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Utilization Of Origami As A Learning Strategy In Improving Students' Numeracy Skills

Nonik Indrawatiningsih*
Universitas Negeri Surabaya, Surabaya, East Java, Indonesia
nonikindrawatiningsih@unesa.ac.id

Ayyukum Akhsanu Amala
Universitas Negeri Surabaya, Surabaya, East Java, Indonesia, ayukum.lala@gmail.com

Bela Alimatus Saskiyah
Universitas Yudharta, Pasuruan, East Java, Indonesia, belaalimatus33@gmail.com

Shafalma Firdausi Nuzula
Universitas Nahdlatul Ulama Surabaya, Surabaya, East Java, Indonesia,
shafalmafirdausi010.ig20@student.unusa.ac.id

Silatur Rohmah
Institut Teknologi dan Sains Nahdlatul Ulama Pasuruan, Pasuruan, East Java, Indonesia,
silaturrohmah12@gmail.com

ABSTRACT

Based on scientific studies that have been conducted, data shows that Indonesian students' achievement in numeracy is low. This study aims to improve students' numeracy skills by using origami paper media in the learning process. The type of research is descriptive qualitative. The subjects in this study were 5th-grade students at SDN Alastlogo 1 Lekok, Pasuruan Regency, totaling 25 people. The instruments used were the Minimum Competency Assessment (AKM) pretest and posttest sheets and field notes. The data source in this study came from the results of the pretest and posttest of the Minimum Competency Assessment (AKM Class). The data collection technique used is to carry out the AKM Pretest. Then, teach students a learning strategy for flat building materials using origami media. After that, the Class AKM Posttest was conducted as a student evaluation. The data analysis technique used is comparative analysis. In addition, they analyze each learning process using folding paper or origami media to determine the effectiveness of learning implemented in the study. This study's results show an increase in students' numeracy skills by 80%. Students can answer correctly from the flat building questions tested on the AKM post-test, whereas in the AKM Pretest, only 20% of students could answer correctly. This proves that folding paper or origami media is very effective in helping improve students' numeracy skills regarding flat shapes.

Keywords: Origami, Learning Strategy, Numeracy Skills, AKM Class

ABSTRAK

Berdasarkan kajian ilmiah yang telah dilakukan, data menunjukkan bahwa prestasi siswa Indonesia pada aspek numerasi masih rendah. Penelitian ini bertujuan untuk meningkatkan kemampuan berhitung siswa melalui pemanfaatan media kertas origami dalam proses pembelajaran. Jenis penelitian yang digunakan adalah deskriptif kualitatif. Subyek dalam penelitian ini adalah siswa kelas 5 SDN Alastlogo 1 Lekok Kabupaten Pasuruan yang berjumlah 25 orang. Instrumen yang digunakan adalah lembar pretest dan posttest Asesmen Kompetensi Minimum (MCA) serta catatan lapangan. Sumber data dalam penelitian ini berasal dari hasil pretest dan posttest Penilaian Kompetensi Minimal (Kelas AKM). Teknik pengumpulan data yang digunakan adalah dengan melaksanakan AKM Pretest. Kemudian membuatkan strategi pembelajaran materi bangunan datar menggunakan media origami kepada siswa. Setelah itu dilakukan Posttest Kelas AKM sebagai evaluasi siswa. Teknik analisis data yang digunakan adalah analisis komparatif. Selain itu menganalisis setiap proses pembelajaran dengan menggunakan media kertas lipat atau origami, untuk mengetahui keefektifan pembelajaran yang dilaksanakan dalam pembelajaran. Hasil penelitian ini menunjukkan adanya peningkatan

kemampuan berhitung siswa sebesar 80%. Siswa dapat menjawab dengan benar dari soal bangunan datar yang diujikan pada AKM Posttest, padahal sebelumnya pada AKM Pretest hanya 20% siswa yang dapat menjawab dengan benar. Hal ini membuktikan bahwa media kertas lipat atau origami sangat efektif untuk membantu meningkatkan kemampuan berhitung siswa mengenai bangun datar

Kata Kunci: Origami, Strategi Pembelajaran, Kemampuan Numerasi, AKM.

INTRODUCTION

Currently, Indonesia has implemented an independent curriculum. The independent curriculum is more flexible, focuses on important material, and is tailored based on student needs. Based on a learning perspective, the curriculum is a planned device containing objectives, content, learning materials, and technical methods for their use as a reference for organizing education to achieve educational goals (Prancisca et al., 2023). In the independent curriculum, one of the benchmarks for student success is assessment using the Minimum Competency Assessment (AKM). The minimum competency in question is students' most essential ability at a certain level. One of the AKM assessment criteria is related to student numeracy (Kemdikbud, 2020). Numeracy is understanding and identifying numbers, distinguishing numbers, and performing basic math calculations (addition or subtraction) (Kovas et al., 2013). This aligns with the (OECD, 2017) that numeracy is the ability to access, use, interpret, and communicate mathematical information and ideas to engage and manage the mathematical demands of various situations in everyday life.

Numeracy is one of the three essential information processing skills assessed in the Programme for the International Assessment of Adult Competencies (PIAAC) (Golsteyn et al., 2016). Numeracy skills emphasize counting in everyday life, where one needs to manage information, solve problems, and respond to mathematical content, ideas or reasoning presented in various forms (Jonas, 2018a). The numeracy content contained in the class AKM includes numbers, geometry, measurement data, algebra, data and uncertainty (Kemendikbud, 2020). Numeracy skills can be measured based on indicators which include: 1) mastering the basics of addition, subtraction, multiplication, and division; 2) being able to use numbering concepts confidently and effectively; 3) being able to understand how to transfer their skills to solve problems (Kemendikbud, 2017). Numeracy skills are measured by tests given directly to respondents, and the test questions are structured in such a way as to cover the five aspects that describe the dimensions of numeracy fully. The results are presented on a scale from 0 to 500 points. To facilitate the interpretation of the scores obtained, the proficiency scale is divided into "proficiency levels" (OECD, 2012)(Jonas, 2018).

Based on scientific studies conducted by the Trends International Mathematics Science Study (TIMSS), Indonesia obtained an average score below the standard points set by TIMSS, 397 out of 500 average scores. This data shows that Indonesian students' achievement in numeracy is low. This is in line with the results of a survey conducted by the Program for International Student Assessment (PISA), which obtained facts in the field that the numeracy skills of students in Indonesia are still relatively low. Indonesia ranks 73 out of 80 countries. The low score obtained by Indonesian students on the results of the TIMSS study shows that students still have difficulty with numeracy (Mahmud & Pratiwi, 2019). Through proper learning, numeracy skills can be developed optimally

(Golsteyn et al., 2016). Students need to solve problems that exist in everyday life. These abilities are not only limited to school learning but are essential to apply in everyday life.

In numeracy learning, teachers can use various strategies during the learning process (Krisztián et al., 2015). One approach that can be applied is using origami media to support student numeracy learning. Origami is an art or handicraft made from paper to create and produce various toys, decorations, functional objects, props and other creations. When presenting numerical information, origami media can be utilized to make it easy for students to understand. Providing numerical information in graphical form and using other media will significantly help students understand the material taught and meet students' learning styles (Pleasant et al., 2016).

Origami has several benefits in math learning activities in the classroom, especially in flat building materials. The main advantage is that origami can significantly contribute to developing mathematical ideas and understanding concepts in mathematics. One of the benefits of paper is that folding paper is suitable for spatial visualization and geometric reasoning (Gürbüz et al., 2018). In addition, folding paper can provide learners with many opportunities to develop and hone language skills and the ability to communicate mathematically. Folding paper can also encourage learners to be more active in math class (Toyib & Ishartono, 2018). Another benefit that can arise from the use of folding paper in the mathematics classroom is that folding paper (origami) can help encourage group interaction and cooperation between learners (Arici & Aslan-tutak, 2015). Math and origami can be considered beautiful art forms in their unique ways. Origami, an ancient paper art form, activates prior knowledge and learning to use hands, step-by-step, schema building, spatial intelligence and logical concept mapping (Etheridge et al., 2022). Spatial visualization can be improved through appropriate activities, namely through students' experiences in folding, and one of the learning methods that can be used is origami-based learning.

Several respondents who have used origami media in classroom lessons stated that learning activities can be more fun and increase students' enthusiasm for learning math (Puspitaningrum et al., 2019). In the world of education, there are many applications of origami that can be applied to math learning activities, such as making triangles from rectangular paper to help illustrate trigonometry and calculus material (Wares, 2019). Several studies link classroom learning with origami media. According to (Suryana & Delfia, 2020) using origami paper media can improve students' learning outcomes. There is also research in an article entitled "Implementation of Origami Construction to Improve Logical Thinking Ability on Early Age Children", which found that the application of origami construction at Kober Mutiara Ibu showed that children's abilities had improved. However, there needs to be improvements in the learning equipment available in the learning device, especially the type of origami paper used, which must be thinner and not slippery (Afrianti et al., 2020). Besides that, origami can make math more visual and practical, which can help students who have hearing problems understand the material presented (Gu & Chen, 2020). Therefore, the results of this study make an overview and reference for researchers in choosing folding paper or origami media as a medium for learning math on flat building material. The difference between this research and previous research is that the teacher first teaches students how to make their favourite objects using origami during the learning process. From the objects the students have made, the teacher

digs deeper into the flat shapes that the students have earned by completing the students' favourite objects. This can improve their understanding of concepts related to geometry and make learning more enjoyable.

METHOD

This type of research is descriptive research with a qualitative approach. Qualitative research aims to understand the phenomenon experienced by the subject using a description in the form of words and language based on observations. (Creswell, 2014). This research was conducted at an elementary school in the Pasuruan district of East Java, Indonesia. The subjects in this study were 5th-grade students, totalling 25 people, namely 11 female students and 14 male students. The instruments used in this study were observation sheets, pretest and post-test sheets, and documentation. Data collection techniques in this study have several stages: class AKM pre-test, implementation of the class AKM post-test, data analysis, and formulation of conclusions.

Class AKM pretest.

AKM is an assessment of fundamental competencies carried out by students to develop their capacity or ability and participate positively in society and government as a form of renewal to familiarize students with critical thinking that is contextual to daily activities and avoid students' tension or anxiety in facing and working on exam questions that contain only content in learning. Before carrying out learning activities using folding paper or origami media that have been prepared, of course, the primary step that must be done is to carry out a measurement test (pretest) to determine the initial ability of grade 5 students related to numeracy and the results can be a reference and consideration in the results of the following measurement test (post-test).

Implementation of learning strategies using origami media includes: (1) Prepare tools and materials; (2) Looking for origami folding tutorial references; (3) In the first meeting, students were invited to reflect on the plane of the plane in groups; (4) In the next meeting, students started to learn origami folding; and (5) Always carry out reflection activities before closing the lesson.

Implementation of the Class AKM post-test.

To discover the development of students' knowledge in the field of numeracy, a second measurement test (post-test) is held again. It is from the results of this second measurement test that the effectiveness of the learning that has been delivered is determined. It is said to be effective if there is an increase in student learning outcomes from pretests to post-tests.

Data Analysis.

After all the results of the measurement tests in the first and second stages are available, the learning strategy using folding paper or origami media has been implemented. Researchers can use a comparative analysis of the first stage measurement test results with the second stage, then describe the learning process with origami media. The results of the study of pretests and post-tests were then concluded.

Formulation of Conclusions.

As a reflection and evaluation, researchers can conclude the results of descriptive qualitative research and provide suggestions for further study. The data analysis technique used is by

comparing the results of the first measurement test (pretest) with the results of the second measurement test (post-test) (Chabot et al., 2014). In addition, researchers conducted observations during the learning process using origami media to determine the effectiveness of the learning implemented in the study.

RESULT AND DISCUSSION

Student Numeracy Pretest Results

This study begins with conducting a pretest to know students' initial abilities related to numeracy. The pretest was conducted on grade 5 students at SDN Alastlogo 1, totaling 25 people. There are 20 items, each of which has a different competency target. However, specifically below, the researchers include a table containing the results of scoring the AKM numeracy pre-test class, which contains competencies related to flat building material. The forms of AKM numeracy questions are complex multiple-choice questions and actual/false questions. The competencies used to measure student numeracy on flat building materials are as follows: (1) calculate the perimeter and area of a rectangle when the length & area are known, (2) calculate the length/area when the area/circle of one of its sides is known. The following is a picture of Table 1—students' numeracy pretest results.

Table 1. Student Numeracy Pretest Results

Problem Form	Competence	Number of students who answered correctly	Percentage
Options Double Complex	Calculating the perimeter and area of a square length when known length & area and calculate length/area if the area/circle of one of the side	5	20%
True/False	Calculating the perimeter and area of a square length when known length & area and calculate length/area if the area/circle of one of the side	4	16%

Table 1 shows that only 16% -20 % of students can correctly answer questions that contain material about flat shapes, proving that students still lack understanding about flat shapes. Most students still have difficulty determining and finding the area and perimeter of flat shapes, distinguishing the shapes and types, and describing the properties of flat shapes.

Numeracy Learning with Origami Media

Before implementing learning strategies using origami media, researchers prepare the necessary tools and materials. The tools can be scissors or cutters, while the materials include folding paper, glue, tape, double tape and yarn. After collecting the tools and materials, the researcher observes the primary media to be used, namely folding paper/origami. Folding paper is a unique medium because it can produce other flat shapes, such as triangles and rectangles, from the initial square shape when folded from different directions. Furthermore, the researcher searched

YouTube for references to origami folding tutorials of various animal shapes, such as butterflies, rabbits, and fish. Researchers need to memorize the steps before being taught and applied by students when entering the classroom later. This paper folding or origami activity shows that the brain works more actively to remember and focus on the fingers that are folding. If one step is wrong, it will produce a different shape, so high accuracy is needed during origami activities. This follows what was done by (Anisa et al., 2021) that by stimulating children's motor development, you can do something exciting. Children will feel challenged to do it perfectly with exciting activities. One way is to provide directional stimulation through paper folding games. Naturally, students will be trained to focus more on instructions and optimize their memory to remember (Jati & Hidayat, 2017; Miller & Saenz, 2021; Puspitaningrum et al., 2019).

The learning strategy using origami media is carried out in stages. In the first meeting, students were invited to reflect on the shapes of flat shapes. In Toke, it feels more accurate and can be imagined, and students are first made into groups for those who have brought their folding paper, then asked to draw the shapes of various flat shapes they know. Most students only draw square, rectangle, and triangle shapes. After that, students make patterns of flat shapes on colourful folded paper and then ask students to cut them out to form a variety of flat shapes (Figure 1).

Figure 1. Student Activities Make Flat Wake Up with Origami

Furthermore, students are asked to observe the flat shapes that have been cut out. For example, a rectangle has a long and wide side in a rectangular flat shape. Students are asked to measure each length and width, then conclude that the formula for the perimeter of a rectangle is two long sides plus two wide sides (Perimeter of a rectangle). In contrast, the formula for the area of a rectangle is the length multiplied by the width. At the same time, the formula for the area of a rectangle is the length multiplied by the width. The same method also applies to other flat shapes. For example, the formula for the perimeter and area will be different in triangles with a base and a height. After recalling the perimeter and area formulas learned, students are asked to write back on the white back sheet of folded paper cut into a flat shape. The goal is for students to remember better what they have learned. In addition, the origami paper learning process can train students' logical thinking in making flat shapes or shapes that students like step by step (Arici & Aslan-tutak, 2015).

The next day, still with the same flat building material, these students were guided to do origami activities or the art of paper folding. Previously, students were divided into several groups (one group contained five). The researcher explained that today, they would do an origami activity in the shape of a butterfly, but before that, the researcher provoked their knowledge and curiosity about butterflies. Questions were asked, such as:

"Ever seen a butterfly?"
"Where did you see the butterflies?"
"What colour were the wings back then?"
"Does anyone know what animal butterflies come from?"
"Has anyone ever seen a cocoon on a tree branch?"
"After coming out of the cocoon, what will you become?"

Students' answers to the triggering question are very diverse, so that students can understand the concept of butterfly life development. Then, invite students to pay attention to the tutorial of folding paper or origami into a butterfly shape.

Figure 2. The process of teaching origami to students

Figure 2 shows that when teaching the steps, the researcher also invites students to think so that students realize that the folding paper made is square and, if folded, two different ends of the side will become two equal triangles. After that, proceed to the last step until the result of the origami butterfly shape. Then, the teacher and students evaluate by giving simple practice problems that students must do individually (Figure 3). After the issues are resolved, the teacher discusses how to solve the flat building problems, and some students are asked to come forward to try and dare to answer the questions listed on the board. By following the teacher's steps, students will easily remember them and can reduce the difficulty they experience (Krisztián et al., 2015; Ryder & Robson, 2023).

As a result, most students have been able to solve problems in the form of perimeter and area of simple flat shapes (square, rectangle, and triangle). Next, the teacher invites students to work on the problems of flat shapes in the theme book. This method will be repeated. Namely, students try to work independently, and then, if they have finished answering all the questions, they must be collected by the researcher. Students who still do not understand are asked to come forward and try to work together, guided by the teacher.

Figure 3. Students do practice questions

Results of Implementation of Numeracy Learning with Origami Media

Using folding paper or origami media in mathematics learning activities on flat building material in school 1 produces many better achievements. Among them, grade 5 students can already distinguish the shapes and types of flat shapes. Students can also find the area and perimeter of square, rectangular and triangular flat shapes. Students are more active and creative in forming works of folding paper or origami, and they can hone and improve their creativity. This is by research (Boakes, 2020) shows that using origami paper media can affect students' attitudes, communication, concept visualization, teamwork, and creativity. Using origami paper also positively impacts students, as we can train students' motor and sensory abilities in making flat shapes continuously. In learning activities, the learning method used is in groups to improve students' speaking skills or public speaking. By grouping, students will also learn to be responsible for the tasks that have been given. Therefore, folding paper or origami media can be a solution for students who have difficulty understanding material in learning math. In addition, the post-test results from the Minimum Competency Assessment (AKM) show improved student numeracy. The post-test results can be seen in Table 2.

Table 2. AKM Posttest Results

Problem Form	Competence	Number of students who answered correctly	Percentage
Complex Multiple Choice	Identify the characteristics of quadrilaterals, triangles, triangles, and circles	25	100%
Complex Multiple Choice	Calculating perimeter and area Rectangle when known Length & breadth and calculate length/area when the area/circle is known to be wrong on one side	25	100%
True/False	Calculating perimeter and area Rectangle when known Length & breadth and calculate length/area when the area/circle is known to be wrong one side	24	96%

Based on Table 2 above, the numeracy of grade 5 students has increased very rapidly. Almost 96% and some even 100% of students can answer correctly from the flat building questions tested in the AKM post-test, whereas previously, in the AKM Pre-test, only 20% of students could answer correctly. This proves that folding paper or origami media is very effective in helping to improve students' understanding of flat building materials. This research agrees with (Etheridge et al., 2022) that using origami to enhance concepts and abilities in geometry, especially the concept of spatial reasoning, provides an alternative for teacher learning and can increase student involvement and motivation in learning

The impact felt by students after the origami activity

Naturally, children are attracted by something simple, such as colourful folding paper. Previously, the grade 5 teacher had never used this media as an alternative numeracy learning strategy in the classroom, so they were very enthusiastic when the researcher-led them to be creative with folding paper. Simple activities such as making patterns, cutting, and applying glue are practical in keeping students from boredom during class. Students who are usually sleepy, protesting to take a break and go home early, are suddenly focused on making creations from folding paper by capitalizing on videos spread on YouTube. According to (Corners et al., 2017), students can use paper folding to produce assumptions during reasoning while thinking geometrically, and this process can be examined under the theoretical framework of the geometric habits of mind.

Some students who have succeeded in making one butterfly creation, for example, will ask in Madurese to the researcher, which, if translated, will be, "Can I make more, mom?" and the researcher agrees, even students who already feel able and confident also help their friends who still have not succeeded in making butterfly shapes. One student could make 3-6 butterflies because he was so excited. Origami is a practical activity that has the potential to increase students' understanding of mathematical concepts and improve their mathematical communication skills (Etheridge et al., 2022). On the other hand, origami practice helps students understand and comprehend the relationship between perseverance and the complexity of life aspects (Gurbuz et al., 2018).

When the researcher observed the origami results that the students had done, the researcher found that several students found a way to fold with the wrong procedure, but the result was still a butterfly. There, the researcher realized that the imagination of some of these students had played so that they became more creative and could find different ways of folding origami, but the results would still be the same. The results of the students' origami will then be made into window decorations and curtains that will be installed with materials related to literacy and numeracy. The next day, the students were happy because their origami works were displayed in their classrooms. The students were even more enthusiastic when the researcher taught them a new way of folding origami.

CONCLUSION

Based on the research and discussion results, it can be concluded that students' numeracy skills have improved through learning by utilizing origami media. Learning is made as enjoyable as possible by inviting students to make flat shapes and toys using origami paper. During the making of toys in the form of flat shapes, they are given questions about flat shapes, then they mention identities such as the length and width of the balanced shapes and then measure them using a ruler. Through this learning, students can easily understand the concept of flat shapes, identify the elements of flat shapes, and calculate the area of flat shapes that have been made. In addition, based on the results of the AKM Numeracy scoring, there is an increase between the pretest and post-test by 80%. The students can answer correctly about identifying flat shapes and calculating the perimeter and area of a rectangle when the length and location are known and calculating the length/area when the area/circle of one of its sides is known. This research proves that folding paper or origami media is very effective in helping improve students' understanding of flat building materials.

Further recommendations based on the results of this study are to utilize origami paper media in understanding the concept of flat shapes. In addition, during the learning process, it can be integrated with games to motivate students to participate in classroom learning. High motivation will have a positive impact on students' learning ability. In this research, time needs to be considered because it takes quite a long time to apply origami media to students' understanding of mathematical concepts

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