

Ethnomathematics For Elementary Student: Exploration The Learning Resources At Kraton Yogyakarta

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Abstract: This paper is the exploration study analyzes data from Kraton Yogyakarta, about learning resources for elementary mathematics. Learning mathematics in elementary school using cultural wealth can make the learning process more meaningful. What learning resources can be identified from Kraton Yogyakarta as ethnomathematics study, that can be used for elementary mathematics? The technics to collect data for this qualitative research are observation and documentation. Data analysis gives a result on the tabulation of resources from Kraton Yogyakarta with basic competences, grade and Ambrosio's category. The finding of the research: there are many ethnomathematics learning resources at Kraton Yogyakarta : Gunungan sekaten, batik, sengkalan, Sultan Agung calendar, Bangsal Manganti, Kraton stairs, Kraton ceramics at Bangsal Pagelaran, etc. The ethnomathematics resources can be used as media for mathematics learning about: measuring length, area, volume, tessellation, shape, pattern, common multiple, common divisor, and multiplication. Based on identification carried out by the researcher, learning resources in Kraton Yogyakarta were obtained fulfilling for the first grade to the sixth grade. By using the six subject: counting, weighing, measuring, sorting, comparing, and classifying of D'Ambrosio's category, there were five categories that could be used. The five subjects are counting, weighing, measuring, comparing, and classifying. The sorting did not occur in the finding learning resources.

Index Terms: Elementary mathematics, ethnomathematics, Kraton Yogyakarta, learning resources.

1 Introduction

Entering the post truth era [9], [11], which is an era where it is difficult to scavenge true truth, requires a strong educational foundation so that students can face the development of the world. Millennials must be prepared to be able to think clearly if they encounter the phenomenon of simulacrum [3]. They must be empowered by culture education in order not to be a stranger in their community. Culture is important matter in education [21], [23] So it will be a great learning process when include culture learning resources in preparing it in the learning process, including in the process of learning mathematics. To be able to carry out good mathematics learning, Marsigit et al. suggested that students explore informal knowledge to teach formal mathematics [16] It is necessary to find concrete learning resources in order to get an interesting learning experience, one of which is through local culture. This is in line with the spirit of realistic mathematics, mathematics learning should be closely related to the contextual world of students which includes principles: the existence of activities, reality, level of ability, and an interrelationship between materials, interactive, and with guidance from the teacher [24] Based on this principle, ethnomathematics can be a harmonious choice in implementing it. Ethnomathematics that study mathematics in certain communities, certain cultures, can be used as an alternative to innovate mathematics learning, provides real, contextual learning resources and uses student-centered principles [17] Mathematical learning that links it with culture will make it more meaningful and empowering for students [15] In harmony with Fasheh, students become more aware, more critical, more appreciative and more confident, as well as G. Ladson-Billings but teachers need to improve their

management skills towards student diversity [8], [10] To facilitate mathematics learning that strengthens cultural love and uses contextual media, it can be explored the existence of cultural heritage around the student learning environment. For the area around Yogyakarta, there are so many noble Javanese artifacts and relics available. The wealth of Javanese culture includes cultural heritage buildings, dance arts, puppet arts, temples, there are still many that have not been utilized yet in mathematics learning. The cultural wealth in the Kraton Yogyakarta, in the form of traditional parties, Jumenengan memorials, Sekaten celebrations, batik, historic relics, and others need to be explored for the development of mathematics learning. The availability of abundant learning resources needs to be balanced with the ability to choose, categorize and classify these learning resources. This article presents the identification of the ethnomathematics learning resources of the Kraton Yogyakarta according to its class, material, and basic competencies for the elementary student, based on 2013 Revision Indonesian Curriculum.

2 RESEARCH METHOD

This research is qualitative research with collecting data using deep observation and documentation, also analyzing across the curriculum. The activity of research is exploring learning resources at Kraton Yogyakarta based on ethnomathematics. After analyzing content, material, grade, basic competences in 2013 Revision Indonesian Curriculum, then finding the appropriate learning resources from Kraton Yogyakarta. Using Ambrosio's category as another tool for analyzing, researchers get the result that sorting category doesn't occur in the ethnomathematics resources.

3 RESULT AND DISCUSSION

3.1 Ethnomathematics and Learning Resources

The selection and evaluation of learning resources must be aimed at supporting education and learning objectives, according to the applicable curriculum [5]. In Ministerial Education Regulation number 21 from 2016 [13] about Standard Content, The unit of mathematics aims at students

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having the following abilities:

- 1) Understanding mathematical concepts, explaining the interrelationships between concepts and reversing concepts or logarithms flexibly, accurately, efficiently and precisely in solving problems.
- 2) Using reasoning on patterns and traits, making mathematical manipulations in making generalizations, formulating evidence or explaining mathematical ideas and statements.
- 3) Solving problems that include the ability to understand, designing mathematical models, completing models and interpreting solutions obtained.
- 4) Communicate ideas with symbols, tables, diagrams or other media to clarify the situation or problem.
- 5) Have an attitude of appreciating the usefulness of mathematics in life.

In determining the learning resources used in learning, it is necessary to hold the following rules. 1) Supporting local/regional curricula; 2) Developed by teachers with adequate competence; 3) In accordance with the development of age, emotional, material, abilities, learning styles and conditions of students; 4). Contains the value of beauty, social value and literacy [5] The use of learning resources in the Kraton Yogyakarta location which is one of the tourism

destinations, in general, must be interesting for students. In addition, the theory states that learning will develop when the teacher integrates student background [6] in this case is the cultural environment of their surrounding. So, learning process, the activity, tools that involves culture in mathematics learning can be developed for meaningful learning.[20], [22]. In relation to mathematics learning resources, D'Ambrosio distinguishes existing ethnomathematics categories into counting, weighing, measuring, comparing, sorting, and classifying [4] This category can be used as an analytical tool to identify learning resources in elementary mathematics learning.

3.2 Ethnomathematics Learning Resources at Kraton Yogyakarta

Kraton Yogyakarta has various cultural properties including ceremonies/activities, customs, and physical objects. Ceremonies in Kraton Yogyakarta are: Sekaten, Siraman Pusaka and Labuhan, Garebeg, Tumpak Wajik [19] The wealth includes the activities of Sekaten, Kraton Anniversary, relics of Javanese Calendar, batik, heirlooms, household items, building spaces in the palace, Bangsal Manganti, Bangsal Pagelaran, the Sultan's vehicle, etc. Based on the wealth in the Palace, an identification table can be arranged as follows.

TABLE 1
Subject, classification, and Learning resources at Kraton Yogyakarta

Learning Resources	Learning Activity	Subject: Grade/ Basic Competences	D'Ambrosio Classification
Gunungan Sekaten Figure 1	Measuring the height of Gunungan, the radius of Gunungan, the volume and counting the weight of material for making Gunungan	Volume, area: 5 / 3.4, 3.5, 4.4, 4.5	Measuring, weighing
Batik Figure 2	Counting the area of Batik motif	Area: 4/ 4.4	Measuring
Tessellations Figure 3	Naming the shape, making or drawing the figure of square, rectangle, triangle, parallelogram, etc	First dimension on geometry : 1/ 3.5, 3.6, 4.5, 4.6, 4.7	Classifying
Hitungan Pasaran	Counting multiplies of 5, counting selapan: Ahad Paing, Selasa Kliwon, remaining division	Multiplication, Division : 4/ 3.6, 4.6	Counting
Kalender Sultan Agung (Anno Javanica).	Quantity concept: a decade, a week in Javanese traditional Practice: How to count 1000 hari of Kamis Pon	Quantity: 4/ 3.4, 4.4	Counting
Motif Keramik, hiasan dinding, hiasan pagar Figure 4	Explain the shape: square, circle, parallelogram, rectangle, triangle, etc Making pattern from the shapes	First dimension on geometry : 2/ 3.8, 3.9, 4.8, 4.9	Classifying
Bangsal Manganti Figure 5	Measuring area of Bangsal, perimeter of Bangsal	Area, perimeter: 3/3.10, 3.11, 3.12, 4.10, 4.11, 4.12	Measuring
Facade of the part of Kraton Figure 6	Drawing two or more shapes, then count the area and the perimeter (Based on shape of real matter in Kraton)	First dimensional on geometry: combine the shapes :6/ 3.7, 4.7	Measuring

The learning resources at Kraton Yogyakarta that are identified in this paper are painted on Fig. 1 to Fig.6 as follows.

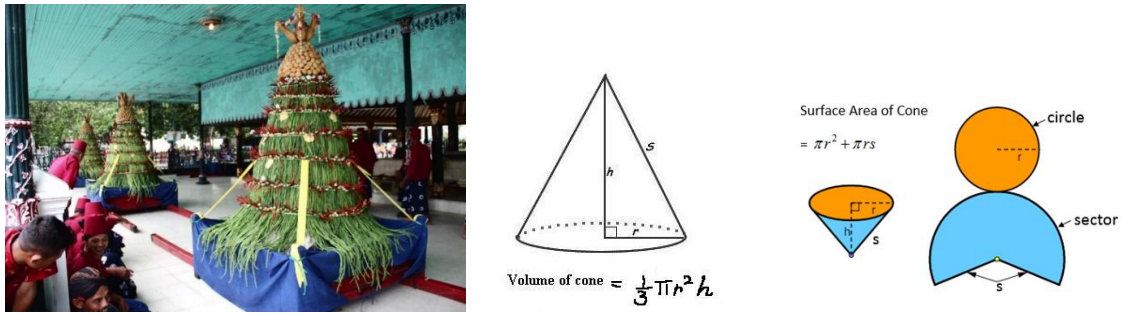


Fig. 1. Gunungan Sekaten for volume and surface area learning



Fig. 2. Batik ceplok kopi pecah: area learning resources with traditional optional subject



Fig. 3 Learning resources for tessellation



Fig. 4 Learning resources for pattern and one dimensional shape

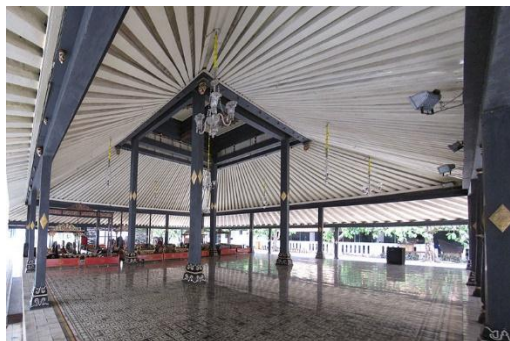


Fig. 5: Bangsal Manganti for: area, perimeter and the length learning resources



Fig.6. Learning resources for shape combination

Based on the analysis table with the revised basic competencies of the 2013 curriculum, learning resources in the Yogyakarta Palace can be identified facilitating learning resources in mathematics learning, starting from grade 1 to grade 6. It explains alternative learning media can be offered and enriched by cultural backgrounds, that is ethnomathematics. Mosimege and Lebeta reported that the indigenous people use different mathematical concept like addition, multiplication, division, set, tessellations and symmetry in the construction of the traditional artifact and cultural activities [14] As with the Javanese community with evidence of artifacts in the Kraton Yogyakarta, it has been shown that Javanese people have used mathematical concepts and knowledge. With this research, ethnomathematics components, formal mathematics and their usefulness in mathematics learning will be proven and identified. The development of ethnomathematics-based learning tools of the Sultan's Palace, Prambanan and Borobudur have been carried out, among others, by Marsigit et al [16] But the material includes junior high school level. Inclusion learning can be integrated with ethnomathematics and it is called contributing to better education, namely in motivating, ethnomatology plays a role in creating and encouraging awareness of values, also in line with the goals of education in Latin America summarized in OEI [7], [1] Even the use of ethnomathematics by teachers results in effective mathematics learning [2].

4 CONCLUSION

Teaching-learning resources for elementary mathematics based on Kraton Yogyakarta Ethnomathematics content are Gunungan sekaten, batik, sengkalan, Sultan Agung calendar, Bangsal Manganti, Kraton stairs, Kraton ceramics in Bangsal Pagelaran, etc. Variations according to the D'Ambrosio

category of learning resources in the Palace include: counting, weighing, measuring, classifying, and comparing.

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