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THE DEVELOPMENT OF ETHNOMATEMATICS-BASED TEACHING MATERIAL WITH A MULTI-REPRESENTATION APPROACH ON THE SUBJECT OF GEOMETRIC TRANSFORMATION TO IMPROVE UNDERSTANDING OF MATHEMATICAL CONCEPTS IN THE GRADE IX STUDENTS OF JUNIOR HIGH SCHOOL

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ABSTRACT

This research purposes to determine characteristics of ethnomatematics-based teaching material with valid quality, practicality and effectiveness using multi-representation approach. Teaching material is one of the efforts to improve students' understanding of geometry transformation concept. This resarch use development research from Plomp model which consists of three phases, they are Preliminary Research, Prototyping, and Assessment. The subject of the research is IX grade students of Undiksha Laboratory Junior High School in 2019/2020 school year. The method fot collecting data is questionnaire and test. Whereas the instrument is validation sheet to obtain data on validity of teaching material, sheets of teaching material implementation, questionnaire responses of teachers and students to obtain data on practicality of teaching material, and tests of mathematical concepts understanding to obtain data on effectiveness of teaching material. The result is teaching material having good quality, validity, practicality, and effectiveness. Student teaching material emphasize student-centered learning, contain problems that are close to student life, use various representations to construct understanding and initiate problems with Balinese culture. It uses carvings of traditional Balinese buildings to instill geometry transformation concept. Teacher's guidance helps teacher in learning including alternative action, answer, lesson plan that are appropriate to learning process on multi-representation approach.

KEYWORDS: Teaching Material, Ethnomatematics, Multi Representation, Understanding of Mathematical Concepts.

1. INTRODUCTION

Uno (2012) states that one of the mathematical characteristics is as a symbol system with abstract structure. The concept taught by mathematics are hierarchical, so a prior understanding is needed to learn the next concepts. In Appendix of Permendikbud No. 58 of 2014 concerning Junior High School Curriculum, it states that one of the goals of mathematics is that students can flexibly, accurately, efficiently, and precisely understand mathematical concepts such as competence in explaining inter-conceptual relationships and using concepts or algorithms in problem solving. Hudojo (in Astuti, 2018) also confirms that learning mathematics needs to understand the concepts and structures contained in the subject being studied and to find the relationship between the concepts and structures.

Mullis *et al* (2011) explain that the average percentage of correct answers of Indonesian students in the TIMSS study in 2011 was 31% knowing, 23% apllying, and 17% reasoning. The average is far below the average percentage of international correct answers, it is 49% of knowing, 39% of applying, and 30% of reasoning. It indicates that students' understanding of mathematical concepts is still fairly low. This is also confirmed by research conducted by Rojak (2017) which stated that the ability of students to understand concepts in the category was lacking. It can be seen from the scores obtained by students after answering the test in the form of a description that is 12.31 of the ideal score of 30 or can be said that students are only able to answer 41.03% and included in the category of less.

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Geometry transformation is a branch of geometry that studies about identifying changes in an object or field of geometry which includes its own position, size, and shape (Novrika et al, 2016; Kirby & Boulter, 1999). Febrian & Perdana (2017) states that in reality most students do not easily understand the concept of geometry transformation, it is due to the weak practice of teaching geometry transformation in the classroom. Tunnisa et al (2018) also confirm from the results of interviews conducted that there was information that there are still many students whose learning outcomes are low on the material of geometry transformation, it is due to the difficulty of the teacher in providing understanding to students to apply the principles of transformation. So that students' understanding of mathematical concepts, especially in geometrical transformations, is fairly low. Whereas learning geometry is very important for students. Paradesa (2016) states that learning geometry is very important for students, because geometry helps humans have a complete appreciation of their world, geometry exploration can help develop problem solving skills, geometry plays a major role in other mathematical fields and geometry is full of challenges and interesting.

Therefore, it needs a more innovative learning in an effort to improve the quality of mathematics learning that can affects students' understanding of mathematical concepts. Herman (2007) states that in abstract mathematics learning students need tools in the form of media and props that can clarify what is conveyed by the teacher, so that it is easier for students to know and understand. Concrete objects that can be imagined and found in everyday life and can be used in the learning process, especially geometric transformation, are indonesian cultures, especially Balinese culture, such as carvings/ornaments or physical forms of traditional Balinese buildings.

Turmudi (2018) states that our common sense can accept that learning and working on mathematics involve culture, social, and cognitive phenomena which are inseparable. Hardiarti (2017) also confirms that mathematics and culture are something that cannot be avoided in daily life, because culture is a whole and comprehensive unit and is applicable in a society. While mathematics is the knowledge that humans use in solving everyday problems. Suharta *et al* (2017) state that mathematics is used in various aspects of life, because mathematics is close to everyday life. Daily habits or activities are included in mathematics. The whole system of thought, values, morals, norms and beliefs of human society is culture. Therefore, in teaching mathematics to students it can be linked to culture so that learning activities become more meaningful. Schultes and Shannon (1997) found that many students more appreciated mathematics after studying the subject matter from a cultural perspective.

Bali has arts that are well known among the general public, Balinese buildings or traditional Balinese houses have unique shapes and appearance filled with carvings or ornaments (Suharta *et al*, 2017). Carving or ornamentation in traditional Balinese buildings unconsciously is nothing else from the result of a mathematical concept that is the transformation of geometry. Ina, *et al* (2018) state that geometric theories that can be applied to the Balinese gate building are reflection and dilation. Novrika *et al* (2016); Clements & Burns (2000); Kirby & Boulter (1999) state that the concept of geometry transformation can be applied in everyday life or working world that requires sophisticated instruction such as in the fields of art and architecture.

The term used to associate mathematics and culture is called by Ethnomatematics (Suharta *et al*, 2017). Ethnomatematics as a context in learning mathematics can be packaged in the form of problems that are used to bridge students in finding mathematical concepts (Martyanti & Suhartini, 2018). Dekam (2014) also confirms that ethno-mathematics aims to draw cultural experience and use of mathematics , so that not only does it make learning mathematics more meaningful, but it also gives insight for student that mathematical knowledge is embedded or close to social and cultural environments, and students can better appreciate the use of mathematics in daily life. Ethnomatematics is introduced by D'Ambrosio, a Brazilian mathematician in 1977. Ethnomatematics is mathematics that is applied to cultural groups identified such as ethnic communities, labor groups, children of certain age groups, professional classes and so forth (D'Ambrosio, 2013).

One of ethnomatematic applications in an effort to maintain culture in student learning processes and to improve understanding of student concepts is by creating teaching material in the form of culture-based modules (ethnomatematics). Idris *et al* (2014) state that the type of module teaching material can be used as one of the alternative teaching material with the purpose of increasing students' understanding of concepts and interest in learning. Module is teaching material that is systematically arranged in a language that is easily understood by

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students, according to their age and level of knowledge. So that they can independently learn with minimal guidance from educators (Depdiknas, 2009).

Paradesa (2016) states from the point of mathematics that geometry provides approaches to solve problems for example drawings, diagrams, coordinate systems and transformations. It relates to the term representation, Goldin (in Kartini, 2009) states that representation is a configuration (form or arrangement) that can describe, represent or symbolize something in a way such as verbal, diagrams, graphs, computer simulations, the use of concrete objects, equations mathematics and so forth. "The use of diverse representations in problem solving is called by multi representation" (Darmastini & Rosyidi, 2014: 57). Based on this, the teaching material that will be developed in this case is based on ethnomatematics using a multi-representation approach, where the teaching material is made to contain various representations such as pictures, graphics, tables, verbal and so forth. So that it will indirectly train students constructing his knowledge, this is also in line with Bruner's learning theory. Ni'am (2004) states that the learning of geometry material as one of the abstract material in the learning process should begin with contextual problems, concrete geometry objects can make it easier for students to understand the material on the concept of geometry. Concreting the geometry of transformation objects can use a multi representation approach.

2. MATERIALS AND METHODS

a. Materials

A. Learning Module

Module is learning tool that containd material, methods, limitations, and ways of evaluating that are systematically and attractively designed to achieve the expected competencies according to their level of complexity. In the side of implementation the module system focuses on student activities and creativity in the teaching and learning process (MONE, 2008). Sirate et al (2017) state that the strategy of organizing learning material contains squencing which refers to the making of the order of presentation of subject matter and synthesizing which refers to efforts to show students the relationship between facts, concepts, procedures and principles contained in learning material. Isniatun (2008) states that the module has certain characteristics which are in the form of the smallest and most complete learning unit, contains a series of systematic learning activities, contains learning objectives, enables independent learning and is a realization of individual differences and the realization of individual learning. Based on a number of opinions, it can be concluded that the module is a teaching material or a systematic and directed learning tool consisting of material, methods, boundaries, and ways of evaluating with the organizing strategy of the material which refers to make the order of presentation of subject matter and efforts to show to students the relationship between facts, concepts, procedures and principles contained in the material to achieve learning objectives and enable students to independently learn.

B. Ethnomatematics

Ethnomatematics had been introduced by D'Ambrosio a Brazilian mathematician in 1977. Rosa *et al* (2017) state that ethnomatematics is a research program that combines history, anthropology, pedagogy, linguistics and mathematical philosophy with pedagogical implications that focus on the techniques of explaining, understanding, and overcoming various social cultural environment. Yusuf et al (2010) state that ethnomatematics refers to all forms of cultural knowledge or characteristics of social activities of cultural groups that can be recognized by other groups. Zayyadi (2017) states ethnomatematics can be in the form of various results of mathematical activities that are owned or developed in the community, including mathematical concepts such as cultural relics in the form of temples and inscriptions, pottery and traditional equipment, local units, batik cloth motifs and embroidery, traditional games, and community settlement patterns. Based on several opinions, it can be interpreted that ethnomatematics is mathematics learning in the form of cultural knowledge that is applied through social activities and cultural groups such as tribal communities, labor groups, children of certain age groups, professional classes and so forth.

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C. Multi Representation

According to Goldin (in Kartini, 2009), representation is a configuration (form or arrangement) that can describe, represent or symbolize something in a way such as verbal, diagrams, graphs, computer simulations,

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mathematical equations. Meanwhile, according to Sabirin (2014), representation is model or substitute for a problem situation that can be used to find solutions such as pictures, words or mathematical symbols. The use of diverse representations in solving a problem is called by multi representation (Darmastini & Rosyidi, 2014). Carl Angell (in Treagust, 2008) states that multi-representation is a model that represents the same concept in a number of different formats. Based on this, it can be concluded that multi representation is a form or arrangement that can describe something in a way in various forms of representation such as tables, graphs, drawings, sketches, mathematical models or other ways.

In this research, multiple representations contained in minimal teaching material is in the form of pictures, tables, verbal, mathematical equations used for students find sub-topic concepts being discussed such as finding the formulation, understanding and properties of the type of transformation discussed. Students also use concrete objects that lead students to do activities to find answers why carving/ornamentation or even the physical form of the Balinese building includes the concept of the type of transformation being discussed. Teaching material is designed in such a way that students are asked to cut out the carvings found on the back page of the module, then they attach to the area of the Cartesian coordinates with a certain point and use concepts that have been previously found. During class discussions, the teacher shows the use of other media such as GeoGebra to clarify student work that is manually done.

D. Understanding of Student Mathematical Concept

Understanding the concept consists of two words, they are understanding (comprehension) and concepts. Sardiman (2007: 42) states that understanding or comprehension can be interpreted as mastering something with the mind, learning must mentally understand the meaning and philosophy, purpose and implications as well as its applications, thus causing students to understand a situation. According to Wardhani (2008: 8), The meaning of the concept is ideas (abstract) that can be used or allows someone to classify or classify an object". According Kilpatrick et al (2001: 5), understanding concept is the ability to understand concepts, operations and relationships in mathematics. Based on this, it can be concluded that the understanding of mathematical concepts can be interpreted as the ability to understand abstract ideas to classify objects or events in mathematics.

The indicator used in this research to measure students' understanding of mathematical concepts uses the NCTM (2000) reference. The ability of students to understand mathematical concepts in this research will be assessed by tests of understanding mathematical concepts

E. Teaching Material Based on Ethnomatematics with Multi Representation Approaches

Ethnomatematics used in this case are traditional Balinese buildings both in terms of carving/ ornamentation or physical form of the building in the study of the concept of geometry transformation. As for some forms of Balinese carvings/ornaments will be used on teaching material in which the carvers unconsciously and basically use the concept of geometry transformation.

1. Translations

Figure 1. Carving of Kaketusan Kakul-Kakulan

Suparta (2010) states that the motive of keketusan is the result of the stylization of the shape of plants, animals and other natural objects. It is created by compiling repeatedly, with the same patterns and motifs, in order to find a beautiful whole carving. One of the best-known *kaketusan* in Bali is *kaketusan kakul-kakulan*. Making one carving to another carving is repeatedly with the same pattern by not changing the shape and size of each carving, so people unconsciously make objects with one another using the concept of translation / shift.

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2. Reflection

Figure 2. Candi Bentar

Another characteristic of the island of Bali is the existence of gate which is more commonly called by *Candi Bentar* which is mostly found in temples. Between the right and left sides of candi bentar, it has the same appearance, shape and size. If someone precisely stands in the middle among the two sides of the temple, the distance between the temple and the right side will have the same distance as the temple of the left side of the temple to the person. Thus, it unconsciously makes an archway containing an element of reflection on the *Y*-axis.

3. Rotation

Figure 3. Carving of Patra Samblung

Suparta (2018) states in the Balinese Dictionary that *patra* is a decorative motif that has a pattern and has characteristics in accordance with the flora and fauna that are stylized. One of the carvings which is *pepatraan* is *samblung* carving found in traditional houses in Bali in which people commonly call it with *ganggong* building which has ornaments like Figure 3. In Figure 4, it is a simpler carving *samblung*, *samblung patra* is a *patra* made by repetition of motifs by turning the next object. Because of its creation which flips the next object / engraving, it is related to the concept of rotation. One of them is a rotation of 180^0. It can be simply described as following.

Figure 4. Application of Rotation Concepts in Simplified *Patra Samblung* Carving

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4. Dilation

Figure 5. *Karang Bhoma* Pintu Puri Agung

Karang Bhoma is a mask of the face of a sacred face carved above the entrance gate of the main gate (*kori agung*) area or the building of Bali. *Karang Bhoma* has the form of a giant head depicted from the neck upward complete with ornaments and crowns, derived from the *Baomantaka* story.There is *Karang Bhoma* without hands and some are complete with hands from wrist to fingers with fingers in bloom. This giant face mask ornament is generally united with carved flowering plants spreading in various artistic directions. Seen from the head which is carved with barong with several levels (figure 5), when it is viewed from the first carving to the top, it will be *k* times enlargement. While it is viewed from above until the first carving, it will be a reduction in *k* times. This is in accordance with the concept of dilatation which reduces or enlarges an object with a certain multiplier factor *(k).*

The pictures above are some examples of carvings/ornaments or physical forms of traditional Balinese buildings that will be used in teaching material developed. The teaching material is contained by elements of pictures, tables, verbal, students' skills in using media in the form of concrete objects as well as the use of other supporting media that are adapted to the sub topics discussed, one of the approaches used is the multi representation approach. Simply, the design of integrating learning with ethnomatemics-based teaching material in learning uses a multi-representation approach, they: (1) The teacher gives apperception to students as a prerequisite material before students are taught new concepts, (2) Students are formed into several groups, (3) Students discuss teaching material used by teachers. In the instructional material containing the design, ethnomatemics drawings are displayed in this case, they are traditional Balinese carvings / ornaments / buildings in accordance with the sub topics discussed, so that it will arouse students' curiosity, (4) Students carry out activities such as drawing and cutting engraving / Balinese ornaments on the back page of the module, then it is attached to the area of the Cartesian coordinates to fill the table designed, so that later students find the formulation of the type of transformation discussed, (6) Presentation and class discussion is to see the extent of student understanding, (7) Demonstrated by media such as using Geogebra to clarify the work made by students on teaching material, (8) Students will be given by another ethnomatematics picture, then students are asked to show a part of the building that contains the sub-topic concepts being discussed to see that students are able to master the material taught through the use of teaching material.

b. Methods

This type of research is development research. The development of this research refers to the Plomp development model (2013) which consists of 3 phases, they are: 1) Preliminary Research, 2) Prototyping, and 3) Assessment. The products produced in this research are teaching material for students and teacher instructions in the form of ethnomatematics-based mathematics modules with the stages of implementing learning using a multi-representation approach. The method fot collecting data is questionnaire and test. The quality of teaching material produced is reviewed from three aspects, they are validity, practicality, and effectiveness.

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This research took place in Undiksha Lab Junior High School. The research time is in the odd semester of the 2019/2020 school year. The timing of the research was in the odd semester of the 2019/2020 school year because the material for transformation in class IX was found in this semester. Research subjects are experts, students, and teachers. The expert's role is to obtain data regarding the validity of teaching material. Students play a role to obtain data about the practicality and effectiveness of teaching material. The selection of class IX as a research subject is based on several considerations which basically support the realization of teaching material developed, one of them is the characteristics of heterogeneous students and classes that are not superior classes. The students of this research are students of class IX-2 in limited trials, class IX-3 in practice trial I and class IX-1 in practice trial II. The teacher's role is to obtain data about the practicality of teaching material. The process of developing teaching material can be seen in the following prototype model diagram.

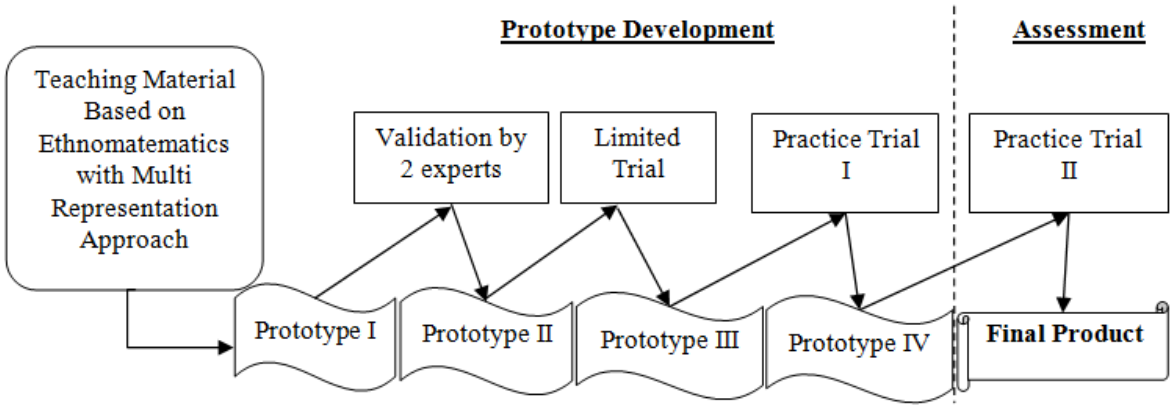

Figure 1. Prototype Model Diagram

The instruments used in this research are as following.

1. The instrument to measure the validity of the developed teaching material used the validation sheet of teaching material of student mathematics module and mathematics instructional module of teacher. The validation sheet was filled by two experts, they were two lecturers from Ganesha University of Education majoring in mathematics education. The results of the validation were recapitulated to determine the average score of validation and find out the categories of the scores obtained. In determining the category of the score obtained, it was used the validity criteria of teaching material.

Table 1. Validity Criteria of Teaching Material

Score	Criteria
$3{,}5 \leq Sr \leq 4{,}0$	Very valid
$2{,}5 \leq Sr < 3{,}5$	Valid
$1{,}5 \leq Sr < 2{,}5$	Invalid
$1{,}0 \leq Sr < 1{,}5$	Very Invalid

2. Instruments to measure the practicality of teaching material developed used observation sheets of the implementation of teaching material, student questionnaire responses to student mathematics modules and teacher questionnaire responses to teaching material, it was student mathematics modules and teacher mathematics modules. On the implementation sheet of teaching material, the student response questionnaire and the teacher's questionnaire responses to teaching material were also validated by two experts on the first point. The questionnaire was filled out by students, teachers and researchers. The results of the filling were analyzed to determine the category score using the practicality criteria of teaching material.

Tabel 2. Validity Criteria of Teaching Material

Score	Criteria
$3{,}5 \leq Sr \leq 4{,}0$	Very practical
$2{,}5 \leq Sr < 3{,}5$	Practical
$1{,}5 \leq Sr < 2{,}5$	Not practical

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Score	Criteria
$1{,}0 \leq Sr < 1{,}5$	Very Not practical

3. Instruments to measure the effectiveness of teaching material that were developed use a mathematical concept understanding test instrument, the material is devoted to the subject of geometrical transformation in accordance with the material set forth in the teaching material developed in this research. The test contains several indicators of learning geometry transformation material and contains indicators of understanding mathematical concepts that refer to NCTM (2000) as well as several dimensions of knowledge, they are C1, C2 and C3. The indicators used can be seen in the test grille used. To assess the results of tests that have been carried out, it refer to the scoring rubric using the reference NCTM (2000). Teaching material is stated to be effective, if the average score of students' understanding of mathematics concept tests reaches the minimum KKM set by the school.

Table 3. Test Scoring Rubric of Concept Understanding in Mathematics

Indicator	Score	Category
Reiterating concepts learned in their own words	0	No answer
	1	Restating a concept in their own words but being wrong
	2	Restating concept that have been made in their own words correctly
Identifying what is included as an example or not as an example of a concept.	0	No answer
	1	Identifying what is included as an example or not an example of a concept but being wrong
	2	Identifying what is included as an example or not of a concept correctly
Applying concept in various situations.	0	Not making answers or just repeating information that is known from the answer
	1	Applying the concept in various situations but wrong
	2	Correctly applying concepts in various situations, but the calculations and final answers are wrong
	3	Correctly applying concepts in various situations, calculations are correct but the final answer is wrong
	4	Correctly applying concepts in various situations, calculations and final answers are correct

4.RESULTS AND DISCUSSION

Results

1. Results of Development of Teaching Material

The process of developing teaching material uses the theory of Plomp development through three phases. In the results of the preliminary research phase (initial research), it was found that there are still many obstacles faced by the teacher in the learning process, they are: (1) The learning process carried out is still teacher centered, (2) Lack of active participation from students, (3) Teacher rarely compiles teaching material that support learning activities, (4) Textbooks used by students are focussed on symbols and mathematics, and do not contain real life elements, (4) Lack of mathematical activities (doing mathematics) in order to instill mathematical concepts. In addition, judging by grade promotion test for grade VIII, most students still scored below minimal completeness criteria.

The result of the second phase is the prototyping phase (development). After the researcher designs the teaching material which was developed and called by prototype I, the teaching material was validated by two experts, they are the lecturer of Ganesha Educational University in majoring of Education. There are several criticisms and suggestions given to perfect the teaching material developed, they are the student module and the teacher instruction module on the subject of geometry transformation. As for some suggestions and criticisms given, they are: (1) Changing the cover to emphasize ethnomatematics is by Balinese culture but not

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separated from the mathematical elements, (2) Naming Balinese carvings used must be clear on teaching material, (3) Improvements in some indicator. In addition to teaching material, other instruments are also prepared such as the implementation sheet, the student response questionnaire sheet, the teacher response questionnaire sheet and the lesson plan and the instruments which are also validated. The revised prototype I is called by prototype II which is ready to be trialled in the practiceIn a limited practice trial, two meetings were held to see the implementation of learning using the developed teaching material, there were some improvements in teaching material such as improvements in the reflection sub-section in the formula discovery process and the addition of ethnomatemics. It is Balinese carvings in the rotation sub-topic. The revision of prototype II is called by prototype III which is then retested, it is pratice trial I. At the pratice trial I in the final meeting, a test was conducted to measure student understanding, and the teacher and students fill out the response questionnaire. Some revisions were obtained, they are the improvement of the editorial in each sub-topic to make it clearer in each of the steps requested in the teaching material and clarify the steps of completing the exercises in the teacher instruction module such as adding what is known and what is asked from the problems given.

The results of the third phase are the assessment phase. The revised prototype III, called by prototype IV, was retested, it is practice trial II. At the end of the meeting in the practice trial II, students and teachers filled out a questionnaire related to responses regarding teaching material developed to determine the level of practicality. Students also conduct evaluations with tests of understanding mathematical concepts. The results of the assessment are used as material for revision, so the final product is obtained. Based on the results of the II practice trial, the activities of revising student modules and teacher instruction modules were not carried out too much. The revision only focused on readability, choice of words and sentences and typing errors in the student module and the teacher instruction module until the final product is obtained.

2. Quality Results of Teaching Material

The result of the validity of the learning modules that have been validated by two experts in this case two lecturers of the Ganesha Educational University Department of Mathematics Education was obtained that the results of the validity value of ethnomatematics-was based on teaching material with a multi-representation approach for Student at The Grade IX Junior High School developed in this study, it is Very valid student module with an average validity score that respectively is 3, 68. While the average score of the validity of the teacher's instruction module is 3, 42 which are classified as valid criteria. Other instruments, such as RPP, are classified as very valid criteria with a score of 3, 50. Execution sheet, student response questionnaire, teacher questionnaire, according to validator I, is feasible to use without revision. Whereas according to validator II, it is feasible to use but with some revisions.In the test instrument of understanding, the concept, according to the two validators, is relevant to use.

The results of the practicality of teaching material are observed from the results of filling out the learning implementation sheet, the student response questionnaire and the teacher's questionnaire response to the developed teaching material. The results obtained for the feasibility sheet in a limited trial overall average score of the 1st and 2nd meetings are 2.90 which fall into the practical category. In practice trials I obtained, an average of overall score in practice trial I was 3.20 which fall into the practical category. Whereas in the second practice trial, the average score of the two observers was 3.47 which was included in the practical category. The results of filling in the questionnaire responses of students in limited trial, practice trial I and practice trial II were respectively obtained by an average score of teaching material that is 2.89, 3.01 and 3.12 which were included in the category practical. The results of filling out the teacher questionnaire response limited, practice trial I and practice trial II were respectively obtained by 2.94, 3.53 and 3.72 . It shows that in the limited trial, the teacher instruction module is in the practical category and in the first and second practice trial the teacher instruction module is in the very practical category. Based on practicality instruments, teaching material developed in this case student modules and practical teacher instruction modules can practically be used in the learning process.

The results of the effectiveness of teaching material refer to the average test scores in understanding mathematical concepts obtained by students. From the results of the analysis, it was found that the average value of students in practice trial I was 74.80 and the average value of students in practice trial II was 78.36.

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The average value of students both practice trial I and practice trial II shows that the results of the concept understanding test classified is in the "Completed" category, because this value has exceeded minimal completeness criteria set at the school.

Discussions

In terms of validity, the teaching material developed has met the validity criteria shown by the average score given by two experts in education called as the validator. The average score is the one who can conclude that the teaching material developed has met the valid criteria. As for several reasons the teaching material developed (in this case, it is the student module and the teacher instruction module) can meet valid criteria, they are: (1) The learning purpose in the student module teaching material is very clear according to the learning indicators and the level of student development. (2) The teaching material compiled are in accordance with curriculum demands found in research school. The curriculum demands student to activite in learning. It has also been published through the use of multiple representations, so that students are able to construct their knowledge through several activities by utilizing Balinese cultural objects, they are traditional Balinese carvings. (3) The components of ethnomatematics-based teaching material with the multi-representation approach that is developed have accord with the components specified in the teaching material validation sheet with some revisions from the suggestions and input from each validator.

Practicality of teaching material can be seen from three things, they are: (1) learning implementation sheet, (2) student responses to learning performance (student module) and (3) teacher response to learning performance (student module and teacher instruction module). From the result of the practice trials on teaching material, it is found that the average performance, response of students and teachers has been included in the practical category. Although the teaching material developed has been included in the practical category, but there are some obstacles encountered in the limited trial activities in class IX-2 where it is conducted during 2 meetings. Now some of the obstacles encountered during the learning process are: (1) Students are not accustomed to face the problems presented in the teaching material that is the problem that begins the story using Balinese carvings. (2) There is not yet a construction activity for students to understand their own concepts because there is still a lot of teacher guidance needed. (3) Teachers are still adjusting in the use of teaching material that are directed by the teacher instruction module. Based on these problems, the causes of the obstacles during the learning process are allegedly, because teachers and students are not accustomed to follow learning or direction which in accorded with the demands of developed teaching material that are more demanding for students to construct their knowledge, one of them is finding the formula for each type of transformation through the use of various representations. Following up on the obstacles faced by the teacher and students during the 1st meeting, the researcher and the teacher designed the handling of these constraints. The treatments designed by the teacher together with the researcher turned out to have a positive impact on the implementation of learning activities at the next meeting. This is evidenced by the results on the observation sheet in a limited trial where the average score of the learning instrument implementation is 2.75 at the first meeting and is successfully increased to 3.05 at the second meeting and meant that the teaching material used are included in the practical category. These results also provide a decision that the developed teaching material is ready to enter the next stage, it is practice trial I. Reviewing the learning in practice trial II that took place in class IX-1, teachers and researchers jointly applied the results of reflection in f practice trial I, so that the same obstacles encountered in the previous trial can be overcome in this second trial.

Besides the score of the feasibility of teaching material, to see the practicality of teaching material also carry out giving student questionnaire responses and teacher questionnaires. The results show that according to students the teaching material developed, in this case the student module is practically used by students during learning. One of the reasons is caused that the modules developed are interesting, such as colorful, interesting images, interesting stories that attract great student curiosity. The following is one of the students' opinions related to the module developed. Students become helped in constructing their knowledge, so that students do not tend to memorize formulas, then students gain new knowledge that is the application of the concept of geometrical transformation into daily life that is unconsciously present in the their neighborhood.

Based on the results of the trials that have previously been delivered, ethnomatemics-based teaching material with the multi-representation approach developed in this research is stated to be effective, because they have been able to

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achieve the specified learning goals, in this case it is understanding students' mathematical concepts as one of the impacts of applied teaching material. Looking at the average score of understanding students' mathematical concepts which are obtained has increased. This shows that the average obtained from both classes is above the specified minimal completeness criteria. Therefore, it can be stated that teaching material have met the effective criteria, because they have met the minimum completeness criteria on the average score of students' understanding of mathematical concepts. Therefore, overall teaching material that have been successfully developed in this research have fulfilled valid, practical and effective criteria.

5. CONCLUSION

This research has succeeded in developing ethnomatematics-based teaching material with a valid, practical and effective multi-representation approach and has characteristics that distinguish them from other teaching material. The characteristics of teaching material in this research are as following.

a. Characteristics of the student module developed in this research are: (1) Student module emphasizes student-centered learning and discovery, (2) Student module contains problems that are close to student life, (3) Students construct their understanding of concepts learned through activities in module with the use of various representations, (4) The student module contains the values of Balinese culture, in this case by using carvings/ornaments of traditional Balinese buildings to embed the concept of geometry transformation and (5) In the student module, there is space for students to write conclusions from activities that have been implemented.
b. The characteristics of the teacher instruction module developed in this research are: (1) The teacher instruction module helps teacher in the learning process in the class, (2) The teacher instruction module contains alternative actions and includes alternative answers and (3) The teacher instruction module contains the lesson plan in accordance with the learning process based on a multi-representation approach.

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