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# Utilization of Moringa Leaves as a Mathematics Learning Media at Elementary/Islamic Elementary School

# Pemanfaatan Daun Kelor sebagai Media Pembelajaran Matematika di Tingkat SD/MI

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***Abstract***
*The study of the use of Moringa a leaf in mathematics learning at elementary / Islamic elementary level as an alternative media for learning mathematics based on local wisdom aims to introduce the use of Moringa leaves in mathematics learning, especially in the concept of counting and connections in making patterns. The method applied is a literature review obtained through the Research Gate and Google Scholar databases and other relevant sources. Data were analyzed using descriptive analysis method. Based on this study, it is known that in addition to its role in culinary and treatment, Moringa leaves can also be used as a medium for learning mathematics, especially in applying the concept of arithmetic at the elementary / Islamic elementary level and in making connections. So according to this, it is expected that the study can be used as a reference in developing the creative potential of teachers and students in order to create the characteristics of effective and efficient mathematics learning.*
***Keywords:*** *Moringa leaves; mathematics learning; elementary/Islamic elementary school*
***Abstrak***
*Kajian pemanfaatan daun kelor dalam pembelajaran matematika di tingkat SD/MI sebagai alternatif media pembelajaran matematika berbasis kearifan lokal bertujuan untuk mengenalkan pemanfaatan daun kelor dalam pembelajaran matematika khususnya dalam konsep berhitung dan koneksi dalam membuat pola. Metode yang diterapkan yaitu kajian pustaka yang diperoleh melalui database Research Gate dan Google Scholar serta sumber lainnya yang relevan. Data dianalisis dengan menggunakan metode analisis deskriptif. Berdasarkan kajian ini diketahui bahwa selain berperan dalam kuliner dan pengobatan juga daun kelor dapat digunakan sebagai media pembelajaran matematika khususnya dalam menerapkan konsep berhitung di tingkat SD/MI maupun dalam koneksi membuat pola. Sehingga sesuai dengan hal tersebut, diharapkan kajian dapat dijadikan sebagai acuan dalam mengembangkan potensi kreativitas guru dan*

*peserta didik dalam rangka menciptakan karakteristik pembelajaran matematika yang efektif dan efisien.*

***Kata Kunci:*** *Daun kelor; Pembelajaran matematika; SD/MI*

## Introduction

Mathematics teaching at the primary school level, i.e. Sekolah Dasar or Madrasah Ibtidaiyah (SD/MI) requires its participants to be able to develop their reasoning capability and imagination to understand the material being taught (Hakim & Windayana, 2012). Supporting its practice, the learning process consists of a series of activities that involve reciprocal interactions between the teacher and students in realizing an educative situation to be able to achieve the targeted learning goals. Nevertheless, the success of students is considered related to their motivation, attention, interest, and learning activities from themselves, as external factors, including learning resources being used, surrounding environment, the atmosphere created during learning, and learning methods applied by the teacher (Ismayani, 2018).

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Learning can be considered meaningful of the teacher can apply learning media in delivering the material. It is hoped that when the use of the media is realized, the opportunity of the students to understand the material being presented is higher (Muryaningsih, 2019). However, the learning method being applied by the teacher in supporting the mathematics teaching only relies on lecturing without being accompanied by feedbacks from its students (Rohimah & Prabawanto, 2019), However, the learning method being applied by the teacher in supporting the mathematics teaching only relies on lecturing without being accompanied by feedbacks from its students (Muna et al., 2019).

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In the primary level, one of the mathematical concepts introduced is the concept of arithmetic and connection in making patterns. The concept of arithmetic is helpful for students to solve calculation questions in all grade levels. The capability of this concept needs to be strengthened so that students are skilled in arithmetic without using any aids (Al Musthafa & Mandailina, 2018). In the primary level, one of the mathematical concepts introduced is the concept of arithmetic and connection in making patterns. The concept of arithmetic is helpful for students to solve calculation questions in all grade levels. The capability of this concept needs to be strengthened so that students are skilled in arithmetic without using any aids (Syamsi, 2014; Izzah & Azizah, 2019).

Related to the effort of understanding the concept of arithmetic, students also need an alternative object to ease the explanation of said concept using natural resources available in the surrounding environment. In essence, each region has a diverse potential and natural wealth that can be utilized for the benefit of the community, for example, in the city of Palu in which the general community often use and cultivate moringa traditionally, both for its culinary use and traditional medicinal use (Pitopang & Ramawangsa, 2016; Syah, 2017).

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**Method**

This study applies the literature review method by utilizing secondary sources in a variety of literature obtained through databases from ResearchGate and Google Scholar, such as scientific journals, research findings presented in the form of

conference proceedings, and other relevant sources. Analysis of the data is used by applying descriptive methods through the depiction of facts obtained with an analysis to give a detailed understanding and explanation.

**Result**

The detailed results of the study are as follows:

1. The use of moringa leaves as a learning media for counting

For learning objectives to be carried out properly and effectively, it is a necessity that a learning media is used, bearing in mind the positive contribution in facilitating students to learn subject matter and stimulate interest in learning activities(Tanwir & Rahman F, 2018). However, this is certainly inseparable from the weakness of this implementation so that it often becomes a reason preventing teachers from using teaching media, namely the complexity in its preparation and the amount of time required, which would contradict the positive impact of learning media (Muslihatun et al., 2019).

Related to innovative learning media to improve the quality of learning, variated teaching methods are also applied to support verbal communication to ease students in understanding and mastering and also motivate the student to play an active role regarding the teaching material being taught, to increase the learning success (Nataliya, 2015).

When mathematics is realized in everyday life, it will certainly revolve around arithmetic competence such as addition, subtraction, multiplication, and subtraction. However, learning that doesn't support students by being boring, uninteresting, or monotonous is one of the factors that cause the low capability of students to count which results in the emergence of boredom and lack of enthusiasm of students (Nataliya, 2015).

When mathematics is realized in everyday life, it will certainly revolve around arithmetic competence such as addition, subtraction, multiplication, and subtraction. However, learning that doesn't support students by being boring, uninteresting, or monotonous is one of the factors that cause the low capability of students to count which results in the emergence of boredom and lack of enthusiasm of students (Yusri & Arifin, 2018).

In this study, the researcher describes the use of moringa leaves as a counting medium in mathematics taught at the primary level through these three stages of representation. The following presents an example of its application to SD/MI students in grade 1.

Stage 1. Presentation with a concrete model using real objects in working on a question such as, "Jihan arranged the first moringa leaves as much as 4 sheets, and then she arranged second moringa leaves as much as 2 sheets, how many moringa leaves are arranged by Jihan?". An illustration is as follows:

*Figure 1.* The use of concrete models (moringa leaves) in counting

In Picture 1, the student can be seen trying to use moringa leaves in solving problems related to arithmetic operation, addition.

Stage 2. The next stage is the presentation of a semi-concrete model or a drawing that doesn't use real objects such as actual moringa leaves, but is limited to the drawing of oval-shaped representation of moringa leaves such as shown below:

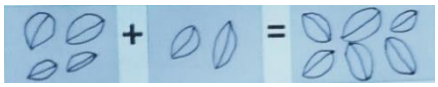


*Figure 2.* Presentation of the semi-concrete model (i.e. picture model)

Stage 3. The symbolic presentation can bring students to understand the meaning of "two" and "four" without any aids. Therefore, at this stage, students can understand the meaning of 4 sheets of moringa leaves + 2 sheets of moringa leaves = 6 sheets of moringa leaves. Symbolically, the number 6 is obtained from writing 4 + 2 = n, with the value of n satisfying the equation is 6.

Based on these examples, it is shown that learning in mathematics does not only require the use of learning equipment that is immediately made but can also use medias available in the surrounding environment so that the learning process can go hand in hand with maximizing the involvement of and active role of students in various explorations, experiments, and discussions to minimize boredom in the learning process (Syamsi, 2014).

About learning mathematics, moringa leaves can also be used as a counting medium in working on math problems. By using moringa leaves, students can learn mathematics while playing so that the scary impression in learning mathematics can end up becoming interesting.

2. The use of moringa leaves as a learning media for connection in making patterns

Mathematical connection skills play a role in achieving meaningful understanding for students. Being able to connect or associate a mathematical concept with its application in everyday life is considered as a mathematical connection capability (Muchlis et al., 2018). The capability of creating mathematical connections is considered paramount as it goes by the nature of mathematics going structured from easier to more complex concepts (Rohmah et al., 2018).

Learning mathematics is known as a process undertaken to develop students' abilities in using calculation formulas in solving problems in everyday life so that they can have experience in interacting with the environment. Nuraini (2018) explained per the educational goals formulated by the National Council of Teachers of Mathematics that the application for mathematics in the environment contributes to achieving:

a. explained per the educational goals formulated by the National Council of Teachers of Mathematics that the application for mathematics in the environment contributes to achieving;
b. Social goals oriented to the ability of students to play an active and intelligent role in establishing relationships regarding society. Mathematics is not just developing students' cognitive abilities but also affective aspects so that through mathematics education they can develop social aspects and intrapersonal intelligence of the students, and;
c. Cultural objectives are intended as placing mathematics learning in contribution to cultural development.

Referring to these objectives that go by the curriculum in place in SD/MI, it is certainly demonstrated that mathematics learning does not only include cognitive learning, but also affective and psychomotor learning so that mathematics learning can also be used to shape students' ability in thinking.

Adjusting to the 2013 curriculum which currently used in SD/MI, the 2013 curriculum aims to prepare Indonesia's young generation to be able to live as

individuals who are faithful, productive, creative, innovative, and effective while at the same time can contribute to the community, country, and worldwide. The 2013 curriculum also has the characteristics of:

a. The development of a balance between attitude, spiritual, social, curiosity, creativity, and cooperation in stimulating students' cognitive and psychomotor capability, and
b. The development of attitude, knowledge, skills, and application in various situations in the school or the community.

The Ministry of Education has prepared a series of thematic learning books to implement the 2013 curriculum which has been reviewed by various parties under the coordination of the Ministry of Education and Culture. These books contain a description of various learning goals that students need to achieve to facilitate students' ability in finding other learning materials available in their environment. Based on this, teachers need to improve and adjust their role in enriching students' creation through the means of relevant activities based on their surrounding social and natural environment by providing concrete objects to ease students in understanding learning materials as well as in making pictures as in iconic stage.

Based on this, Amir (2015) assumed that mathematics can be used as a fun activity without being separated from its instructional objectives in cognitive, affective, or psychomotor aspects. One of these examples is through the application of a tangram game consisting of various geometric shapes that make students active in fiddling with tangram to create various shapes. This helps students in managing their mathematical thinking patterns and reasoning abilities.

Zapata-Grajales et al. (2018) conducted a study of learning outcomes through the development of mathematical modeling related to the study of distribution and growth of leaves. In these findings, the modeling is based on learning the shape and geometric size of the leaves so that students can explore, represent, and formally construct and validate the findings to find the meaning and concept of mathematics. Students are assessed as having a special interest in describing plant growth, identifying the shape and geometric size of plants, and assume that it is easy to retrieve and analyze data when these observations are applied to direct contact with media.

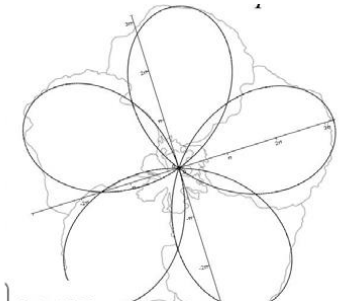


*Figure 3.* Zapata-Grajeles' study

*Figure 4.* Refugio's study

Refugio (2019) conceptualize the nature of reflection on 1500 Moringa oleifera stems, he examines the mathematical and statistical properties of the leaves of the plant by counting the number of Moringa oleifera leaves on the right and left sides of the stem as well as the number of leaves on the top and bottom of the stalk so that a positive correlation is found between the number of leaves on various sides.

As with these studies, the researcher is interested in directing students to do mathematics learning through pattern recognition and imitating them into paper drawings. Thus, in making patterns, students are directed to connect concepts of arithmetic and geometry related to the concept of estimation. This is in line with the Lestari KW (2011) that mathematics is identical with these concepts and assessment that the introduction of the concept of patterns and relationships in primary level students has the purpose of developing simple patterns beginning with stages of knowing, analyzing, replicating, and continuing patterns as predicted by students.

A study conducted by Lisa (2017) assesses that to support the development of the capability to recognize patterns and relationships, some activities can be carried out, such as playing with the child to play queue with car toys and arranging them with colors. These capabilities are essential in learning sequence and pattern finding that is

useful in the ability to develop sequence patterns and function-relationship that is seen in developing the ability to create correlations.

Also, there is an introduction to the relationship of geometry that can be done by inviting children to play while observing a variety of objects around them. Through this introduction, children will learn that objects have various shapes and try to be creative in building geometric shapes. Based on this, the goal is for students to be given the freedom in recognizing objects through its manipulation and understanding of similarities and differences.

The ability to arrange patterns (patterning) is the ability of students to form an arrangement that is done repeatedly by paying attention to the previous form. The arrangement can be made in terms of colors, objects, movement, sound, and so forth. This exercise can be started by introducing students to the picture that will be used as an exercise to arrange the next drawing pattern. Students can also be trained to form two-dimensional images such as straight and curved lines. For object-coloring activities, students are trained to color with an understanding of certain limitations in color rendering (Naimah, 2015). Thus, in making patterns, students have shown the result of observational activities that are followed following the observation.

In this study, the researcher used moringa leaves as media to train students in making patterns with the following learning stages:

a. The teacher provides tools and materials for making patterns such as a handful of moringa leaves, A4 papers, pencils, erasers, rulers, and paper double tapes;
b. When the foresaid learning media are available, the teacher then begins learning by starting an explanation of the basic concept of geometry consisting of points, lines, and fields. When students understand these three concepts, the teacher then introduces them back to the concept of flat figures;
c. The teacher then explains the steps and procedures and demonstrates how to make patterns using the moringa leaves in different positions but in the same direction for each geometric shape, as shown in Figure 5:

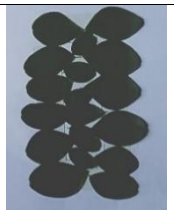
| | | | |
|---|---|---|---|
|  |  |  |  |
| Circle geometry shape | | Quadrilateral geometric shape | |
| The fronds gather around the center of the circle | The leaf strands gather around the center of the circle | The leaf strands face each other in the center of the quadrilateral | The fronds face each other in the center of the quadrilateral |

*Figure 5.* Examples of patterns made of moringa leaves.

d. The teacher asks students to name the next pattern. The teacher then sorts the pattern according to what the students mentioned;
e. The teacher assigns students to choose their activities to make patterns before mobilizing students to try other geometric shapes;
f. Students collect and tell the pattern of their composition to the teacher for evaluation.

When students have completed the stages of making the pattern, the teacher can show the further application of the moringa leaves pattern, such as those found carved in handicrafts or drawn in batik; a motif unique to the city of Palu. The example of moringa leaves pattern can be seen in Figure 6:

| | |
|---|---|
|  |  |
| The initial shape of the dot | The initial shape of the line |

*Figure 6.* Examples of moringa leave pattern with an initial shape of dots and lines

According to Figure 6 above, the teacher can explain too students about one of the moringa leaves motif with initial shapes of dot and line. Regarding the moringa leaves motif, it is certainly not a new as moringa leaves motif has been applied in Indonesian batik as shown in Figure 7:

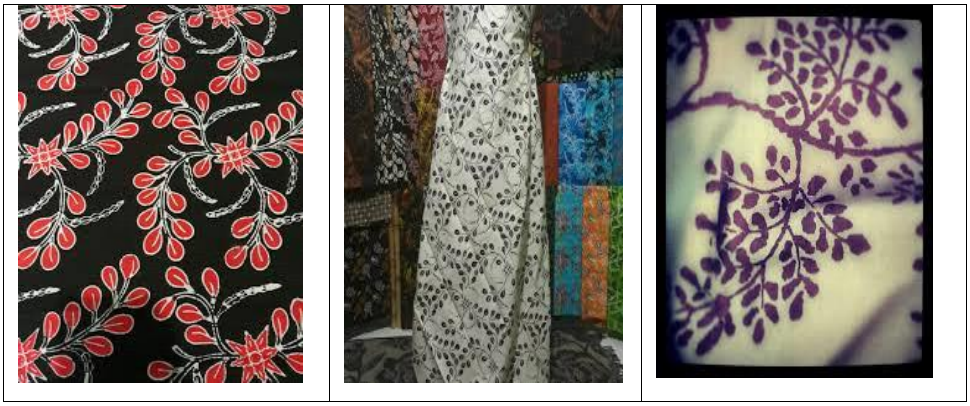


*Figure 7.* Examples of moringa leave motif (source: google.com)

Thus, the use of moringa leaves as a learning medium for students at the primary level becomes one of the efforts that teachers can make in introducing ways of learning mathematics. This is appropriate by using different concepts by linking basic mathematical theories and their application in playing patterns. This activity is expected to increase students' creativity and imagination.

**Discussion**

The learning process is generally influenced by variables originating from students' personalities, but the characteristics of learning are known through interaction during the learning process. Thus, teachers as educators are required to be able to develop creativity in their learning activities (Nursupiamin, 2019).

Learning mathematics in the primary level requires special tips to attract the attention and active role of students. One that can be applied is through the use of objects available around students' environment, used as creatively as possible to increase students' interest, motivation, and understanding in the concept of learning.

Based on the literature study, it is known how the use of learning media originating from the environment such as moringa leaves can contribute to supporting the active role of students in mathematics learning. As it is known that media and teaching aids can increase effectiveness by avoiding monotonous learning conditions and creating a conducive learning environment.

It should be noted that Moringa oleifera has a positive impact has positive reflective properties as described in Refugio study in 2019 where it is known that moringa leaves have the same mirroring side in various aspects both in the position of

the leaf stalk and leaves so that order is formed in terms of symmetry, which is related very closely to geometry.

Basic geometry concepts introduce points, lines, and planes. At the primary level, this concept is limited only to what points, lines, and planes are. However, if it is adapted to the existing curriculum, the understanding of this concept can be developed. One of which is by linking the concept of order and pattern. Learning material of order in mathematics at the primary level is introduced in row and series material. This is similar to Zapata-Grajales study in 2018 which found the meaning of mathematical concepts through modeling based on the learning of geometric shapes and quantities so that students were able to explore, represent, formally construct, and validate their findings.

Therefore, it is known that mathematics is not just a matter of arithmetic, but also its application in everyday life such as in developing patterns. Although the skill to develop patterns is further improved at the secondary level, this paper aims to implement mathematics closer to the daily lives of students, one of which is through moringa leaves which are often used by the people of Palu in culinary.

This is certainly in line with previous studies describing that the use of learning media can improve students' learning outcome, as Sulviani (2019) that the application of concrete media in mathematics learning of number lines found the average of grade 3 students have learning outcomes following the established assessment indicators. Darnia (2019) has also found that applying reinforcement of local wisdom was considered to be more effective in increasing grade 3 students' learning motivation in class with a mean value of 81.03.

Other research conducted by Mawarni (2019) explains that the use of origami media increases the number of passing students and those meeting the minimum passing grade (KKM) as it contains elements of creativity and fun in the learning experience. It is also found that students' capability in geometry has increased to 100% compared to before of only 47%. Alni (2019) have also proposed that the used of teaching aid as learning media can help the teaching and learning process so that communication can be established effectively and efficiently which can be assessed from the acquisition of learning outcome score which increased by 89.82%.

Londa in 2018 has also proposed that using a puzzle as a new learning media could increase the students' learning success due to the influence of cognitive, affective, and psychomotor capability that aids in the acquisition of knowledge, understanding, application, analysis, organization, assessment, acceptance, response, character, as well as skills such as productive, technical, social, managerial, and intellectual skills (Londa et al., 2018).

Based on this, it is known that mathematics is not difficult when presented in an interesting, fun, and easy to understand form. Mathematics is associated with art as it can be realized in the forms of games or its benefit in daily life. Related to that, it is certainly inseparable from teacher's creativity in connecting objects in the environment with mathematical material.

Supporting the development of reasoning and students' creativity, it is then necessary to allow students to ask questions, submit opinions, or criticize a matter. Moreover, students in primary level are still fond to playing, so teachers need to explore learning mathematics through learning activities that utilize the environment to promote students getting concrete benefits, ability to manipulate objects, as well as the opportunity to explore, get experiences, develop thinking patterns, and ability to use utilize natural learning resources.

**Conclusion**

The application of mathematics learning media in the primary level by using existing objects around students is used as an effort to encourage students' active role in the learning process. The application of instructional media produces output, whenever possible, to entice students in learning and motivate the continuity of effective learning.

In the example of moringa leaves, in addition to being served in culinary delicacies of Palu or being used as traditional alternative medicine, moringa leaves can also be used in mathematical learning, especially the application of the concept of counting and connection in making patterns. As it is known that moringa leaves have asymmetry that is closely related to basic geometry that introduces points, lines, and fields, which, when realized, will form patterns that can be developed without being detached from empowering and maintaining local culture.

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