ETHNOMATHEMATICS TROWULAN'S SITE: LEARNING MATHEMATIC WITH REACT STRATEGY ON RECTANGLE AND SQUARE FOR JUNIOR HIGH SCHOOL

Yuliyanti Masruroh
SMPN 1 Jatirejo, Jalan Raya Gebangsari No 04 Jatirejo, Mojokerto,
yuliyantimasruroh@gmail.com

Abstract: This study was aimed to describe process and produce the development of REACT strategy based on ethnomathematics, as well as determine the effectiveness of REACT strategy based on ethnomathematics learning on Square and Rectangle for seventh-grade students. Development research model proposed by Thiagarajan, Semmel & Semmel was adopted. Learning device included lesson plan, student worksheets containing ethnomathematics Trowulan's site and assessment test. This study use two class at seven grade, one class for pilot testing class and the other class for implementation. Data collection techniques through observation and student respon data and the data were analyzed descriptively. This development resulted in a valid categorized learning device based on expert validation. The assessment test met the criteria valid, reliable, and sensitive. From the trial class, it was obtained that (1) the class management ability of the teacher was good, (2) student activities was categorized as active, (3) the response from the students was positive, and (4) the classical mastery learning was completed. From the implementation learning using REACT strategy based on ethnomathematics on rectangel and square met the standard of the effectiveness.

Keywords. REACT, ethnomathematics, Trowulan's Site

1. Introduction

Education is one important factor in building a civilization of a nation. Through quality education, a nation will uphold its dignity in the eyes of the world. An educator has an important role in the success of a nation's education, therefore a teacher must have innovation and creation in the learning process. One of the innovative learning mathematics can be done through a cultural approach or so-called ethnomathematics. According to D'Ambrosio (2007), ethnomathematics is a study of the pattern of life, customs or customs of a society in a place that is related to mathematical concepts but is not realized as part of the mathematics by that society. Meanwhile, the form of ethnomathematics is the result of mathematical activity that belongs to or develops in the group itself, such as mathematical concepts in cultural heritage such as temples and inscriptions, traditional device, traditional games, and various kinds of activities that have been entrenched. According to Balamurugan (2015), ethnomathematics is the cultural utility of mathematics as a science. According to Rose et al.(2016), ethnomathematics offers a broader view of mathematics that embraces ideas, notions, procedures, processes, methods, and practices rooted in distinct cultural environments.

Trowulan's site is one of the relics of the Majapahit kingdom that can be used as a concrete model in the learning process of mathematics, especially on geometry material that is rectangular and square, because people of Majapahit Kingdom believed that their god keep man from the four directions of the north, south, east and west. While the right strategy for the development of ethnomathematics is the REACT strategy, According to CORD (2012), The REACT strategy has five steps of relating, searching and investigating by students, actively to find the concepts learned (Experiencing), application of the understanding of mathematics in Applying, provides opportunities for students to learn through cooperation and sharing (Cooperating), and provides opportunities for students to transfer knowledge of mathematics in solving mathematical problems and in the field of other math applications (Transferring). Learning with REACT strategy begins by linking learning materials with the real context that exists in the environment and the culture around the students. This can be used as a form of cultural preservation of the nation that began to erode by the impact of globalization. According to eggen and kauchack (2011), effective Instruction occur when students are actively involved in oraganizing and finding relationships in the information they encounter rather than being the passive recipient of teacher-delivered bodies of knowledge. Teaching materials in this study included lesson plan (called RPP), student worksheets containing ethnomathematics Trowulan's site (called LKS) and assessment test (called THB). Based on the background that has been described above, this study was aimed at producing learning device with the REACT strategy based on ethnomathematics Trowulan's site on rectangle and square for junior high school.

Learning device is a collection of learning resources that allow teachers and students in learning activities (Hobri, 2010). Learning device containing about a group of learning resources that can support so that the process of learning can take place. Learning devices in this research is a group of learning resources that are used in the performance of teachers and students learning process in the classroom. Learning devices used in the study include implementation plans, student worksheets and test student learning results arranged by model of learning. Learning device can be said to be of good quality, if meets the criteria of a valid, practical and effective (Nieveen, 1999).

2.   Method

2.1. Development Design

This research is a development research, the products that would be produced were lesson plan (called RPP), student worksheets containing ethnomathematics Trowulan's site (called LKS) and assessment test (called THB). The development model used was the model of Thiagarajan, Semmel & Semmel (1974), which consisted of four stages, so-called "Four-D Model" (Model 4-D). The four stages were defining, design, developing and disseminating. The purpose of defining stage was setting and defining learning needs by analyzing the goals and the material limits. The activities undertaken at this stage included initial-fnal analysis, students analysis, material analysis and tasks analysis and learning objectives. In designing stage, designing the prototype of teaching device was done by selecting the format, selecting media and the initial design of teaching materials. The format selection in teaching materials development included format selection for designing the content, the selection of learning

strategies, strategy of REACT assignment and the use of learning resources in order to obtain Draft I.

In development stage, modifying the learning equipment and research instruments, which had been generated on the initial design activities, was revised based on the input of experts. The activities that needed to be done at this stage were experts assesment, legibility testing, and pilot testing. The experts assessment included content validity, language, display, equipment conformity with the objectives. After the draft I was validated and revised based on the judgement of experts, it became Draft II. Furthermore, the legibility testing was done. legibility testing was conducted to obtain direct input in the form of responses, reactions, comments from students and teacher comment on learning equipment and instruments that had been arranged. Based on the legibility testing revision was performed in order to obtain draft III. The equipments produced after legibility testing was pilot testing in learning to see if the learning device produced met the practical and effective criteria as prescribed in this study. The pilot testing result was analyzed, then revised. After it fulflled the criteria, the equipments that had been developed was gained. In disseminating stage, the equipment that had been developed was implementated in another class in the same school to knew the effectiveness study used learning device produced in the development stage.

2.2. Instrument and Data Analysis

The research instrument was a validation sheet, teacher's observation sheet in managing learning, student activity observation sheet, and students' respon data. The data of expert assessment for every aspect of each developed device is analyzed descriptively based on suggestions and comments from the validator. Validation was done to look at the validity of the lesson plan, student worksheets, and assessment test.

Learning device is said to be valid if: (1) Assessment criteria against any validator format, content and language on implementation plans and learning, student worksheets in the category at least well; (2) the test results of the study were declared valid by the validator and meets the criteria of validity, reliability and sensitivity.

Learning device is said to be practical if: (1) the device can be used by teachers, indicated by the observations of teacher's ability in managing learning, namely the assessment of every aspect of the teacher on the initial activity carried out, the core activities, activities and capabilities in managing time in each meeting had a minimal category either; (2) the results of the observation activities of students showed that students can carry out learning activities at each stage in accordance with the allocation time has been set out in the implementation plans with time ideal contained in the implementation plans with a tolerance of 10%.

Learning device is said to be effective if: (1) the student response device learning and positive learning activities, a minimum of 70% for every aspect of the student's response, asked towards learning and student response devices are toward learning activities; (2) to achieve of classical learning outcomes are minimum of 80% of students got a score $\geq$ Minimal mastery criteria.

Data analysis of student activities is describing by the activities of students during learning activities. Percentage of time students used in performing activities is calculated by the formula:

$$\% \text{ Activity} = \frac{time\ spent\ by\ students\ in\ each\ stage}{all\ time\ spent\ in\ one\ meeting} \times 100\%$$

(1)

Student activity is said to be effective when students perform learning activities at each phase in the lesson plan according to the ideal time contained in the lesson plan with a tolerance of 10%.

Analysis of effectiveness data used is the analysis of student responses by using the percentage of student answers to each aspect of the response. The percentage of each student response is calculated by the formula:

$$\% \text{ Response} = \frac{number\ of\ student\ positive\ responses\ each\ aspect\ that\ appears}{total\ number\ of\ students} \times 100\%$$

(2)

The students' responses are positive if each criteria responded positively to each learning component, the percentage is ≥ 70%.

According to Kemp (2011), measurement of effectiveness can be as certained from assessment test, ratings of projects and performance, and records of observations of leaners' behavior. Learning effectiveness is a measure of the success of the implementation of the learning that can be achieved in a meet the indicators: (1) At least 80% of students in the class reaches the thoroughly study; (2) the ability of teachers in managing learning well; (3) the activity of the students effectively; (4) the response of the students towards positive learning.

3. Result and Discussion

The results of the study given in the following stages.

3.1 Defining Stage

The activities that were done at this stage included initial- final analysis, analysis of student, material analysis, tasks analysis and learning objectives. In the initial stage, curriculum analysis was done, were the school use The Curriculum 2013. In the Curriculum, students need to be active in learning activities, scientific thinking, and not only able to solve the problem, but also must be able to construct concepts or procedures with the guidance of teachers as a facilitator.

From the observation of the mathematics learning process in the classroom and the interview with the students at seven class of Junior High School about mathematics lessons, identified some real problems as follows: (1) student learning outcomes not maximized, (2) students feel embarrassed and less trust (3) students memorized the formula, but can not apply the

formula in solving math problems, (4) students are less able to express their opinions systematically, (5) when the teacher gives Questions to students, only some students are trying to answer, (6) Students are less motivated in following learning activities, (7) The student's home is close to the trowulan site.

According to Crawford (2001), the REACT strategy is one of the learning strategies that have relevance to daily life and culture. In addition, this learning strategy seeks to attract and nurture students' interests or concerns. In line with that, the researcher recommends to design and develop learning device REACT strategy based on ethnomatematic-based for rectangular and square materials in seventh-grade junior high school as a solution to solve existing problems.

3.2 Designing Stage

At this stage, the protopype of learning device was designed as lesson plan, student worksheet, and assessment test. In designing stage, prototype of learning device was designed by selecting the format, selecting media and the initial design of learning device. The format selection in development of learning device included format selection for designing the content, the selection of learning strategies, strategy of REACT assignment and used of learning resources.
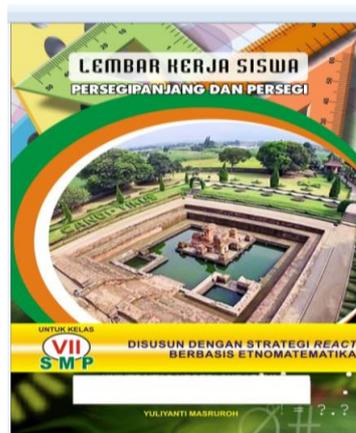
Picture 1. The Cover of Student Worksheet
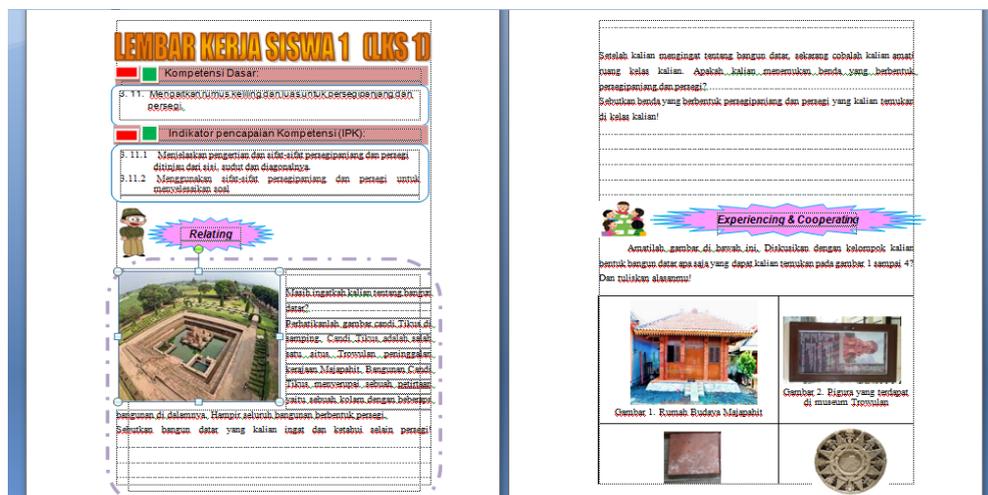
Picture 2. One of The Contens of Student Worksheet

3.3 Developing Stage

At this stage, learning device and research instruments, which had been generated on the initial design activities, were revised based on the input of experts and data obtained from pilot testing. Based on the above activities, acquired lesson plan, student worksheet and assessment test were described below. The developed of lesson plan is one for three meetings. The time allocation used is 6×40 minutes for three meetings, so for each meeting it takes 2×40 minutes. The Student Worksheet (LKS) consists of 3 sets of LKS for three meetings. Activity on LKS 1 aims to enable students to write down the sense of rectangle and square, and students can write down the properties of rectangles and squares. The activity at LKS 2 aims to enable students to find a square and square circumference formula and students can apply the concept of rectangular and square to solve problems in everyday life. While the activity on LKS 3 aims so that students can find a wide formula square and square and students can apply the concept of broad and round square and to solve problems in everyday life.

THB is prepared in the form of essays consisting of 5 items with the allocation of time provided 80 minutes. The process of preparing the test is done by taking into account the indicators of achievement of competence to be achieved. The design of THB includes a grain of questions, test questions and scoring guidelines. The result of learning device development activities can be seen in the following table.

Table 1. Achievement of Learning Device Criteria

Categories	Information
Device learning validation	Valid
Teacher's Ability to Manage Learning	Good
Student activities	Effective
Student's responses	Positive
Completed Student's Learning is 81.25%	Completed

The result of assessment test (THB) can be seen in the following table.

Table 2. The Result of Validity and Sensitivity

Question number	Coefficient of validity	Validity categories	Index of Sensitivity	Interpretation of Sensitivity
1	0.72	High	0,74	sensitive
2	0.55	Enough	0,61	sensitive
3	0.64	High	0,68	sensitive
4	0.69	High	0,71	sensitive
5	0.61	high	0,6	sensitive

The reability result is 0.63 included in the high category. We can conclude that THB meets the criteria of validity, reliability and sensitivity. Based on the data, developed learning

device meet valid, practical, and effective categories. So that learning device can be said good quality.

3.4 Disseminating Stage

After obtaining a good quality learning device, then the learning device is disseminate to different classes at the same school. The purpose of this disseminate is to know the effectiveness of learning by using the REACT strategy based on ethnomathematics. Here the result of disseminating stage

Table 3. The Result of Disseminating Stage

Categories	Information
Teacher's Ability to Manage Learning	good
Student activities	effective
Student's responses	positive
Completed Student's Learning is 84,38%	Completed

Based on Table 3 above, learning by using REACT strategy based on ethnomathematics met all four predefined effectiveness indicators so that it can be said that learning with an ethnomatematics-based REACT strategy on rectangular and square materials of class seven is effective.

4. Conclusions and Sugestions

Development of mathematics learning device with REACT strategies based on ethnomathematics on materials of rectangles and square rectangles for seventh-grade developed using the 4-D model, in this study has been declared valid after obtaining validation from the validator. The learning device can also be said to be practical. The ability of the teacher to manage the learning well where the observer provides a minimum rating of 4 for each assessment criterion, and good or positive student responses. The result of the analysis of effectiveness learning is effective in the classic learning completeness test in the classical reach 81.25% and in the class of learning achievement classically reaches 84, 38%. Therefore is suggested this method could be used to study other materials.

Reference

Balamurugan, M. (2015). *Ethnomathematics; An Approach for Learning Mathematics from Multicultural Perspectives*. International Journal of Modern Research and Reviews. Volume 3, Issue 6, pp 716 -720

CORD. (2012). The REACT strategy: Obtained from http://www.cord.org/the-react-learning strategy/ 8 october 2016.

D'Ambrosio, U. (2007). *The Role of Mathematics in Educational Systems*. ZDM, 39(1–2), 173–181

Eggen, P. D., & Kauchack, D. P. (2011). *Strategies for Teachers: Teaching Content and Thinking Skills*. Boston: Allyn and Bacon.

Hobri. (2010). *Metodologi Penelitian Pengembangan*. Jember: Pena Salsabila

Morrison, G. R., Ross, S. M., Kemp, J. E.,.(2011). *Designing Effective Instruction 6th Edition*. New York: Macmillan College Publishing Company.

Nieveen, N. (1999). *Prototyping to Reach Product Quality. Design Approaches and Tools in Education and Training*. Netherlands. Kluwer Academic Publisher.

Rosa, M, Orey, D. C & D'Ambrosio. (2016). *Current and Future Perspectives of Ethnomathematics as a Program.* Switzerland: Springer Open

Thiagarajan, S., Semmel, D.S., Semmel. M.I. (1974). *Instructional Development for Training Teachers of Exceptional Children, A Source Book*. Blomington: Center of Inovation on Teaching the Handicapped Minnepolis Indiana University. http://www.eric.ed.gov/PDFS/ED090725.pdf (18 Oktober 2016)