

Learning Math Through Making Shadow Puppet

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Abstract – This research is a research conducted in an area known as Kampung Wayang Indonesia, namely in the Kepuhsari area, Manyaran District, Wonogiri, Central Java. Although in the view of the community making shadow puppets is considered a cultural activity, the things examined in this research are related to other aspects of education. Specifically, it aims to describe findings about aspects of ethno-mathematical learning content portrayed in the process of making shadow puppets. This research was conducted by observing the research subjects, namely early childhood who are skilled in helping the craftsmen of tatah sungging to make shadow puppets. The research methodology used in this research is qualitative with the Spreadley model ethnographic approach. Data collection techniques in this study using interview data collection techniques, documentation, and observation. The results of this study indicate that the tatah sungging activities of Kepuhsari children in assisting inlaid craftsmen represent the existence of mathematics learning content in the aspects of learning patterns and learning geometric shapes. This learning content is technically learned by children through the process of making shadow puppets that are made precisely with imitated shadow puppets characters. The research also found supporting factors for the emergence of this ethno-mathematical learning process, namely the philosophical value of shadow puppets and the level of difficulty in making shadow puppets work through tatah sungging's craft.

Keywords – Ethnomathematic, early childhood, tatah sungging.

I. INTRODUCTION

The making of shadow puppets or tatah sungging is a culture inherent in the life of the people of Kepuhsari, Wonogiri, Central Java. This culture has existed in the life of the Kepuhsari community since the days of Kyai Panjang Mas, who was a student of Sunan Kalijaga who originated Islamic preaching through the shadow puppets method (Tanto, 2019). In contrast to the views of the Kepuhsari community, the activities of making shadow puppets carried out by these children have an educational side, namely the existence of mathematics learning content that occurs during the process of tatah sungging.

The results of the literature study noted that the shadow puppets making activity has many educational values. The results of the study (Tanto et al., 2019) reveal that the Tatah Sungging activity represents the process of cultivating the character of patience, perseverance, conscientiousness, independence, responsibility, discipline, and mutual cooperation in children who are skilled in making shadow puppets. Another source revealed that the Tatah Sungging activity also reflects the fine motoric aspect that is stimulated as long as it uses various kinds of inlay tools with small diameters and coarse and hard textured media (Tanto, Octavian Dwi, 2020). Apart from that, other studies also explain that tatah sungging activities reflect early childhood social skills such as the ability to work together, empathize, and communicate. Recently, there is a study which reveals that tatah sungging activities can

stimulate basic science process skills in early childhood such as observing, comparing, classifying, measuring, predicting, and communicating.

Although many studies have examined the educational side of shadow puppets making activities in early childhood, there has not been a single study that discusses the content of learning mathematics. The research is almost the same, namely research (Narulita et al., 2019) on ethnomathematics in the art of shadow puppets performance. Technically this is in contrast to this research which is more in-depth about learning mathematics through the process of making shadow puppets or better known as *tatah sungging*.

In the perspective of early childhood education, the results of this study contribute to mathematics learning activities carried out through cultural activities. This is important to prove that theoretically early childhood learning should be carried out through activities based on local wisdom. This newness is specifically supported in the source (Trinowati, 2017) which reveals that learning mathematics using ethno-mathematical objects can enrich the existing mathematics applications around students and can facilitate students to understand abstract mathematics by using concrete ethno-mathematical objects.

The urgency of learning mathematics based on local wisdom is empirically proven from the results of previous research. The results of a literature study (Barton, 1996) reveal that the culture of mathematics has an attractive, artistic, and useful appearance component in the implementation of the learning process. The statement of the research results is confirmed by the results of research (Hafsi & Hasanah, 2018) which reveal that there are mathematical concepts in the aspects of learning geometric shapes that are studied through the architecture of long *tanayan* structures such as squares, rectangles, lengths, widths, areas, and the circumference of flat shapes which is in the traditional house of the Madura tribe. Through observations in their social environment, children find it easier to relate math learning content to the real world around them.

The importance of learning mathematics through this cultural activity can also be seen from some of the results of previous research which specifically discussed ethnomathematic. The results of the study (Zayyadi & Subaidi, 2017) reveal that batik activities can be used as a method for learning mathematics learning content such as; Straight lines, curved lines, parallel lines, symmetry, points, angles, rectangles, triangles, circles, parallelograms and the concept of congruence. The content of learning mathematics is reflected in the Madura batik motif depicted on cloth media. In line with the results of the above research, (Fathikhin & Wijayanti, 2020) explains that the tradition of batik in the Ngawi community can be used as a reference in designing realistic mathematics learning in schools.

The results of other studies reveal that the composition of the parts of the temple building can be used by teachers to teach mathematics learning content such as squares, rectangles, lanes, trapezoid and irregular quadrilateral (Trinowati, 2017). Supporting the empirical study above, research findings (Hasanuddin, 2017) show that there are many ethnomathematic activities in Riau Malay society, ranging from literary arts, Malay clothing, carving to ethnomathematics in Riau Malay community games.

Various kinds of research results above show that mathematics learning in early childhood is provided through local cultural wisdom, so that it is easier for children to learn mathematics learning concepts realistically. This is like the principle of learning in early childhood, where the media used in the learning process of children at that age refers to concrete objects that are around the child's environment.

II. RESEARCH METHODOLOGY

This study uses a qualitative research method with an ethnographic approach to the *Spreadly* model which aims to examine cultural phenomena. According to (Mulyana, 2018), ethnography aims to describe research on culture and its aspects as a whole, both material such as artifacts (tools, clothing, buildings, etc.) as well as abstract ones such as experiences, beliefs, norms, and systems. group value. Technically, this research procedure is carried out using 12 steps forward starting from 1) choosing a social situation, 2) carrying out participant observation, 3) recording the results of observations and interviews, 4) conducting descriptive observations, 5) conducting domain analysis, 6) making observations focused, 7) conducted taxonomic analysis, 8) conducted selected observations, 9) conducted a component analysis, 10) conducted a theme analysis, 11) cultural findings, and 12) wrote a qualitative research report (Sugiyono, 2007).

The research procedure above was carried out to examine the data on the content of mathematics learning contained in the shadow puppets making activity or better known as the *tatah sungging*. The data in this study were taken using interview,

observation, and documentation data collection techniques (Afrizal, 2016). Retrieval of data with the data collection technique is used to see the process of making shadow puppets which contains mathematics learning content.

Meanwhile, the data sources in this study were the children of Kepuhsari, Wonogiri, who were skilled in doing tatah sungging activities. According to (Herviani & Febriansyah, 2016) the source of data in research is the subject from which data can be obtained. The data obtained were then analyzed using the Spradley model of ethnographic data analysis starting from; 1) domain analysis, 2) taxonomic analysis, 2) compositional analysis, and 4) analysis of cultural themes (Spradley, 1997).

III. RESULT AND DISCUSSION

Based on the results of field observations, it was found that the activity of making shadow puppets children in Kepuhsari reflected the existence of learning mathematics during the process of making shadow puppets, namely that children indirectly learned about the content of learning mathematics in the aspects of learning patterns and learning geometric shapes. The learning content can be seen at every stage of the tatah sungging's craft, starting from the mengeblak stage, engraving, to grafting with leather media.

Mathematics learning content on the aspects of learning patterns in the mengeblak stage can be seen when children draw sketches of body parts, clothing, and shadow puppets accessories. On the body part of the shadow puppets, the child sketches hair with tracing techniques. For shadow puppets clothes, children make various batik motifs using tracing techniques, such as kawung, parang barong, sawat, truntum, sidomukti, satrio manah, and semen rante. For shadow puppets accessories, the children sketched the arrangement of the motifs using tracing techniques such as weapons, sumping, uncal, necklaces, praba, belts, and sampur.

Mathematics learning content in the pattern learning aspect at the carving activity stage is seen when children make holes in shadow puppets patterns, children make holes in patterns of body parts, clothing, and shadow puppets accessories. The difference in the shooting and mengeblak stages is that when the child learns the pattern through drawing, and when it is engraved, the child learns the pattern during the carving activity.



Figure 1.1 Mengeblak Stage



Figure 1.2 Engrave Stage

Mathematics learning content on the aspect of learning patterns at the menyungging stage is seen when children coloring shadow puppets patterns, children coloring patterns of body parts, clothes, and shadow puppets accessories. At this stage the child learns the pattern through a variety of menyungging techniques from mulas ndasari (basic coloring), mulas gradasi (coloring gradations), mulas ndrenjemi (making small circle patterns using dyes), and nyeweng (shading).

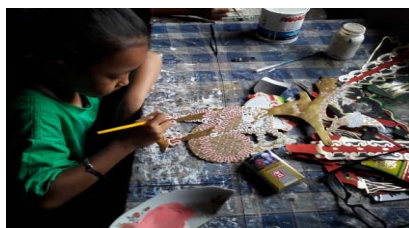


Figure 1.3 Menyungging Stage

In addition, learning mathematics on the learning aspects of geometry at the *mengeblak* stage, can be seen when children draw various forms of shadow puppets ornaments, children make geometric shapes of *bubukan* (resembling circular shapes), geometric shapes of *tratasan* (resembling squares and rectangles), shapes of *mas-masan* geometry (jewelry) is a combination geometric form found in the *badong* ornament (belt) and *praba* (crown), and the geometric shape is a geometric shape made with curved lines such as the hair tie motif, *kawung batik* motif, and so on.

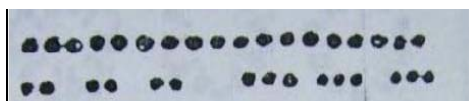


Figure 1.4 Bubukan Shapes



Figure 1.5 Prototype Tratasan

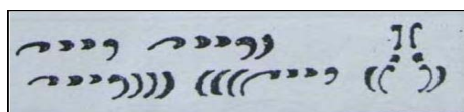


Figure 1.6 Mas-Masan Shapes



Figure 1.7 Prototype kuwung

The differences in the aspects of learning geometry at each stage of making shadow puppets, namely at the *mengeblak* stage where children learn geometric shapes through drawing shadow puppet sketches, at the engraving stage through punching holes in shadow puppet sketches (patterns), and at the *menyungging* stage through coloring activities with various techniques, *mulas ndasari* (basic coloring), *mulas gradasi* (coloring gradations), *mulas ndrenjemi* (making small circle patterns using dyes), and *nyeweng* (shading).

In addition to the content aspect of learning mathematics, there was also an internalization process of learning geometric patterns and shapes through the making of shadow puppets. This can be seen from the precision craftsmanship of puppets made by children with imitated shadow puppet characters. Starting from the arrangement of the shape of the body parts, clothes, to the ornamentation of each shadow puppet character, the children make exactly the same.

Another interesting finding is the philosophical value of shadow puppets and the level of difficulty in carrying out *tatah sungging* activities, which are the driving factors for children's enomatematic learning activities. Parents familiarize themselves with *Kepuhsari* children to make precise inlay patterns and shadow puppets's *sunggingan*, so that they can reflect the character of the character. The antagonist and protagonist puppet characters have different forms of inlay and *sunggingan*'s grips.

The antagonist shadow puppets have geometric shapes and patterns depicting large eye inlay, thick noses, chubby bodies, and gaping mouths with large rows of teeth and fangs to reflect their physical ugliness, with a combination of contrasting and strong colors, such as red black and black. orange combination to express his ugliness. The protagonist shadow puppets have geometric shapes and patterns that depict slanted eyes, a sharp nose, and a small body to reflect the beauty of her appearance, with a combination of subtle colors to reflect her beauty, and good looks.

Apart from that, the children of Kepuhsari were also accustomed to making shadow puppets inlay patterns and sunggingan of Shadow puppets by using tools and materials commonly used by craftsmen. They created a wide variety of arrays of geometric shapes and patterns using small diameter inlay tools and hard, coarse-textured leather. This difficulty level makes the child really observe in detail each geometric shape and arrangement of the shadow puppet pattern. This is done so that the shadow puppets produced are really precise so that they can reflect the character.

This finding is in line with the results of research (Yanti & Haji, 2019) which reveals that teachers can use Bengkulu besurek cloth as a medium and teaching aid in mathematics learning, especially in understanding the concepts of transforming geometric shapes and providing realistic and contextual outdoor learning. In another aspect (Funan et al., 2019) added that the shape and structure of the *uem le'u* building had elements of mathematical concepts and approaches as patterns in making buildings. Reaffirming the above, the results of development research (Fitriyah et al., 2018) explain that through a discovery learning-based ethno-mathematics approach, the mathematics learning process has a high percentage of effectiveness, which is 83% for teaching materials and 84.5% for the practicality of the learning process.

IV. CONCLUSION

The making of shadow puppets or what is known as *tatah sungging* is a culture of the Kepuhsari community that reflects ethnomatematic learning. Through the stages of *mengeblak*, engraving, and *menyungging* of shadow puppets, children learn how to make precise arrangements of patterns and geometric shapes. Each arrangement of patterns and geometric shapes that are made using precision inlay tools and materials reflects how the characters of the shadow puppets antagonists and protagonists are.

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