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Mathematics Instructional Model Based on Realistic Mathematics Education to Promote Problem Solving Ability at Junior High School Padang

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Abstract. This research aims to develop a mathematics instructional model based realistic mathematics education (RME) to promote students' problem-solving abilities. The design research used Plomp models, which consists of preliminary phase, development or proto-typing phase and assessment phase. At this study, only the first two phases conducted. The first phase, a preliminary investigation, carried out with a literature study to examine the theory-based instructional learning RME model, characteristics of learners, learning management descriptions by junior high school mathematics teacher and relevant research. The development phase is done by developing a draft model (an early prototype model) that consists of the syntax, the social system, the principle of reaction, support systems, and the impact and effects of instructional support. Early prototype model contain a draft model, lesson plans, worksheets, and assessments. Tesssmer formative evaluation model used to revise the model. In this study only phase of one to one evaluation conducted. In the preliminary phase has produced a theory-based learning RME model, a description of the characteristics of learners in grade VIII Junior High School Padang and the description of teacher teaching in the classroom. The result showed that most students were still not be able to solve the non-routine problem. Teachers did not optimally facilitate students to develop problem-solving skills of students. It was recommended that the model can be applied in the classroom.

Keywords: Realistic mathematics education, problem solving ability, instructional model

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INTRODUCTION

Indonesian government attempts to perform a variety of programs to improve education quality by removing various government

regulations and the regulation as a reference for implementation of education at all levels of education. In 2013 the Minister of National Education issued the Regulation on the

Content Standards Education Unit, Competency Standards, the Standards of Learning Process, and assessment standards.

Efforts have been made by the government as described above in improving the quality of education has not figured satisfactory education in particular areas of West Sumatra. Some indicators that reinforce this argument can be seen from the achievements of the National Examination every year. The low quality of secondary school education achievement is also evident from the results of the Pre UN to the level of West Sumatra Province. Pre-examination of the results of 2009, only about 20% of high school and junior high school students who can exceed the value of 5 or more (Musdi, 2009). So also in the Pre-Examination 2009 National Junior mathematical level of Padang, the percentage of correctly answered questions about the area and perimeter of a flat wake respectively about 32% and 38% (West Sumatra Provincial Education Office). This means that the majority of junior high school students experienced an error reply about the matter this geometry.

On the other hand, not a few students view mathematics as a difficult subject. Many students try to avoid these subjects. This situation is obviously very bad for the development of science and technology because all the subjects require mathematics as a device (device subject). Therefore, changes in the process of learning math fun and touches of everyday life should be a top priority. According to Van de Henvel-Panhuizen (2000), when children learn mathematics apart from the experience of their daily life, the child will quickly forget and cannot apply mathematics.

Based on the above opinion, the learning of mathematics in the classroom should be relevant, namely the need for linkages between mathematical concepts

to everyday experience of children. In addition, the necessary relevance between mathematical concepts that have been studied children with the reality of their daily lives or in other fields. To that end, the relevance of mathematics learning should take advantage of the child when learning mathematics.

One of the learning of mathematics -oriented mathematics of everyday experience and apply mathematics in everyday life is Realistic Mathematics Education (RME). Realistic mathematics approach accordance with the changing learning paradigm, the paradigm of teaching to the paradigm of learning or a paradigm shift teacher-dominated instruction to the paradigm of student-directed learning).

Treffer's (1991) states that the mathematical knowledge of students can be developed the day-to-day. In doing daily activities, which is a real problem for students, is expected they can be directed to reinventions of mathematical concepts. This is also confirmed by Gravemeijer (1994) that an essential part of learning mathematics is doing mathematics through problem-solving activities of daily life. According to Freudenthal (2002), so the mathematics is worth to humans, mathematics must be connected to reality, close to the child, and relevant to the community. Thus students will learn mathematics if the mathematics learning starts from the everyday environment of students so that the impression of abstract mathematics to students can be avoided. It is necessary for RME-based learning device that is easy to understand math students.

RME-based learning devices have to meet the aspect of validity,

practicalities and effectiveness. The validity of the design refers to the development of local learning theory (local instructional theory) that the design of the learning material must be in accordance with the instructions of RME. Practicalities referring to answer the question "whether the RME material can be applied in secondary schools", and effectiveness refers to the level of success where RME approach can overcome the problems in the learning of mathematics, especially geometry in junior high school.

Based on the above explanation, it is necessary to develop a mathematical model of learning based on realistic mathematics education (Model RME) capable of facilitating the development potential of the students in understanding mathematics. Therefore, the problem of this research is how the process and the results of the initial prototype design Model-Based Learning Mathematics Realistic Mathematics Education that meets the aspect of validity and the practicalities? The purpose of this study produce initial prototypes Model-Based Learning Realistic Mathematics Education (RME) that meets valid and practical through a process of development. Meanwhile, the specific objectives of this study are:

1. Generate a RME-based mathematical instructional model to promote the ability of junior high school students' mathematical problem solving grade VIII Junior High School Padang.
2. Generate a instructional device that is valid and practical to apply the RME models.

Based on the background above, the research questions are: How the process and outcomes RME-based mathematics instructional model that

meets the aspect of validity and practicalities to improve students' problem-solving skills

METHOD

This research is developmental research, which is conducting research on the development of a product that is described and evaluated. The product is a RME-based mathematical instructional model that meets valid and practical aspect. Therefore, the discussion focused on three issues, namely the RME Model development, method development of instructional devices and methods development research instruments are carried out simultaneously. Phases are taken in developing the Model RME follow the phases of development of a general model of solving educational problems raised by Plomp (2013) which has been modified by incorporating elements of the learning model proposed by Joice, Weil and Shower (1992) and quality criteria products by Nieveen (1999) conducted in three phases of development: Phase -1 Preliminary Investigation, Fae-2 development and prototype phase, and Phase-3 assessment.. The final results of this study in the form of a draft model of teaching and learning devices (early prototype) consisting of instructional design plan, Student Activity Worksheet (SAW), and problem solving skills assessment form. Phases that have been passed to achieve the final results are:

1. The preliminary investigation is a stage that needs analysis or needs assessment by applying the principle of front-end analysis. Studies conducted is literature study and descriptive-qualitative to identify and assess against (1) the theory of learning model, (2) the theory of Realistic Mathematics Education (RME), (3) the results of

relevant research, (4) the characteristics and level of development student thinking, and (5) analysis of the material. Descriptive-qualitative research done by observation and interviews with teachers to determine the characteristics of student thinking and learning in the classroom management overview associated with RME.

2. Prototype and development phases aim to design solutions of problems about learning model that has been defined in the initial investigation. Studies conducted descriptively aims to: (1) draw up the outlines of the elements of the learning model which consists of (a) syntax, (b) social systems, (c) the principle of reaction, (d) support system, and (e) the impact of instructional and accompaniment, (2) draw up an outline of the theoretical foundation designed models, and (3) developing guidelines of the learning model. This stage is the design and construction phase in the form of a draft (early prototype Model RME) model of learning and instructional devices (lesson plans, worksheets, and assessments). Studies conducted by the theoretical and empirical analysis to see legibility draft model and suitability needs of the teachers. The activities carried out by discussions between researchers and teachers as well as the validator.

3. Assessment Phase is done to meet the practicalities and effectiveness aspects of RME models. In this study, only to the practicalities to be done

Formative evaluation used by the expert validation and evaluation of one-one.

RESEARCH FINDINGS AND DISCUSSION

Fase-1: The preliminary investigation

From the results of the initial investigation of the current state of mathematics to mathematics teacher at 4 Secondary High School, obtained information as: a). Learning mathematics by teachers in the classroom is not applying mathematics education realistic both in terms of products and processes, b) There is still a small percentage of teachers who use contextual problems in initiating the learning process geometry, c) in the learning device used is also not focused on aspects of mathematics horizontal and vertical in understanding mathematical objects, d) there is no process of reinvention towards understanding the formula and properties of mathematics because teachers tend to provide formula and properties without prior process of reinvention, e) the teacher has not familiarize students to learn cooperatively that raises interaction among students in the learning process of geometry.

Based on the results of the initial investigation revealed the existence of RME-based mathematics instruction demands that can provide services to the student to learn math with fun in understanding the concepts and principles of mathematics. In this study, the material subject geometry surface area and volume figures with the flat side). This fact suggests need application-based learning model geometry that meets valid and , practical. In this study only the two first phase be done. The output of this initial phase of the investigation is the result of the study of the theory of learning models, theories RME, learning objectives, and junior high school geometry grade VIII

material.

Fase-2: Prototype and Development Phase

The results of the development in this phase in the form of preliminary design that includes three ways, namely (1) the preliminary draft Model RME, (2) the preliminary design of the learning device according Model RME, and (3) the results of the design of instruments that will be used to obtain data required in the development process. An initial draft produced RME models includes (a) Introduction (b) Rational, (c) Supporting theories, (d) Characteristics Model RME and (e) Implementation Guidelines Model RME. Rational development of RME models includes things become a major consideration or grounding importance of the development of geometry-based learning model realistic mathematics education.

In addition, the planning models also elaborated on the need to be prepared for learning to take place RME models are practical and effective. Such devices, among others, are (a) Lesson Plan, (b) Worksheet (c). Assessment sheet, and (d) Means or the Devices of Learning. Section on the implementation of the study included the syntax that consists of five phases, namely: Phase-1 Orientation Learning, Group Discussion Phase 2, Phase 3 Discussion Class, Phase 4 and Phase 5 Integration Evaluation.

Here are the results of the design of the model is described in its components.

Theoretical of RME Model

RME-based mathematical model of learning is a learning model with the goal of serving the learning and teaching materials based on the mathematical

problem of everyday life of students as well as it provides an opportunity to rediscover (reinvent) concepts of mathematics under the guidance of teachers. This model is based on five main theories, namely (1) Theory RME (2) Piaget's theory, (3) Theory Vygotski, and (4) Theory of Bruner. In addition to support it are also supported by the results of relevant research.

An outline of the RME theory explains that the principle of the learning process in the RME is to encourage students to explore the role of mathematical ideas so that the mathematical ability of students increased. Jones, Thornton, and Nisbet (2002: 133) states RME allows students to follow the mathematics curriculum that is rich in ideas mathematical strong. The strength is mainly due to the phenomenon of didactic principles in RME linking contextual problems with math that helps students in developing mathematical knowledge (Presmeg, 2002: 295).

Treffers (1991) states that the mathematical knowledge of students can be developed daily. In doing daily activities, which is a real problem for students, is expected they can be directed to rediscover (reinventions) of mathematical concepts. This is also confirmed by Gravemeijer (1994) that an essential part of learning mathematics is doing mathematics through problem-solving activities of daily life. According to Freudenthal (1991), so the math is worth to humans, mathematics must be connected to reality, close to the child, and relevant to the community. Thus students will learn math if the math learning starts from the everyday environment of students so that the impression of abstract mathematics to students can be avoided.

McNair (2000) states that

mathematics teaching approach that focuses on the mathematical relation to student life has the potential to improve student achievement in the study of mathematics. According to Van de Henvel-Panhuizen (2000), when children learn mathematics separate from their daily experience that the child will quickly forget and cannot apply the principle of mathematics. The above opinion is supported by Boaler (1997) that connects between the world of everyday life and the world of mathematics is essential in the learning of mathematics. The reason is that mathematics is seen students during this abstract and formal can seem more concrete if learners can associate mathematics material with their everyday experience.

Gravemeijer (1994) states there are three main principles of realistic mathematics education, namely a) guided discovery and progressively (guided reinvention and progressive mathematization); b) the phenomenon of learning (didactical phenomenology); and c) an independent development model (self-developed model), as follows

Guided Reinvention and Progressive Mathematization.

This principle states that students should be given the opportunity to experience a process that is similar to the reality of how mathematics is found (Gravemeijer, 1999). This principle assumes that knowledge cannot be taught (transmitted) by the teacher, but it can only be built (constructed) by the learner. According to Jaworski (1995), teachers must give students the opportunity to gain knowledge of self-constructed (knowledge constructions) by the students themselves so that he is able to account

for such knowledge.

De Lange (1987) mentions some activities that includes a horizontal component, namely: (1) identifying the specific mathematics in a general context, (2) schematizing, (3) formulating and visualizing a problem in different ways, (4) discovering relations, (5) discovering regularities, (6) recognizing isomorphic aspects in different problems, (7) transferring a real world problem to a mathematical problem, (8) transferring a real world problem to a known mathematical model.

On the other hand, vertical math is mathematics students completed form of formal or informal using the concepts, operations, and procedures applicable mathematics. Some activities that includes mathematics vertical is as follows (De Lange, 1987): (1) representing a relation in a formula, (2) providing regularities, (3) refining and adjusting models, (4) using different models, (5) combining and integrating models, (6) formulating a new mathematical concept, (7) generalizing.

Didactical Phenomenology

Principle phenomenon emphasizes the importance of learning about contextual to introduce math concepts to students. This principle should consider two objectives, namely: (1) the application of conformity in the context of teaching and (2) the suitability of an impact in the process of rediscovery (reinvention), shapes and mathematical models of the contextual matter.

Self-developed Model

According Gravemeijer (1994), the

principle of self-development models (self-developed models) serves to bridge the gap between knowledge of mathematics is not formal and formal mathematics of the students. Students develop the model using mathematical models (formal and informal) that has been known to solve problems contextual of the real situation (real) well-known student, later found "model of" (models of) in the form of informal and then followed by find a model in the form of formal and eventually get in the form of problem-solving standard mathematical knowledge. Gravemeijer (1994) refer to this process as a transition from a model-of to model for. After this transition models can be used as a model of mathematical reasoning (mathematical reasoning). Treffers (1987) propose a model that appears in the RME. With independent development model students learn math through a series of mathematical informal and slowly headed to the formal mathematics beginning with the completion of the contextual problems of the real situation (real) which are students. Thus, according to Treffers there are four phases through which students in mathematics, namely the real situation, the model of the problem, mathematical models and formal form.

An outline of Vygotsky's theory is explained as follows Bell [2]: (a) the use of symbols obtained by students in solving problems through social interaction. Every function in the cultural development of the students looked at the social level and the individual level; between people and in children. For that to happen social interaction in solving the problem needs to be created and filed groups that allow students to share knowledge and strategy. The group should not be too large (2-3 members) with heterogeneous capabilities. The group's objective is to transform the concepts of spontaneous child through scientific counterpart

(scientific counterparts). (b) Development of knowledge requires the intervention of adults in children's thinking. Without the mediation of symbolic, thinking students will be at a low level. Zone of proximal development (zone of proximal development) is an area between the level of actual development as determined by problem solving independent and the level of potential development as determined through problem solving under the guidance of an adult or in collaboration with more couples are capable

Based on the information in this section can be concluded that there are three main principles in realistic mathematics education, namely: (1) guided discovery and mathematization progressively, (2) didactical phenomenology; and (3) self-developed model. These three principles form the basis of realistic mathematics learning materials.

An outline of Vygotsky's theory is explained as follows: (a) the use of symbols obtained by students in solving problems through social interaction. Every function in the cultural development of the students looked at the social level and the individual level; between people (inter-psychology) and in children (psychology). For that situation, social interaction in solving the problem needs to be created and filed groups that allow students to share knowledge and strategy. The group should not be too large (2-3 members) with heterogeneous capabilities. The group's objective is to transform the concepts of spontaneous child through scientific counterpart (scientific counterparts). (b) Development of knowledge requires the intervention of adults in children's thinking. Without the mediation of symbolic, thinking students will be at a low level. Zone of proximal development (zone of proximal development) is an area between the level

of actual development as determined by problem solving independent and the level of potential development as determined through problem solving under the guidance of an adult or in collaboration with more couples are able (capable)

Based on such a view means that the task of solving the problem as well as the filing of the problem can be a form of intervention on the thinking of the child, so the child until it reaches the level of potential development. (c) use ideas Bruner Vygotsky like scaffolding (supporting) to explain how the teacher and the spouse who is able to direct students to help them understand the level of understanding further. In studying the role of teachers, adults, or peers to help bring the knowledge of the child at a higher level. This can be done by providing a cantilever (scaffolds) that are no longer needed by the child after the learning process is completed. Problem-solving skills and creative thinking is the knowledge that later required while still in school or after school is over. Tasks as well as the submission of problem solving in the classroom can be a crutch child reaches the level of problem-solving skills are higher.

The results of the design of these are described as follows.

Preliminary draft Model RME

An initial draft RME models produced is a book that contains (a) Rational, (b) Supporting theories, and (c) Implementation Guidelines Model RME. Rational development of RME models include things become a major consideration or grounding importance of the development of geometry-based learning model realistic mathematics

education

In this section are also discussed supporting the theory that discuss relevant theories, namely (a) The basic idea RME (b) Principles of learning RME (c) theories of learning support and (d) models of learning. A discussion of the RME models include a discussion of the basic concepts RME models, characteristics of the RME models, component models and assessment of learning based RME models.

In addition, the planning models also elaborated on the need to be prepared for learning to take place RME models are practical and effective. The devices, among others are; (a) Learning Implementation Plan, (b) Student Worksheet (c). Assessment sheet, and (d) Means or the Devices of Learning. While the section on the implementation of the study included the implementation of syntax consists of five phases, namely: Phase-1 Orientation Learning, Group Discussion Phase 2, Phase 3 Discussion Class, Phase 4 and Phase 5 Integration Evaluation.

Design of Early Learning Device

Devices designed learning includes (a) Learning Implementation Plan, (b) Student Worksheet (c) The Assessment and (d) aids/learning aids. In this phase were successfully designed based on the phase in RME models, that is reaction principle, social systems, and the impact of instructional and accompanist. Lesson Plan (LP) includes aspects (a) Standards of Competence (b) Basic competencies (c) Achievement Indicators Competence, (d) Learning Objectives, (e) Teaching Materials (f) Method of Learning (g) Devices and Learning Resources, and (h)

assessment. The material on this RPP is circumference/area of a triangle and a rectangle.

Worksheet, Sheets and Assessment device/learning aids are adjusted by the number of meetings and Lesson Plan. Presentation style also did not present the concepts and principles of mathematics in detail, but it is made in such a way so as to guide the students to construct their own concepts and principles learned

Research Instruments

To obtain data about the process and results of the development model and its RME devices appropriate learning, prepared instruments to test the validity, practicality and effectiveness of RME models that include three kinds, namely the validity of the instrument, the instrument practicality and effectiveness of the instrument.

Instruments of validity resulting in the design phase are aspects of assessment and indicators every aspect related to (1) Format Assessment Model RME, (2) Sheet Assessment Feasibility Application Model RME, (3) Validation of RME Model, (4) format Validation Student Questionnaire response, and (5) format Validation Assessment Sheet.

Instruments designed practicality successful in this phase, include sheets of observations, namely: (1) Observation Sheet Model RME implementation, and (2) Observation Sheet implementation Learning Implementation Plan.

The effectiveness of the instruments designed in this phase include: (1) Student Activity Sheet Observation, (2) Observation Sheet Capability Teachers Manage Learning, (3) Student Response Questionnaire, and (4)

Sheet Learning Outcomes Assessment. The design of the instruments mentioned above has instructions and fill the whole instrument. Aspects of the content are based on the theories that support the objects that will be revealed through the instrument.

The results obtained in Phase 1 and 2 further directed to arrange / realize the more mature models and their RME devices appropriate learning and instruments are needed. The products obtained in this phase include (1) Book Model RME, (2) devices that conform to the model of learning RME, and (3) the instruments validity, practicality, and effectiveness of RME models. This product is named Prototype-1 (Model RME, devices and instruments). Description Prototype-1 (Model RME, devices, and instruments) as the results obtained in the development phase of realization was stated as follows.

Description of RME Model

RME-based mathematics instructional model is made in the form of books. A general description of the Model RME is a refinement of the model has been designed in Phase-2 which contains five main parts, namely: (a) Introduction, (b) Rational, (c) Theories Supporting Model RME, (d) Characteristics Model RME, and (e) Implementation Guidelines for Learning Model RME

In the "Introduction" expressed about the things that need to be known to the reader, especially math teachers who are interested to apply RME models in mathematics. The "Rational" contains the rationale for the importance of the Model RME and in the "Theories Supporting Model RME" stated cores relevant theory / support Model RME. These theories include (1) Basic Idea RME, (2) Principles of Learning RME, (4) the theory of Piaget,

(5) Vygotsky's theory, and (6) the theory of Bruner. The "Characteristics Model RME" presented RME Model components, namely: (a) syntax, (b) Social Systems, (c) Principles of reaction, (d) Supporting factors, and (e) Impact Instructional and Accompaniment. Lastly on the "Instructions RME Learning Implementation Model" put forward three subsections, namely (a) Planning, (b) Class Management, and (c) Operational Learning Model RME.

Description RME Instructional Device

RME instructional devices include; (1) The lesson plan, (2) Student Worksheet, (3) assessment sheet (4) observation sheet. Description of the devices are described below. Learning Implementation Plan produced comprises (a) Subjects Identity, (b) Competency Standards, (c) Competency Achievement Indicators, (d) Learning Objectives, (e) Teaching Materials (f) Method of Learning (g) Devices and Resources Learning (h) Completion of Learning. Completeness of learning or support facilities include devices that are used in teaching and learning aids. These devices include: Student Activity Sheet for each lesson plan. Individual Worksheet and Advanced Exercise sheet for each lesson plan

Student Worksheet prepared to get the surface area and volume formulas geometry with a flat side requires that students undertake a series of activities to discover these principles. So the student activity in the LKS directing students can construct their own concepts and principles learned.

Learning Activities

Structured learning activities based components Model RME, especially syntax, reaction principle, and social systems. Teacher activities in each phase focused on how teachers membelajarkan students by implementing aspects of RME.

The principle adopted in preparing the learning activities are student-directed learning or student-oriented instructions that combines some theories supporting this model (the theory of constructivism, Vigotsky, Bruner, and Behaviorisme).

In phase-3 has generated Prototype Model RME-1 consisting of Model Book, Learning Devices and Instruments. The results of the Phase-4 is followed by activities Model RME validity test, validity test devices, and test the validity of several related instruments. Before presenting the results of testing the validity of the model and the devices used first presented the results of the development of instruments like the following.

Validity and Reliability

As already mentioned in the previous phase of realization, that the instruments which have been developed include instrument validity, practicality, and effectiveness. In this phase is also expressed general overview of these instruments as follows.

Instrument validity

Validity instruments include: (1) Sheet Assessment Model RME, (2) Sheet Application Feasibility Assessment Model RME, and (3) Formats validation. These

instruments is modified from similar instruments that have been developed by Darwis (2006), and discussed individually to the three students S3 UNP.

Validation sheet is validated by the validator 4, comprising two lecturers and two teachers of mathematics. Aspects assessed were (1) manual validation or assessment, (2) coverage is validated, and (3) conformance validation purposes with a grain validated.

All validators judge that the sheet validation of research instruments and devices of learning are good and can be used with slight revisions.

Observation sheet activities of students and teachers' ability to manage learning validated by 2 validator which assess (1) the clarity and enforceability of the instructions, (2) the scope of activity of students and clarity of each type of student activities, and (3) coverage aktivitas teachers and clarity of each type of activity teacher. All validators assess good for all aspects assessed. One validator gives the observation assessment sheet quality is very good and the validator gives a good assessment. Conclusion The results of the validation is observation sheet was accepted without revision, and therefore can be used.

Student questionnaire responses on the activities of the RME models are validated by 2 validators. Aspects assessed include: aspects of the instructions, grains conformity with the indicators, the accuracy of the content of the grain, and the precision of the language. There 24 items questionnaire can be used and agree with all aspects assessed. One validator gives excellent quality assessment questionnaires and one validator gives a good assessment. Two validators assessing the questionnaire can be used without

revision and a questionnaire assessing the validator can be used to revision. Based on the results of the assessment, the questionnaire can be accepted without revision. Based on the results of the validation, all questionnaire items are received and can be used for research

Practicality Instrument

Observation sheets of the implementation of RME model has been validated by two experts, namely from the Department of Mathematics Andalas Padang, and Department of Mathematics, State University of Padang. Based on the expert assessment of the two instruments have fulfilled the requirements for use.

Effective Instrument

The effectiveness of the instrument include (a) The Problem Solving Assessment, (b) Activity Student Observation Sheet, (c) Observation Sheet Capability Teachers Manage Learning Model RME, and (d) Student Response Questionnaire.

Observation sheet student activity made to obtain one type of data supporting the effectiveness of the Model RME. This instrument includes three aspects, namely the instructions, the types of student activity, and a table to record the frequency of student activity every 5 minutes.

Based on the results of the assessment of the two validators obtained Reliability coefficient $R = 0.80$ (This means it meets the criteria of reliability of the instrument and can be implemented.

Teacher Observation Sheet of Capability to Manage Learning Model RME made to obtain one type of data supporting the effectiveness criteria Model RME. This instrument contains

instructions, aspects of teacher ability, and assessment column. There are six components that assessed the ability of teachers and distributed to 32 indicators.

Students' Responses on Questionnaire.

Questionnaire responses of students were made to obtain one type of data supporting the effectiveness of the Model RME. This questionnaire contains instructions; the aspects of learning that become the object of student responses and column response categories of students consisting of 23 indicators.

Assessment / Validation Model RME

From the analysis of the data obtained (a) Value Average total validity Model RME obtained by the $V = 4.2$. With reference to criterion (i) the validity of the RME models can be concluded that the value is included in the category "Valid" ($3.5 < V < 4.5$). So in terms of the overall aspect, RME models otherwise meet the criteria of validity. (b) The average value RME validity Model for Supporting aspects of theories, aspects of syntax, social system, and the principle of the reaction is within the category of "valid" ($3.5 < V < 4.5$). Thus the elements of each of these aspects have a connection with each other.

Based on the above data, it can be concluded that the Model RME otherwise supported by the theories are strong. Therefore, according to the guidelines that have been raised about the activities of model validation, model RME Book are in a valid state.

Validation results Learning Device

The devices used in the learning RME

models are: (1) the lesson plan, (2) Student Worksheet, (3) Sheet Assessment.

Based on the validity of the criteria that have been raised, it can be concluded that the devices mentioned above are included in the category of "valid". Nevertheless, in particular there are certain aspects of those devices according validator not meet the criteria of validity, namely: (a) For the lesson plan at the meeting I, II, III, IV, and V aspect of timeliness in every phase yet proportionate and not visible phase of RME, (b) For the Student Worksheet I and II have not seen activity-based activities and worksheets III, and IV aspects of the organization have not been systematic. Workspace to write answers the worksheets is too small. The use of cardboard to make a flat wake is not described in detail on the worksheet. ,

After worksheet has validated by the expert then implemented one to one evaluation to see the practicality of worksheet. It awarded to three students who work in person individually. Three students were representing a group of students of high, medium and low.

The next step, Model RME along with devices and instruments are declared valid, namely (1) to test the model, (2) analyzing the test results, and (3) make revisions based on the results of the analysis.

Mathematics learning model has been validated by the three validators consisting of two lecturers from universities and one teacher in grade VIII SMP. After an improvement on the suggestion validator then instructional model (consisting of learning models, learning devices and teaching aids) math-based RME declared valid. Furthermore,

the one-to-one evaluation of three students is conducted in each SMPN 13 and SMPN 11 Padang. Students are excited and interested in studying the surface area and volume of a flat surface on one to one evaluation phase. This is because the learning begins with contextual issues and students to manipulate objects in finding concrete surface area and volume formulas geometry. Students are actively involved in determining the surface geometry formulas because there is a physical activity that students go through before finding the formula. Some of the questions that arise from the students when finding the formula is about making the final conclusion of any such reinvent activity. Based on the questions of the students' student worksheet is simplified and students can find the answer with a little help of a teacher.

The observed results of the research that has been presented shows that the approach can make students learn math with fun. This is evident from the activities of students, such as, in finding a formula broad flat wake using cardboard through interactions among students. This is consistent with Vygotsky's theory of learning proposed stating that the child's intellectual berkembangannya encouraged interaction among students. These findings reinforce and complement the findings Fauzan [5], Armanto [1], Hadi [10], Oh Nam [14], Streefland [17] and Saragih [16]) that concluded the approach RME increase some math skills such as the ability of understanding fractions, the ability of logical thinking, mathematical communication, positive attitudes towards mathematics, problem solving and achievement motivation. Results of this study are also consistent findings Tuan Anh Le [21] which has been conducting research realistic mathematics education in primary schools in Vietnam.

Manipulating objects in finding volume of figures with the flat side is favored students because they can find their own formula of the volume using objects around the students. At the end of one to one evaluation activities these students feel happy to learn math because math is not as difficult as they think.

CONCLUSION AND RECOMMENDATION

The conclusion of this study is the Early Prototype Design Geometry-Based Learning Model RME generated after (a) Initial investigation phase, (b) the design phase, and (c) the assessment phase, which meet the criteria of validity and practicalities. This model comes with lesson plans and student activity sheet.

(1) Draft Initial Prototype Model RME should be used as an alternative learning approach to improve students' mathematical problem solving. Therefore, the Department of Education through the MGMP Mathematics advised to implement the model RME is horizontally in all secondary schools, 2) Model RME supports the upgrading of mathematical problem solving through the use of rich context, the mathematical and manufacture of devices / mathematical model by students own. Therefore, the authors of teaching materials realistic mathematics learning should use environmental context that is familiar with student life and rich with mathematical concepts in order to expedite the process of mathematical students. 3) For teachers who want to apply to materials other math, need to develop their own devices you need to pay attention to the components of the Model RME and characteristics of the subject matter that will be developed, 4) The test model development RME is limited to the topic of triangles / rectangles for students SMP. Accordingly, it is

suggested for further research to examine the effectiveness and practicality of RME models, both on the same topic or different and using the same criteria used in this study or other criteria.

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