test in the experimental class.

It can be seen that the t count is -9.131 with a probability of 0.000. For the two-tailed test, the probability number is 0.000/2 = 0. Since 0 < 0.025, then $H_0$ is rejected. It can be concluded that the use of *drawing strategies* can improve student learning outcomes.

2) The difference in the increase in scores between the *pre-test* and *post-test* in the experimental class and the control class.

It can be seen that the calculated F for the *pre-test* with Equal Variances Assumed is 0.636 with a probability of 0.428. Because probability > 0.025, then **$H_0$ is accepted**, or both variances are the same.

It can be seen that the t-count for the *pre-test* with Equal Variances Assumed is 30.82 with a probability of 0.000. For the two-tailed test, the probability becomes 0.000/2 = 0. Since 0.000 < 0.025, then **$H_0$ is rejected**. The two mean results *pre-test of* the experimental class and the control class are different.

It can be seen that the calculated F for the *post-test* with Equal Variances Assumed is 30.820 with a probability of 0.000. Because 0.000 < 0.025, then **$H_0$ is rejected,** or the two variances are completely different.

It can be seen that the t-count for the *post-test* with Equal Variances Not Assumed is 5.347 with a probability of 0.000. For the two-tailed test, the probability becomes 0.000/2 = 0. Since 0 < 0.025, then **$H_0$** is **rejected**. The average results *pre-test of* the experimental class and the control class were different.

3) Mean difference *Pre-test*

After testing with the F test and t-test and knowing the use of Equal Variances Assumed and *Equal Variances not Assumed*, it is known that there is a significant difference between *pre-test* and *post-test* in the experimental class and the experimental class. control. The next step is to find out how big the difference is.

From the F test in the previous discussion, it was found that the average difference test was carried out with *Equal Variances Assumed*, so the 95% statement "Confidence Interval of the Difference of means" in the Equal Variances Assumed column. This means that the difference between *pre-test* the experimental class and the control class ranges from -16,993 to 6,160, with an average difference of -5,417.

From the F test in the previous discussion, it was found that the average difference test was carried out with *Equal Variances not Assumed*, so the 95% statement "Confidence Interval of the Difference of means" in the *Equal Variances not Assumed column*.

This means that the difference between *pre-test* the experimental class and the control class ranges from 92.38 to 61.84, with an average difference of 30,534.

## 5. CONCLUSION

From the results of this research, it can be concluded that there is the difference in the increasing scores between the *pre-test* and *post-test* in the experimental class. It is obtained that the t count is -9.131 with a probability of 0.000. For the two-tailed test, the probability number is 0.000/2 = 0. Since 0 < 0.025, then $H_{0\ is}$ rejected. The difference in the increasing scores between the *pre-test* and *post-test* in the experimental class and the control class. It is obtained that the calculated F for the *pre-test* with Equal Variances Assumed is 0.636 with a probability of 0.428. Because probability > 0.025, then **$H_{0\ is}$ accepted**, or both variances are the same.

## ACKNOWLEDGMENT

The author would like to thank Universitas Islam Negeri Maulana Malik Ibrahim Malang and MIN 1 Malang for their support and assistance in completing this research.

## AUTHORS' CONTRIBUTIONS

All authors have different roles in the accomplishment of the study. For this manuscript, they contributed equally to the process of drafting, revision, and approval of the final revision.

## REFERENCES

[1] F. Geijsel, F. Meijers, Identity learning: The Core Process of Educational Change, Education Studies 31(4) (2005) 419–430.

[2] I. Bakkenes, J. D. Vermunt, T. Wubbels, Teacher Learning in the Context of Educational Innovation: Learning Activities and Learning Outcomes of Experienced Teachers, Learning and Instruction, 20(6) (2010) 533–548.

[3] J. S. Rose, F. J. Medway, Teacher Locus of Control, Teacher Behavior, and Student Behavior as Determinants of Student Achievement, Journal of Educational Research 74(6) (1981) 375–381.

[4] A. Amin, L. Charli, W. N. Fita, Pengaruh Model Pembelajaran Kooperatif Tipe Jigsaw dan Konvesional terhadap Hasil Belajar Fisika, SPEJ (Science Physic Educ. Journal) 2(1) (2018) 11–17.

[5] P. Dianti, Integrasi Pendidikan Karakter dalam pembelajaran Pendidikan Kewarganegaraan untuk Mengembangkan Karakter Siswa, Jurnal Pendidikam Ilmu Sosial 23(1) (2014).

[6] H. B. Uno, K. Panjaitan, N. Lamatenggo, Improving Students' Learning Interest and Outcome through STAD Cooperative Learning Model at SDN 8 Elementary School Kwandang of North Gorontalo Regency, in International Conference on Education Technology (ICoET 2019), 2019, pp. 313–319.

[7] N. Nursalam, Diagnostik Kesulitan Belajar Matematika: Studi pada Siswa SD/MI di Kota Makassar, Lentera Pendidik Jurnal Ilmu Tarbiyah dan Keguruan 19(1) (2016) 1–15.

[8] J. Boaler, Mathematical Mindsets: Unleashing Students' Potential Through Creative Math, Inspiring Messages and Innovative Teaching, John Wiley & Sons, 2015.

[9] A. UTAMI, Optimalisasi Penerapan Brain Gym untuk Meminimalkan Phobia Siswa dalam Belajar Matematika (PTK Pembelajaran di Kelas IV SD Negeri Kaliancar Selogiri), Universitas Muhammadiyah Surakarta, 2009.

[10] E. T. Lestari, Cara Praktis Meningkatkan Motivasi Siswa Sekolah Dasar, Deepublish, 2020.

[11] E. A. Afriansyah, Problem Posing sebagai Kemampuan Matematis, Mosharafa Jurnal Pendidikan Matematika 6(1) (2017) 163–180.

[12] N. F. Ellerton, P. C. Clarkson, Language Factors in Mathematics Teaching and Learning, in: A. J. Bishop, K. Clements, C. Keitel, J. Kilpatrick, C. Laborde (Eds.), International Handbook of Mathematics Education: Part 1, Springer, Dordrecht, Netherlands, 1996, pp. 987–1033.

[13] I. K. Darma, I. G. M. Karma, I. M. A. Santiana, Need analysis for developing applied mathematics textbooks based on blended learning to improve problem solving abilities at the students of polytechnic state of Bali, in AIP Conference Proceedings, 2268(1), 2020, p. 30004.

[14] L. Fiorella, Q. Zhang, Drawing boundary conditions for learning by drawing, Educ. Psychol. Rev., 30(3) (2018) 1115–1137.

[15] L. L. Morin, S. M. R. Watson, P. Hester, S. Raver, The Use of a Bar Model Drawing to Teach Word Problem Solving to Students With Mathematics Difficulties, Learning Disability Quarterly 40(2) (2017) 91–104.

[16] L. Fiorella, R. E. Mayer, Eight ways to promote generative learning, Educational Psychology Review 28(4) (2016) 717–741.

[17] K. Sedig, From play to thoughtful learning: A design strategy to engage children with mathematical representations, Journal of Computers in Mathematics and Science Teaching 27(1) (2008) 65–101.

[18] A. S. Posamentier, S. Krulik, Problem Solving in Mathematics, Grades 3-6: Powerful Strategies to Deepen Understanding, Corwin Press, 2009.

[19] Purwanto, Metodologi Penelitian Kuantitatif untuk Psikologi dan Pendidikan, Yogyakarta: Pustaka Pelajar, 2017.

[20] T. Cockburn, Case Studying Organisations: The Use of Quantitative Approaches, Res. Soc. care Soc. Work, (2000) 59–68.

[21] N. S. Sukmadinata, Metode Penelitian Pendidikan, Bandung: Remaja Rosdakarya, 2016.

[22] Sugiyono, Metode Penelitian Kuantitatif Kualitatif dan R&D, Bandung, 2017.

[23] H. Iqbal, M., Metode Penelitian dan Aplikasinya, Jakarta: GhaliaIndonesia, 2002.

[24] A. M. Rosyidi, Model dan Strategi Pembelajaran Diklat, Andragogi Jurnal Diklat Teknologi Pendidikan dan Keagamaan 5(1) (2017) 100–111.

[25] F. Fakhrurrazi, Hakikat pembelajaran yang efektif, At-Tafkir 11(1) (2018) 85–99.

[26] Y. Abidin, T. Mulyati, H. Yunansah, Pembelajaran Literasi: Strategi Meningkatkan Kemampuan Literasi Matematika, Sains, Membaca, dan Menulis, Bumi Aksara, 2021.

[27] A. S. Purwandari, M. D. Astuti, A. Yuliani, Evaluasi kemampuan komunikasi matematis siswa smp pada materi sistem persamaan linear dua variabel, IndoMath Indonesian Mathematics Education Journal 1(1) (2018) 55–62.

[28] R. Ariawan, H. Nufus, Hubungan kemampuan pemecahan masalah matematis dengan kemampuan komunikasi matematis siswa, J. THEOREMS 1(2) (2017) 82–91.

[29] U. Sumarmo, Suatu Alternatif Pengajaran untuk Meningkatkan Kemampuan Pemecahan Masalah Matematika pada Guru dan Siswa SMP, Lap. Penelit (Tidak Diterbitkan), Bandung IKIP [Institut Kegur. dan Ilmu Pendidikan] Bandung, 1994.