Developing of teaching materials for junior high school students based on ethnomathematics on traditional woven cloth (Tembe Nggoli) of Mbojo tribe

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Abstract. This research is based on the absence of teaching materials about the concept of geometry that is able to facilitate the students connecting the culture, especially tembe nggoli which is one of the traditional woven cloth of mbojo-NTB with the concept of mathematics. Ethnomathematics is a mathematical bridge with culture, and ethnography recognizes the different ways of doing mathematics in community activities. The result of this study is to produce teaching materials in the form of students’ worksheets. The method used is design research which includes: (1) preliminary design, in this phase is made Hypothetical Learning Trajectory (HLT); (2) experiments, in this phase existing designs are tested to students; (3) retrospective analysis, in this phase the researchers compare the HLT with the actual student learning process. The results of this research showed that tasks which were presented in teaching materials by considering learning obstacle and preliminary study able to facilitate students to define the properties of triangles based on their angle.

1. Introduction
Mathematics and the culture are two very important parts in order to achieve educational goals to educate the lives of the nation. The existence of mathematics as one of the subjects taught at each level of education gives influence and impact in shaping the personality and abilities of students. The ability to think critically, logically, and creatively in mathematics learning will be easier for students to get, one of them is by developing learning that connects the material to be taught with a culture that is inherent in students' daily activities.

As one of the sources of science, the role of the teacher in designing learning that is interesting and easily accepted by students is one of the keys in the learning process. This makes the success or failure of a learning activity depends on the creative ability of the teacher to create a learning process in such a way that it can stimulate students to actively learn [1]. Teachers are required to be able to innovate to create learning tools that are able to develop children's abilities in learning mathematics [2]. One of the innovations that can be done by the teacher is to develop teaching materials that connect mathematical concepts with students' daily lives is known as ethics, so that learning will be more meaningful for students.

Ethnomathematics is a bridge between mathematics and culture. Ethnomathematics recognizes the different ways of doing activities related to mathematics in the process of the community [3]. Applying ethnomathematics as a part of teaching materials in learning will enable a material that is learned related to student culture, so that understanding of material becomes easier because the material is directly

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related to the culture which is a daily activity of students in the community. This helps the teacher as a facilitator in learning to be able to facilitate students well in understanding a material through the development of teaching material.

Through ethnomathematics, the teacher in compiling teaching materials will be assisted by the students' prior knowledge of the mathematical concepts of mathematical motives in the form of triangular, quadrilateral, and parallelogram found in traditional woven cloth (tembe nggoli) of the mbojo tribe which is a woven cloth that students meet daily. Students' initial understanding of the mathematical motives found in the woven cloth (tembe nggoli) helps the teacher to make challenges and encouragement so that students learn. So that knowledge is not transferred from one person to another, but individuals who learn to build their own knowledge [4].

The mathematical concept found in tembe nggoli which is a woven cloth that is familiar and even used daily by students makes learning more meaningful and not rigid. This is as expressed [1] that the structure and direction that is rigid in learning mathematics will make students have limited conceptualization abilities, as a result, the students have difficulty when faced with new problems because of concepts that are not fully understood. This will later become a learning obstacle for students. To overcome this, in developing teaching materials that will be applied to students in the form of learning tasks that are outlined in student worksheets, teachers are required to have a deep understanding of mathematical concepts that will be taught and able to describe it in the form of flexible mathematical knowledge.

One of the mathematical concepts studied in an integrated and continuous manner is the triangle. This concept is studied by students ranging from elementary school level to advanced understanding at the secondary school level. Triangle material when viewed in terms of material structure, concepts, and principles, basically students are familiar to them in their daily lives. Therefore, if it is related to the motives of tembe nggoli which is one of the students' culture, then learning will be more interesting and meaningful so that mathematics material is no longer considered bored and difficult by students.

Based on observations regarding the triangle concepts carried out in one of the seventh grade junior high schools in Dompu district as respondents, it was found that learning obstacles were experienced by respondents, especially junior high school students when working on questions about the triangle material. The first learning obstacle, based on the results of the instrument trial obtained that students have difficulty identifying the properties of triangles based on the angle. This difficulty is more because students still have difficulty in choosing and using the information available to solve the problem. The second learning obstacle, based on the results of documentation and interviews with seventh-grade math teachers, obtained the teaching materials made is very routine and uses the same format in the learning steps for each sub-material to be taught. Likewise with the given Student Worksheet. It tends to only be a collection of routine questions and exercises and has never been associated with ethnomathematics in the form of mathematical motifs found on traditional woven cloth (tembe nggoli).

2. Methods
The research method used in this study is design research which was developed based on the ethnomathematics of the traditional woven cloth (tembe nggoli) mbojo tribe through preliminary studies with pre-field analysis stages, an analysis in the field, and overall data analysis, then developed a design. Teaching materials that are in accordance with preliminary studies. According to Cobb et al; cited in Mulyana [5] design research consists of three interlocking phases of cyclic processes both in each phase and in the overall design research process. The three phases are preliminary design, experiment, and retrospective analysis. Explanations of the three phases are:

2.1. Preliminary First Design
At this stage the researcher carries out a theoretical study in order to understand the problem more thoroughly, can formulate research questions, and can propose an appropriate solution in solving the problem. In this phase, in addition to the hypothetical learning trajectory (HLT). In this case, HLT contains anticipation of things that might happen, including the thinking process of students in the learning process.
2.2. Experiment
In this phase, the designs that have been designed are then tested on students. The learning experiment in design research aims to investigate the learning process. In this case, the development process of students' way of thinking in the situation and learning atmosphere that is formed from HLT so that there will be a match between the things that have been anticipated in the initial design phase and the reality.

2.3. Retrospective Analysis
In the analysis phase of the review, the researcher compared HLT with the actual student learning process, then analyzed several possible causes and synthesized the possibilities that could be done to improve HLT, which would be used in the next cycle (initial design, experiment, and analysis of subsequent reviews). After obtaining good teaching materials through three phases, the results are used as material to compile teaching materials in other materials.

Subjects in this study consisted of subjects used as a place of observation of students' learning difficulties and subjects which were used as a place for the testing of instructional materials that had been developed. The subject used as a place to observe learning difficulties is one class VII in one of the junior high schools in Dompu district in the second semester of the 2017/2018 school year.

The subjects that were used as the place for the testing of teaching materials that have been developed are some students who have low, medium and high ability categories based on information from grade VII mathematics teachers in one of the junior high schools in Dompu district.

Data collection techniques used in this study are observation and interviews. Observation is a non-test evaluation technique that inventory data about students' attitudes and personality in their learning activities [6]. Observations are made to students when learning is taking place in order to find out the tasks in teaching materials that are difficult for students to complete and require intervention (assistance) from the teacher in its completion. According to [7] the interview is a conversation with a specific purpose, the conversation is carried out by two parties namely the interviewer who asks the question and the interviewee who provides answers to that question.

This interview was conducted with the aim of obtaining more in-depth information from the respondents because it was considered that the answers to questions had not been able to represent students’ difficulties, through interviews of researchers could: (1) identify students' difficulties in solving mathematical problems of geometric forms; (2) knowing the students' responses to the teaching materials developed by the teacher in teaching the concepts of geometric shapes connected with woven cloth of tembe nggoli. Thus, it will be known which tasks are perceived by students as difficult apart from the answers to the tasks on the teaching materials that students do, as well as the usefulness of the mathematical concepts associated with culture.

The data collected in the form of student interview transcripts, teacher interviews, students' work results on the initial ability test, and students' answers to teaching materials. Data processing is performed since the first phase to the third phase. In the first phase, data is obtained about the results of the students' initial ability tests on triangular and quadrilateral material. The results of students' work on this test were analyzed by describing the difficulties experienced in working on the problem. Then anticipation is made to overcome these difficulties in the form of a Hypothetical Learning Trajectory (HLT) which consists of planning learning and tasks. The tasks are arranged in teaching material.

Teaching materials that have been completed by students, then analyzed the students' answers as data. The technique used to analyze the data is based on [8] which states that activities in qualitative data analysis take place continuously until complete and are done interactively. There are three activities in data analysis, namely data reduction, data display, and conclusion drawing/verification. Data reduction means summarizing, choosing key things, focusing on important things, looking for themes and patterns, and removing unnecessary things. After that, the data is presented. Through the presentation of data, the data is organized and arranged in a relationship pattern so that it is easier to understand. In qualitative research, the presentation of data is in the form of narrative text. The last activity is to draw conclusions based on the data that has been obtained to answer the formulation of the problem. Determination of this technique considers its suitability with the research design that has been designed so that in its implementation can be carried out systematically.
3. Results and Discussion

Design research is a research that develops teaching materials by placing the design process (design) as a strategy. In practice, this study was conducted in three main phases. The three phases are preliminary design, experiment and retrospective analysis.

3.1. Preliminary First Design

In this phase, researchers conducted a study of the theory in order to understand the issue more thoroughly, to formulate research questions and to propose appropriate solutions to resolve the issue which is then connected to ethnomathematics contained in tembe nggoli woven fabric. The thing that was done after the preliminary study was to analyze student learning difficulties and make HLT from the results of interviews with students and teachers.

3.2. Analysis of Student Difficulties

Learning obstacle based on the results of the instrument trial obtained that students have difficulty in identifying the properties of triangles based on the angle. This difficulty is more because students still have difficulty in choosing and using the information available to solve the problem. Furthermore, based on the results of documentation and interviews with seventh-grade math teachers, the instructional materials obtained were very routine and using the same format in the learning steps for each sub-material to be taught. Likewise with the worksheet that was given. It tends to only be a collection of routine questions and exercises and has never been associated with ethnomathematics in the form of mathematical motifs found on woven cloth (tembe nggoli).

3.3. Hypothetical Learning Trajectory (HLT)

HLT consists of three components, namely learning objectives, learning activities, and learning hypotheses that will occur [9]. Based on the results of interviews with seventh-grade students and mathematics teachers and analysis of student answers, HLT was compiled. The following is an explanation of one of the student learning path hypotheses in the tangent learning material.

The purpose of learning in one of the tasks that contained in the worksheets in this study were given a few examples in the form of triangle which is a motif found on a woven cloth (tembe nggoli), students can define the properties of triangles based on the angle through observe, ask, explore, reason, and communicate based on the characteristics of the examples given.

Learning activity plans can be prepared by paying attention to learning obstacle and theoretical studies related to learning. First, the teacher conveys an apperception about rectangles with the aim of reminding students of concepts related to the concept of the properties of triangles. In the core learning activities, the teacher presents examples of motifs found in tembe nggoli in the form of a triangle. This is so that students feel that the learning carried out is related and that there is an application on woven cloth that is commonly used every day.

In one of the worksheets created in this part assignment, students are required to be able to conclude the definition of the properties of triangles based on their angular side from several images given as in the presentation of one of the tasks in this study as follows.

Before the students are given a few pictures of the motive of tembe nggoli that appertain with the triangle. Students are first motivated about the meaning of nggusu tolu (triangle) in their daily lives with the aim that students are increasingly motivated to get to know their culture which also means studying triangle material. After the introduction is given, then proceed with exposing the triangular motifs on tembe nggoli. The picture below is some of the triangles found in the tembe nggoli motif.
3.4. Experiment  
After doing the preparation of teaching materials in the triangular material, the next is to test it on some students who have low, medium, and high ability categories based on information from grade VII mathematics teachers in one of the junior high schools in Dompu district.

3.5. Retrospective Analysis  
At this stage, the results of the experiments carried out at the experimental stage were analyzed by a review of learning about defining the properties of triangles based on their angle. In this task teaching material, students are given examples of triangles contained in the tembe nggoli motif commonly called nggusu tolu which means that the highest power is in the hand of Allah symbolized in the peak of the
triangle. This task is given the goal so that students are able to define the triangular properties found in the tembe nggoli woven fabric. It was seen that at first some students felt confused when doing this task, after being given instructions and through question and answer by asking how the size of each side of each triangle students began to understand so that they did not have difficulty completing this task.

Based on the description on the trial of this teaching material, it can be concluded that task 1 as one of the tasks in this teaching material can facilitate students to find definitions of the properties of triangles based on their angle. Although in practice it was found that there were still students who were still lacking in mastering the prerequisite material that supports the teaching and learning process such as the basic concepts about the whole parts and the concept of congruence that requires more apperception and scaffolding than the teacher.

4. Conclusion
Based on the results of the research and discussion in this study, it can be concluded that task which is presented in teaching materials by considering learning obstacle and preliminary study, is able to facilitate students to define the properties of triangles based on their angle. Although in practice it is still found that there are students who are still very lacking in mastering the prerequisite material that supports the teaching and learning process such as the basic concepts of segregated parts and congruent concepts that require more apperception and scaffolding by the teacher.

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Acknowledgments
The authors would like to thank Kemenristekdikti for the research grant provided