STUDY OF PROJECT BASED LEARNING WITH SCIENTIFIC APPROACH OF ETHNOMATHEMATIC TO IMPROVE PROBLEM SOLVING ABILITY

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Abstract

This research aims to determine the problem-solving ability of students using learning model based project learning with a scientific approach containing ethnomatematics. The subjects of the study were students of class VII.A, VII.B and VII.C at Junior High School Negeri 1 South of Tanimbar, Southeast Maluku Regency. The research method is a development method with pretest-postest, design group dick. The experimental group was treated in a project based learning model with a scientific approach containing ethnomatematics and control group with expository learning. Data were collected through syllabus, RPP, LKS and test result of student learning. The result of data analysis shows that the problem solving ability of the students applied by project based learning model with the scientific approach of ethnomatematics is better than the expository learning.

Keywords: ethnomathematic, problem solving skills, project based learning, scientific.

Introduction

Education is an important key in the development of a nation. According to Carter in Siswoyo (2007: 54) education is the process of developing human capabilities and behavior as a whole. The development step is always strived in tune with the demands of the times. The development of the times always raises new problems that never thought before.

One of the subjects that has a role in building student competence is mathematics. According to Wardhani (2010: 10), the standard content of mathematics subjects in 2006 stated that the subjects of mathematics are studied with the aim that learners have some ability, namely; ability to understand mathematical concepts, using reasoning, problem solving, communicating ideas,

and having an appreciative attitude to the usefulness of mathematics in life. Problem solving skills are necessary in everyday life to overcome the problems that exist. Therefore it is necessary to teach that can spur students' ability in solving math problems.

Facts that exist, the problem solving ability of junior high school students / equivalent in West Southeast Maluku regency is still low. The low ability of problem solving is shown from the result of problem-solving test by the researcher in the preliminary research with the average value of problem solving ability of class VII students on triangle and quadrilateral material is 58.67 less than KKM that is 70. Low ability of problem solving of students caused by some errors, such as can not understand the problem and can not design problems.

Culture math learning will contribute greatly to school mathematics, because schools are different social institutions with others that enable socialization between different cultures (Shirley, 2008). Learning that links material to the cultural environment will encourage students to make connections between their knowledge and application in everyday life. According to Rosa (2011: 48) the application of etnomatematika in learning can develop a mathematical understanding and can improve the absorption of mathematical concepts.

Model project based learning is very appropriate in overcoming the existing problems. The main activity in this model is to solve problems through a series of group activities based on the project so that students can be actively involved in learning. The main focus of this learning model is student activity, learning activities will be more leverage with an appropriate approach is the scientific approach. Steps on a scientific approach that observes, asks, gathers information, associate, and form a network / communicate (Kemendikbud, 2013).

The purpose of this study is to determine the problem solving ability of students through project-based learning model with a scientific approach containing ethnomatematics and expository learning.

THEORY

Project-based learning by Yusoff (2006: 22) has the first six stages of "Starts With the Essential Question". Learning begins with an essential question. This question can come from teachers or from students or collaboration between the two. This essential question will be the center of the Project Based Learning. The second stage is "Design a Plan for the Project". At this stage, students work collaboratively together with teachers to plan a project to solve the questions that have been formulated in the first stage. To be precise in the design of the project, then digging information related to the question.

The third and fourth stages are "Creates a Schedule" and "Monitor the Students and the Progress of the Project". At this stage, students create a project execution schedule and simultaneously run projects under the teacher's monitor. The essence of project implementation is done at this stage. Students make observations / experiments in ways that have been designed in the previous stage. The fifth stage of "Assess the Outcome". Outcome can be interpreted as the overall result (product) during project activity. Thus, this stage is done after the project is completed. Outcomes are assessed to assist teachers in measuring competency standards, knowing each student's progress, providing feedback on the level of understanding students have achieved, and assisting teachers in developing future learning strategies.

The last stage is "Evaluate the Experiences". At the end of the learning process, teachers and students reflect on the activities and outcomes of the projects already obtained and their feelings

and experiences during project completion. Teachers and students develop discussions in order to improve performance during the learning process so that a new inquiry can be found to answer the problem posed at the first stage of learning.

Permendikbud No. 65 Year 2013 on the Standard Process of Primary and Secondary Education has hinted at the need for a learning process guided by scientific / scientific approach principles. The application of a scientific approach to learning involves process skills such as observing, questioning, experimenting, associating, networking (Kemendikbud, 2013). Teacher guidance is necessary in carrying out the scientific process.

Observing activities aim to make learning closely related to the context of real situations encountered in everyday life. The process of observing facts or phenomena includes seeking information, seeing, hearing, reading, and or listening. In observing activities, the teacher opens opportunities for learners to broadly and widely observe through viewing, listening, listening and reading activities. Activity of questioning is done as one of the process of building student knowledge in the form of facts, concepts, principles, procedures, law and terori. In this activity the teacher guides learners to be able to ask questions about concrete object observations to abstract results relating to facts, concepts, procedures, or anything else more abstract.

Experimental activities try to improve students' curiosity in strengthening the understanding of facts, concepts, principles, or procedures by collecting data, developing creativity, and scientific work skills. These activities include planning, designing, and conducting experiments, presenting data, processing data, and drawing conclusions. Activity of association aims to build the ability to think and be scientific. The information (data) result of the activity tries to be the basis for the next activity that is processing information to find the interconnection of one information with other information, find the pattern of the information linkage and even take the

conclusions from the pattern found. The results of try and associate activities allow students to think critically high level (higher order thinking skills) to metacognitive thinking. The next activity is to write or tell what is found in information seeking activities, associate and find patterns. The results are presented in the classroom and assessed by the teacher as a result of learning the learners or groups of learners.

Learning with a scientific approach has the following characteristics; (1) student-centered; (2) involve the skills of the process of science in constructing concepts, laws or principles; (3) involves potential cognitive processes in stimulating the development of the intellect, especially the students' high-order thinking; and (4) can develop student character.

Ethnomatematics is the implication of culture characteristics in learning mathematics (D'Ambrosio, 2008: 94). Ethnomatematics was originally pioneered by Ubiratan D'Ambrosio 1985, etnomatematics can be referred to as "math in the environment" or "math in the community. Bishop (2004) explains that the ethnomatmatic implications should take account of the following; (1) Human interaction, ethnomatics relate mathematical activities in society; (2) Social values, involving mathematics with values, beliefs in society; (3) Language, mathematical and cultural interactions, because language as the main carrier of mathematical ideas; (4) The history of mathematics, developing mathematical ideas in the cultural diversity of society; (5) Cultural Roots.

Methodology

Research and development methods according to Sugiyono (2013: 407) is a research method used to produce a specific product and test the effectiveness of the product. Research and

development (R & D) by Borg & Gall (2003) is a research method used to develop or validate products used in education and learning.

According to Ibrahim the learning tools needed in managing the teaching and learning process can be: student book, syllabus, learning implementation plan (RPP), student activity sheet (LKS), evaluation instrument or learning result test and instructional media (Trianto, 2013: 68). In this study the researcher limits the learning device only on: syllabus, learning implementation plan (RPP), student book, student activity sheet (LKS), and problem solving ability problem.

Borg and Gall's research and development stages are simplified into four main steps: preliminary study, planning, testing, validation, and dissemination.

1. Preliminary study phase, is a research and information collecting activity has two main activities, namely literature study (literature review and previous research results) and field studies.
2. The planning stage, as a combination of the planning and development stage of the preliminary form of product contains activities; determining the objectives, determining the qualifications of the parties involved in research and development, formulating the participation of the parties involved in research and development, determining the working procedure, and the feasibility test.
3. Field test phase contains preliminary field testing, main product revision, main field testing, and product revision have main activities that are test, both preliminary field test and broad field test. At this stage it also contains revising the results of the product trial. This pilot activity is cyclical (design, implementation, evaluation, and refinement) until a product is ready to be validated. The next activity is validation, consisting of operational field testing and final product revision with the aim to test the product through the

experimentation of device product in school. The results of this experimentation are taken into consideration in making recommendations on the effectiveness and adaptability of learning tools.

4. The dissemination stage, defined as the dissemination and implementation stage contains socialization and distribution activities. This activity is realized in the form of socialization of the products of development to prospective users and related parties in the field of education

Subjects and Objects

This research was conducted at Junior High School Negeri 1 South of Tanimbar in academic year 2016/2017. The experimental subjects in this study were grade VII students of 3 classes from 4 classes. 1 class as an experimental class (experimental) class VIIA with total number of 37 students, 1 class as control class using expository learning that is class VIIB with total 35 students and 1 class of test instrument of problem solving test that is class of VIIC. Subjects in the experimental class were selected 6 students, each of which 2 students representing the upper group, 2 medium group students and 2 lower group students for further analysis purposes.

Data Collection Instruments

Learning device validation sheet, Observation sheet, Test Question, Sheet Questionnaire

Data analysis technique

Data analysis techniques on research instruments developed to support learning tools in this study are as follows. Data obtained from validator of learning device development for each aspect of each device including: syllabus, RPP, teaching materials, LKS and problem solving test developed were analyzed based on score average. Assessment criteria consist of 5 criteria that is

very low (value 1), low (value 2), medium (value 3), high (value 4), and very high (5). Describing the average score from the assessment of the experts using the assessment criteria in Table 1.

Table 1. Validity Rating Criteria

NILAI	KATEGORI
$1{,}0 < x \leq 1{,}8$	Not Good
$1{,}8 < x \leq 2{,}6$	Less good
$2{,}6 < x \leq 3{,}4$	Quite Good
$3{,}4 < x \leq 4{,}2$	Good
$4{,}2 < x \leq 5{,}0$	Very Good

Description: x = Average total score

Learning devices are said to be valid, if each device is in the "Good" or "Very Good" category

Results and Discussion

The syntax of learning-based project learning with an ethnomatmatic-charged scientific approach is described in Table 2.

Table 2. Project Based Learning Syntax with Scientific Approach Being Ethnomatematics

Stages of Project Based Learning	**Learning process**
1. Prepare project questions or assignments	Teachers form groups and then give problems about triangular matter. Examples of students are asked to determine the angle of furniture objects / crafts in the form of triangle and its properties, the teacher prepares the student worksheet to be filled according to the activities to be done.
2. Design project planning	Students discuss how to solve problems encountered, and prepare the necessary materials and tools such as rulers, bows, scissors, adhesives etc.
3. Develop Schedule	Teachers together with students make up the

Stages of Project Based Learning	Learning process
	schedules and tasks of each group member.
4. Monitor project activities and developments	Implementing the schedule that has been made in the previous stage, the teacher monitor the activities of the students.
5. Test results	The teacher measures the progress of the student with the understanding that has been gained as well as the feedback member on the student's work.
6. Evaluate activities / experiences	Each group presents the results that have been obtained in front of the class.

A. Analysis of the Effectiveness of Implementation of Learning Devices

The application of learning tools is said to be effective if: (1) more than 75% of students taught using project-based learning models with ethnomatematically charged approaches have a value of problem solving skills of at least 70 (achieving KKM), (2) Student-solving skills taught using the model of project based learning with a scientific approach containing ethnomatematics is better than the students taught by the expository method, (3) the proportion of students' problem solving abilities taught using project based learning model with a scientific approach containing ethnomatematics is better than the students taught by the method expositories, (4) the influence of process skills and attitudes on the local culture on students problem solving skills, (5) the improvement of problem solving skills of students who are taught using project based learning model with ethnomatematics-charged scientific approach, (6) work on process skills and student attitudes toward culture.

B. Complete Test

Table 3. SPSS Output One-Sample Test

Test Value = 70

	t	Df	Sig. (2-tailed)	Mean Difference	95% Confidence Interval of the Difference	
					Lower	Upper
TKPM	4.149	36	.000	5.83784	2.9842	8.6914

Table 3 shows t count = 4,149 and t_ (table) with dk = 36 and a significant level used 5% = 1,688. Because t count = 4.149 > ttable = ¬1,688, then H0 is rejected and H1 is accepted. It can be concluded that the average problem solving ability of students who were taught by project based learning model with a scientific approach containing ethnomatematics more than 70.

The classical thoroughness test is used to find out if more than 75% of students achieve a minimum score of 70 in the problem-solving test. The value of the test results of problem solving skills of students who were taught using a project based learning model with a scientific approach containing etnomatematics then tested its classical mastery. Obtain a value of z ¬ = 1.67> z tabel = 1.64. Because z count > z (0,5 -0,05) then H0 rejected means H1 accepted. It can be concluded that more than 75% problem solving skills of students who were taught using project based learning model with a scientific approach containing ethnomatematics reached or above 70 (KKM).

C. Appeal test

Tabel 4. *Output SPSS Independent Samples Test*

		Levene's Test for Equality of Variances		t-test for Equality of Means						
									95% Confidence Interval of the Difference	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
TKPM	Equal variances assumed	1.411	.239	3.296	70	.002	6.00927	1.82340	2.37261	9.64592
	Equal variances not assumed			3.317	67.847	.001	6.00927	1.81147	2.39440	9.62414

Calculation using SPSS obtained t count of 3,296. While the t table value with a real level of 5%, obtained ttable of 1.67. Because t count > t table, then H0 is rejected and H1 accepted. It can be concluded that the average problem solving ability of students who are taught by project based learning model is better than the average problem solving ability of students who are taught by expository method.

D. Influence Test

1. Linieritas Test

Tabel 5. *Output SPSS ANOVA*[b]

Model		Sum of Squares	Df	Mean Square	F	Sig.
1	Regression	1383.984	2	691.992	18.776	.000[a]
	Residual	1253.043	34	36.854		
	Total	2637.027	36			

Tabel 5. *Output SPSS ANOVA*[b]

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	Total	2637.027	36			

a. Predictors: (Constant), X2, X1

b. Dependent Variable: Y

From Table 5, the sum of squares for regression is 1383,984; the residual is 1253,043; and the total is 2637,027. The mean squared deviation (mean square) for regression is 691,992 and the residual is 36,854. Ftable = 18,776> Ftable (0,05: 2: 34) = 3,28 and sig = 0,000 <0,05 (5%), meaning H0 is rejected and H1 accepted. So it can be concluded that there is a linear relationship between Process Skills (X1) and Attitude (X2) with Problem Solving Ability (Y).

2. Significance Test

Tabel 6. *Output SPSS Coefficients*[a]

Model		Unstandardized Coefficients		Standardized Coefficients		
		B	Std. Error	Beta	T	Sig.
1	(Constant)	52.022	4.569		11.385	.000
	X1	7.392	1.380	.671	5.357	.000
2	(Constant)	17.633	15.530		1.135	.264
	X1	6.687	1.337	.607	5.000	.000
	X2	8.806	3.820	.280	2.305	.027

a. Dependent Variable: Y

From Table 6 we get the sig value for X1 = 0,000 <0,05 so H0 is rejected and accepting H1, it means that the diversity of Y value can be explained by the diversity of X1 value (process skill) by itself. The sig value for X2 = 0.027 <0.05 so H0 is rejected and accepting H1, meaning that the value of Y can be explained by the diversity of X2 values (student attitudes) by itself.

E. Improvement Test

Tabel 7. *Output SPSS* Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
			Sig.						95% Confidence Interval of the Difference	
		F		T	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
Selisih	Equal variances assumed	.777	.381	2.874	70	.005	4.16216	1.44833	1.27355	7.05077
	Equal variances not assumed			2.890	68.529	.005	4.16216	1.44012	1.28885	7.03548

Based on Table 7 obtained significant value = 0.381 > 0.05, means that both groups have a homogeneous variant. Table 6 shows a tcount of 2.874. While the ttable value with a real level of 5%, obtained ttable of 1.67. Because t count > t table, then H0 is rejected and H1 accepted. It can be concluded that the difference of student problem solving ability after being taught using project based learning model with scientific approach is better than the average problem solving ability before being taught using project based learning model with scientific approach.

The result of the experimental learning of mathematics learning model of project based learning with scientifically charged approach of ethnomathematics shows: 1) problem solving ability which is taught using project based learning model with scientifically-charged approach of etnomathematics reaches classical completeness; 2) the problem solving skills of students who are taught using a project based learning model with a scientific approach containing ethnomatematics is better than students being taught by expository methods; 3) the proportion of students' problem solving abilities taught using project based learning model with a scientific approach containing ethnomatematics is better than the students taught by expository method; (4) there is influence of process skill and attitude on local culture to student problem solving ability 52,5%; (5) the improvement of problem solving skills of students who were taught using a project based learning model with a scientific approach containing ethnomatematics. Based on the description can be concluded that the application of learning devices mathematics model of project based learning with a scientific approach containing ethnomatematics effective

Conclusion

Implementation of learning-based model of project-based learning tools with scientifically-charged approach of ethnomatematics is effective, because the problem-solving abilities that are taught using project-based learning model with a scientifically-charged approach to etnomatematics achieve classical mastery, problem-solving skills of students who are taught using a project based learning model with an ethnomatematically charged scientific approach better than the students taught by the expository method, the proportion of students' problem solving abilities taught using a project based learning model with a scientific approach containing ethnomatematics is better than that of students taught by expository methods, there is an influence of process skills and attitudes on local culture to the problem solving ability of

students equal to 52,5%, the improvement of problem solving ability of students who taught using project based learning model with ethnically charged approach of sincerity atematics, an increase in process skills and attitudes toward culture.

Suggestion

1. The result of research of development of learning device of mathematics model of project based learning with scientifically-charged scientific approach has fulfilled valid, practical, and effective criteria so that learning device can be used as an alternative of learning in school, especially on triangle material.
2. For teachers it is advisable to apply project based learning model learning with scientific approach and using learning tools that have been developed through this research, with note that necessary modification is necessary to adjust to local situation and condition.

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