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Designing Literacy-Based Mathematics Learning Model with Higher-Order Thinking Skills to Develop Junior High School Students' Character and Creativity

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Abstract
The research's root problem is students' low creativity and the need to develop their character. This study aims to develop a literacy-based mathematics learning model with higher-order thinking skills to improve junior high school students' character and creativity. The development of the learning model refers to the Plomp model, which consists of (1) preliminary investigation, (2) design, (3) realization/construction, (4) test, evaluation, and revision, and (5) implementation. The literacy-based mathematics learning model with higher-order thinking skills, called the HOTS-based learning model, is a learning activity involving conditions and things directly to be used as learning resources. In the HOTS-based learning model, the initial learning activities are very feared by students because they are full of challenges that can be completed easily. This learning activity brings students closer to difficult questions because learning activities are directly related to questions that are full of challenges with an investigative learning style. The HOTS-based learning model involves students and teachers as the subject of the activity. In detail, the syntax of the HOTS-based learning model consists of phase I: conveying objectives & apperceptions of the HOTS-based learning model, phase II: representation of learning through HOTS-based investigation patterns, phase III: guiding individuals or groups through thinking skills and presentation of work results, and Phase IV: analyzing and evaluating the learning process and results. The principle of management reaction, the HOTS-based learning model, is based on constructivist theory and numeracy literacy which emphasizes learning centered on student activities so that the teacher's function is in accordance with Ki Hajar Dewantoro's principles in learning.

Keywords: *HOTS-Based Learning Model; Mathematical Literacy; Higher-Order Thinking Skills.*

INTRODUCTION

One that plays an essential role in the success of students' mathematics is thinking ability. Amalia (2013: 5) says that one of the most important thinking skills mastered by students is Higher Order Thinking Skills. Each student is directed to have higher-order thinking skills because higher-order thinking skills make one think critically. Because higher order thinking skill is one of the stages of thinking that cannot be separated from everyday life.

According to Ropiah et al. (2013:18), higher-order thinking skill is the ability to connect, manipulate and transform knowledge and experience to think critically and creatively to make decisions and solve problems in new situations. Many students are unable to work on math problems using higher-order thinking skills tall. When the teacher gives problem-solving questions that increase thinking, most students find it challenging to analyze and create problems, and the last evaluate the answers. They are sometimes slow in analyzing the problem given, so much time is wasted on the questions given. And one of the materials that are the problem is a set theory. According to the theory, this becomes a problem for students because many still struggle to use draft sets to solve problems in

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everyday life. To direct students in achieving abilities and acquiring higher-order thinking skills, teachers must design learning models that support it. The learning model in question is a literacy-based mathematical learning model to improve higher-order thinking skills.

The teacher must also know students' learning styles (*learning styles*)—wrong one style study we know is style study with model personality Holland typology of personality. Model personality Holland differentiates six types: realistic, investigative, artistic, social, entrepreneurial, and conventional. This study will research style study type investigative. The investigative kind of learning style tends of nature: aloof, analytical, careful, complex, critical, suspicious, orderly, intellectual, logical, reflective, pessimistic, right, fulfillment of message, systematic and task-oriented.

Based on the description above, it can be concluded that the higher-level thinking ability tall students very required to solve problem mathematics because basically, students with an investigative type of learning style tend to have the ability to think critically, logically, and analytically should complete problem math well. Mathematics is a universal science that underlies the development of modern technology, has an important role in various disciplines, and advances the power of human thought. The rapid growth in information and communication technology today is based on the development of mathematics in algebraic number theory, analysis, probability theory, and discrete mathematics. Therefore, mastering and utilizing technology in the future requires a strong mastery of mathematics from an early age.

Realizing the importance of mastery of mathematics, then in Law No. RI. 20 Th. 2003 concerning the National Education System, Article 37 emphasized that mathematics is one of the compulsory subjects for students at the primary and secondary education levels. Soedjadi (2000) states that the form of mathematics in primary and secondary education is school mathematics. School mathematics are elements or parts of mathematics selected based on or oriented to educational interests and interests to master and utilize technology in the future. Therefore, the mathematics subjects given in primary and secondary education are also intended to equip students with the ability to think logically, analytically, systematically, critically, and creatively and work together. These abilities are competencies students need to obtain, manage, and utilize information to survive in constantly changing, uncertain, and competitive conditions.

One of the efforts to achieve the competencies students require in learning mathematics is applying a literacy-based mathematical learning model by improving higher-order thinking skills. Given the current model of mathematics learning, the emphasis is on how to investigate procedural mathematics. The learning process is generally mechanistic, only producing instrumental understanding, so students are not empowered to train their thinking skills fully. In addition, the teacher's emphasis in learning mathematics is not on students' understanding of mathematical concepts, principles, and operations but on how students can deal with material that requires literacy and numeracy, especially HOTS questions.

The fact shows that until now, mathematics learning does not have a literacy-based mathematical learning model that increases higher-order thinking skills. Students do not have enough time to construct their mathematical knowledge. In addition, several research results show that the current mathematics learning model is teacher-centered, so students are only used as objects. Concepts and principles in mathematics are given in finished form from teacher to student without going through abstraction and generalization.

Based on the description stated above, several considerations need to be made to refine a learning model, both in terms of learning activities, student activities, and other components that a learning model must own. Therefore, here are some considerations as materials for improvement in the development of the SISMAT model as follows:

1. In reconstructing the concept, the problems posed are not only related to real life and student experiences but are sourced from facts and the social environment of the community.
2. The organization of students in learning mathematics that involves previous experiences also determines the meaning of the information students receive. Each student tries to interpret the information he receives based on his previous experience or knowledge.
3. The deepening of literacy-based mathematical learning models by improving higher-order

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thinking skills is more aimed at dealing with mathematical problems, the nature of which is numeracy literacy associated with HOTS questions, so that it is possible to explore the abilities of previous students.

4.

LITERATURE REVIEW

2.1 Mathematical Literacy

In the current era of globalization, it takes people with the skills to find new concepts, open networks, and have the competence to meet high work standards. The people needed today are not just those who can understand certain sciences but are more profound than that. Currently, people are required to utilize their knowledge optimally to be more intelligent and critical in receiving and processing information. This is very important to support solving increasingly complex problems.

Education has a vital role in facing these challenges. Education is a means of preventing risk and a tool that can help sustain the quality of human life. For this reason, current education is expected to be able to develop students to think creatively, be flexible, solve problems, collaborate, and be innovative skills needed for success in work and life. Education is expected to equip students with the ability to apply their knowledge in everyday life. These abilities are expected to be developed in education through the subjects taught in schools. These expectations are reflected in the 2013 Curriculum Content Standards core competencies.

Schools and other sources that are similar in point of view/theory. The cognitive domain's core competence (KI) for each subject is to equip students with factual, conceptual, and procedural knowledge based on students' curiosity about science, technology, arts, and culture related to visible phenomena and events. The core competencies of the skill domains for each subject are processing, presenting, and reasoning in the concrete realm (using, parsing, assembling, modifying, and creating) and abstract realms (writing, reading, counting, drawing, and composing) according to what is learned in class. Based on these Content Standards, mathematics as one of the compulsory subjects is expected to not only equip students with the ability to use calculations or formulas in working on test questions but also to be able to involve their reasoning and analytical abilities in solving everyday problems.

This aligns with the NCTM (National Council of Teaching Mathematics) view, which makes problem-solving, reasoning and proof, communication, and representation standard processes in learning mathematics. The demand for a student's ability in mathematics is not only to have the ability to count but also to reason logically and critically in problem-solving. Solving this problem is not merely a problem in the form of routine questions but rather daily problems. Such mathematical ability is known as mathematical literacy ability. Based on a survey by the Program for International Student Assessment (PISA), students' mathematical literacy skills in Indonesia are still low. Indonesia is below the international average. Not only that, the majority of students can only solve problems below level 2. Seeing this fact, students' mathematical literacy skills in Indonesia still need to be improved. In order to improve this mathematical literacy ability, teachers, government, and education observers need first to understand what mathematical literacy is. Not only that, but it is also necessary to realize why this mathematical literacy needs to be a concern in learning mathematics.

In PISA, mathematical literacy is defined as follows: "Mathematical literacy is an individual's capacity to formulate, employ, and interpret mathematics in various contexts. It includes reasoning mathematically and using mathematical concepts, procedures, facts, and tools to describe, explain and predict phenomena. It assists individuals to recognize the role that mathematics plays in the world and to make the well-founded judgments and decisions needed by constructive, engaged, and reflective citizens".

Mathematical literacy is an individual's capacity to formulate, use, and interpret mathematics in various contexts. This includes mathematical reasoning and using mathematical concepts, procedures, facts, and tools to describe, explain, and predict phenomena. This leads individuals to recognize mathematics's role in life and make good judgments and decisions that constructive and reflective citizens need. This understanding implies mathematical literacy in mastering the material and using reasoning, concepts, facts, and mathematical tools in solving everyday problems. In addition,

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mathematical literacy also requires someone to communicate and explain the phenomena they face with mathematical concepts. Before being introduced through PISA, the term mathematical literacy was coined by NCTM (1989) as one of the visions of mathematics education, namely to become mathematically literate. In this vision, mathematical literacy is defined as "an individual's ability to explore, to conjecture, and reason logically as well as to use various mathematical methods effectively to solve problems. By becoming literate, their mathematical power should develop".

This understanding includes four main components of mathematical literacy in problem-solving: exploring, connecting, and logical reasoning and using various mathematical methods. This primary component is used to facilitate everyday problem-solving while at the same time developing mathematical abilities. More simply, Ojose B argues that mathematical literacy is knowledge to know and use basic mathematics in everyday life. In this sense, someone with good mathematical literacy skills is sensitive to mathematical concepts relevant to the phenomenon or problem he is facing. From this sensitivity, then proceed with problem-solving using mathematical concepts. In line with this opinion, Stacey & Tuner defines literacy in the context of mathematics as having the power to use mathematical thinking in solving everyday problems to be better prepared to face life's challenges. Conscious mathematical thinking includes problem-solving, logical reasoning, communicating, and explaining. This mindset is developed based on concepts, procedures, and mathematical facts relevant to the problems. Complementing the previous opinion, Steen, Turner & Burkhard added the word effective in mathematical literacy. Mathematical literacy is the ability to use mathematical knowledge and understanding effectively in dealing with the challenges of everyday life. Someone literate in mathematics is not enough to only be able to use his knowledge and experience but also must be able to use it effectively.

In general, the five opinions above emphasize the same thing: how to use mathematical knowledge to solve everyday problems better and more effectively. In solving this problem, someone with mathematical literacy will realize or understand which mathematical concepts are relevant to the issues they face. This awareness then develops on formulating the problem into its mathematical form and solving it. This process includes exploring, connecting, formulating, determining, reasoning, and other mathematical thinking processes. This thinking process can be categorized into three main processes: formulating, using, and interpreting. Thus, mathematical literacy ability can be defined as a person's ability to formulate, use and interpret mathematics in various contexts to solve problems in everyday life effectively.

Mathematical literacy is a person's ability to formulate, use, and interpret mathematics in various contexts to solve everyday problems effectively. This will encourage someone to be sensitive and understand the use of mathematics in everyday life. This sensitivity to the usefulness of mathematics will help a person think numerically and spatially to interpret and critically analyze everyday situations more confidently. In critical interpretation and analysis, numerical and spatial thinking will be indispensable in everyday life. In the political field, for example, people with good mathematical literacy can turn statistical data into quantitative facts and effective information to choose legislative candidates more wisely. Thus, it is expected to create a critical and democratic society. In the world of work, for example, mathematical literacy also has an important use. Although today our performance has been helped by computers, we need mathematical literacy skills. The current work demands are no longer on how to use mathematical calculations but more on how we understand a system and how to develop it. This ability is very much needed for middle-level employees and above. Understanding the system allows them to dynamically develop the plan according to their needs.

Another example is when shopping, we often have several choices of goods. Some of them may get discounts or bonuses in the form of vouchers or other things. With mathematical literacy skills, we can determine which items to choose by considering a more economical price.

In addition to the examples mentioned, there are still many problems in daily life that require literacy skills—ranging from simple things to more complex things. Both require literacy skills, starting from determining the most effective route to determining policies in the business world.

2.2 Development of Mathematical Literacy Ability

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As previously explained, an important part of mathematical literacy is the process of mathematization. The process in question is formulating, using, interpreting, and evaluating mathematics in various contexts. In practice, the selection of methods or representations depends on the situation or context of the problem to be solved. This requires students' skills to apply their knowledge in various contexts. In reality, many students still find it difficult to do so. Students who have been able to use their knowledge in a problem may not necessarily be able to apply it to a different problem. Students must experience problem-solving in various situations and contexts to use their skills effectively. This experience can be facilitated through learning methods that provide students with such experiences. There are many learning methods or approaches that can facilitate this experience. The realistic mathematics approach, problem-based learning, problem-solving, and contextual teaching-learning are some. In the learning approach mentioned above, students will face contextual or real problems that will help them construct their knowledge.

At this stage, students will use their literacy skills to formulate real problems into mathematical problems, then solve them and interpret them in a real context. In this way, they use their mathematical literacy skills and develop them. Problems used in learning are also not just any problems. The problem should meet the following characteristics: real, complex, interesting, and powerful. What is meant is that the problem describes the general context and the real problem. In addition, the problem should also be complex so that it requires students to identify the right questions. Not only that, the problems presented should not just be a matter of ordinary stories. The problems presented can be in the form of problems that have excess information or some that are not yet known

2.3 Higher order thinking skills

According to Sastrawati et al. (2011:6), higher-order thinking is a process that involves mental operations such as classification, induction, deduction, and reasoning. The process of higher-order thinking is often faced with a lot of uncertainty. Also, it demands a variety of applications that sometimes conflict with the criteria that have been found in the evaluation process. But what is more important in this thinking process is the construction and demands for understanding and meaning whose structures are found by students to be irregular. Thus metacognition, namely thinking how one thinks, and self-regulation of one's thought processes are central features in higher order thinking. Meanwhile, according to (Heong et al. 2011), higher order thinking skills are defined as the use of the mind broadly to find new challenges. This Higher order thinking skill requires a person to apply further information or prior knowledge and manipulate data to reach possible answers in new situations.

Higher-order thinking is thinking at a higher level than simply memorizing facts or telling someone something exactly as it was told to us. Wardana Rofiah et al. (2013:17) suggest that higher-order thinking skills are thought processes that involve mental activity to explore complex, reflective, and creative experiences that are carried out consciously to achieve goals, namely obtaining knowledge that includes the level of analytical, synthetic, and evaluative thinking. Dewanto in Amalia (20013:5) states that higher order thinking skills are a capacity above the information provided, with a critical attitude to evaluate, metacognitive awareness, and problem-solving abilities. According to Stein (2008), higher order thinking uses complex, non-algorithmic thinking to complete a task, some of which are unpredictable, using a different approach to the existing task and different from the example. Corebina et al., in Kawuwung (2011: 158), said that higher-order thinking skills could be seen in students' cognitive abilities at the levels of analysis, synthesis, and evaluation. Higher-order thinking skills with cognitive learning outcomes are closely related to students' initial abilities. Based on some of these opinions, it can be concluded that higher-order thinking skills are a thinking process that does not just memorize and convey information that is known. Higher-order thinking skills are the ability to connect, manipulate, and transform the knowledge and experience already possessed to think critically and creatively to make decisions and solve problems in new situations. All of that cannot be separated from everyday life. Bloom's taxonomy is considered the basis for higher-order thinking. This thinker is based on the fact that some types of learning require a cognitive process. Dian Novianti: A student of FKIP Jambi University, more than others, but has more general benefits.

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In Bloom's Taxonomy, revision of abilities involving analysis (C4), evaluating (C5), and creating (C6) are considered higher-order thinking. (Krathworl & Andreson, 2001) According to Krathworl (2002) in A review of Bloom's Taxonomy: an overview – Theorytheory Into Practice states that indicators to measure higher order thinking skills include:

1. Analyze
   a. Analyze incoming information and divide or structure information into smaller parts to identify patterns or relationships.
   b. Able to recognize and distinguish the causes and effects of a complex scenario.
   c. Identify/formulate questions.
2. Evaluate
   a. Provide an assessment of solutions, ideas, and methodologies using suitable criteria or existing standards to ensure their effectiveness or value.
   b. Create hypotheses, critique, and conduct testing.
   c. Accept or reject a statement based on predetermined criteria.
3. Create
   a. Make generalizations of an idea or perspective on something.
   b. Design a way to solve the problem.
   c. Organize elements or parts into a new structure that has never existed before.

Holland (Winkel & Hastuti, 2012) states that individuals with the investigative type prefer activities that are scientific, observational, symbolic, and systematic. The individual likes to research physical, biological, and cultural phenomena to understand and control these phenomena. This individual avoids social activities, repetitive, as well as influencing people. These behaviors encourage these individuals to master mathematics and science. According to Ghufron and Rini (2013: 76), the characteristics of this investigative type are: 1. Prefers work and situations that involve research and avoids activities that require work and situations needed for the entrepreneurial class. 2. Using investigative skills in solving problems. 3. Feeling that you have intellectual, mathematical, and knowledge abilities and lack leadership. 4. Appreciate science. Individuals with the investigative type tend not to have great attention to society and are often ignorant of their social environment. He tends to be isolated, often withdraws from the environment, contemplates himself even in the presence of other people, or even abandons them altogether. Meanwhile, according to Spranger (Ghufron and Rini, 2013: 80), these individuals tend to hang out with people who are considered to be like-minded because the association is seen as a means for advancing their studies. Dian Novianti: Student of FKIP Jambi University Page 6 An investigative type individual does not like to do things in a hurry or without proper preparation because he never feels sure about anything. Because he is too objective in seeing every event, he often finds it difficult to decide. He likes to consider reasons from all sides so that in the end, he hesitates in deciding or doing something in Ghufron (2013: 76).

METHOD

This type of research is development research with a *mixed-method approach*. The development of the learning model refers to the Plomp model, which consists of (1) *preliminary investigation,* (2) *design*, (3) *realization/construction,* (4) *test, evaluation, and revision*, and (5) *implementation.*

The research procedure uses the stages of developing a learning model according to Plomp as follows: (1) the initial assessment stage to find relevant sources, (2) the design phase of the learning model prototype, (3) the realization phase of the preparation and development of the learning model, (4) the tests, evaluations, and revisions by validating and conducting field trials, and (5) the implementation phase by disseminating or disseminating the learning model to other users.

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RESULT AND DISCUSSION

4.1 KBBT-Based Learning Model

Development of KBTT-based learning model through a combination of several model learning. Merger this conducted based on further theoretical study of the supporting theories of the learning model. Many things become study base on the development of the KBTT model.

1. Characteristics of KBTT-based learning activities

Model KBTT-based learning is designed to think and practice students' numeracy literacy activities. Therefore, learning activities must fulfill the criteria as follows:

a. Authentic. Activities must be related to real experiences. Students use the principles of certain academic disciplines.
b. Mystery. The problem should give the challenge to think and not only has a simple answer but requires a complete solution with advantages that encourage students to understand literacy related to the activities assigned.
c. Meaningful. The problems should be more significant for students to provide a high-level mindset.
d. Large. Activity arranged should be character complex, so that enable the achievement of learning objectives. This means solving problems found in draft and principle mathematics by time, space, and resources. In addition, students can analyze errors and obstacles experienced students.
e. Beneficial. Activity which arranged must be helpful, good for student nor teacher, so that could increase ability think high level.

2. Organizing students in learning

In constructing mathematical knowledge, the KBTT-Based Learning model utilizesstudent learning interactions individually or in groups. In addition, available learning tools, such as lesson plans, teacher books, book students, sheet activity students, and other supporting devices. This meant that constructive interaction between students and other students, students and teachers, and student-problem-teacher could be well designed. Thus, the discussion process that occurs in class is maximized. The thing this means so that students' thinking processes are not just memorizing and relaying general information, but how students can connect, manipulate, and transform the knowledge and experience they already have to think critically and creatively to make decisions and solve problems in new situations and that's all inseparable from everyday life.

3. Dynamics group study

In applying the KBTT-based learning model, student conditioned (distribution members of the group consider characteristics student)in cooperative groups. The division of students into groups thinks the distribution of students based on gender and initial ability so that members of every group are heterogeneous, and between groups which one with others are homogeneous. KBTT-Based learning can lead students to think more critically with good literacy.

The teacher's job is to act as a mentor, counselor, and coach. Learning is centered on activity students: asking, discussing, giving opinions, explaining, and thinking about solving problems. Interaction between students and their friends, students and teachers, and student-problem-teacher is regulated using the cooperative learning principle. Hope theory constructivist (specifically theory of constructivist social), so that students interact with other students, students, and teachers in solving problems do not necessarily create. Still, with good literacy, students can construct high-level thinking patterns. Likewise, if the teacher does not understand the learning theories that support the KBTT-Based Learning model, so he will experience difficulty in practicing it in class.

4. Experience study in class

Students who can develop their critical thinking in dealing with HOTS questions can at least make them more comfortable learning. The desired learning process can at least emphasize the achievement of meaningful learning. Good literacy when students are faced with challenges, especially in solving problems, students will find it easier to interpret and interact with their group friends.

Mathematics can be fully understood and mastered by humans because concepts and principles, as well as the elements contained in mathematics, result from the abstraction of the human mind on

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objects of artistic nature surrounding and solving problems faced by man in the environment. Man makes mathematics, and man tends to make an error.

5. Compilation device learning

To support the conditions so that the KBTT-Based Learning model can be implemented effectively and efficiently, implementation requires device and instrument-supportive learning. Device learning is needed. Among other plans, implementation of learning teacher books, student books, student worksheets, and concrete things used in the learning process to help students find draft and principal mathematics and literacy.

The development of device and instrument learning is based on supporting Theorytheory. It shows the development Model of KBTT-based education aims to forget the principles of meaningful learning, new knowledge, and memorable experiences. The KBTT-based learning model also involves facts and figures that drive students' literacy and numeracy. Activities and competence submitted by teachers related to the facts that exist are mainly things that most students have never experienced outside of school. Because of that, preparation of learning tools and instruments utilizing everyday experiences. Thereby also, in process learning, device and instrument learning could maximize horizontal knowledge students, that is,the results of a combination of literacy and numeracy that match previous students' experiences.

4.2. Description of KBBT-Based Learning Model

Activities The KBTT-based learning model involves students and teachers as the subject of the activity. The KBTT-based learning model is a learning activity that involves things directly to be used as learning resources. Through the activities of the KBTT-based learning model, learning activities that students originally feared because they were full of challenges can be completed easily. This learning activity brings students closer to difficult questions because learning activities are directly related to questions full of challenges with an investigative learning style.

KBTT-based learning model, according to Dewanto in Amalia (20013:5), states that a high level is a capacity above the information provided, with a positive attitude critical for evaluation, awareness (awareness), metacognitive and problem-solving skills. According to Stein (2008), higher-order thinkinguses complex, non-algorithmic thinking to solve a problem task. Some are unpredictable and use a different approach to duty, for example. Corebina et al., in Kawuwung (2011:158), said that higher-order thinking skills could be seen in students' cognitive abilities at the level of analysis, synthesis, and evaluation. Higher-order thinking skills with learning outcomes are related to the ability of early students.

Ability thinkshigh level is the ability to connect, manipulate, and transform knowledge as well as experience, which i s already owned for thinkingby critical and creative to determine decision and solve the problemin a situation that new and that all could be released from everyday life. Bloom's taxonomy is considered the basis for higher order thinking; thinkers based that many types o f learning need process cognition which is more from one than the other but has more public benefits. Bloom's taxonomy of ability revision involves analyzing (C4), evaluating (C5), and creating (C6) considered think level tall. Based on several opinions, they could conclude that the higher-order thinking skill is a thought process that does not just memorize and convey the known information. (Krathworl & Anderson, 2001) state that indicator for measuring ability at a high thinking level includes:

1. Analyze
   a. Analyze information that enters and divides or structuresinformation into smaller parts to recognize patterns orrelationships.
   b. Able to recognize and distinguish the causes and effects of a scenario which complicated.
   c. Identify/formulate a question.
2. Evaluate
   a. Give evaluation to solution, idea, and methodology using suitable criteria or existing standards to ascertain the value of effectiveness or the benefits.
   b. Make hypotheses, criticize and do testing.

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c. Accept or reject something statement based on criteria that have been set.

3. Create
   a. Make generalization, something idea or method look to something.
   b. Designing some way to complete the problem.
   c. Organizing elements or parts into a new structure that has not yet existed.

Determining the KBTT-based learning model significantly impacts and benefits student development. This strategy has several advantages, namely encouraging students to learn more effectively and take part in teaching and learning activities, applying the concept of meaningful learning, being able to eliminate the fear of facing difficult questions during class learning, and being able to develop a critical life in the world of education.

The activities of the KBTT-based learning model carried out certainly have clear objectives. Activities The KBTT-based learning model has a goal to be achieved. The objectives of the KBTT-based learning model are: (1) students can adapt to the environment, the natural surroundings, and the life of the community; (2) students can know the importance of life skills and life experience in the environment and the natural surroundings, namely understanding the real reality that is happening; (3) Students have a high level of learning ability (4) teachers can help students find their extraordinary achievements.

In line with contextual learning, the KBTT-based learning model is designed with the concept of literacy first, meaning that the questions given are more challenging so that it becomes meaningful learning, namely learning activities that are more meaningful for students because students' creativity can be increased by allowing them to use a variety of activities. Ways such as observing, asking, proving something, testing facts, and others appear, in this case, students' mathematical literacy.

Mathematical literacy is the ability of a person to reason mathematically and formulate, use, and interpret mathematics to solve problems in various real-world contexts. This ability includes concepts, procedures, facts, and tools to describe, explain and predict phenomena. This ability helps one understand mathematics's role in the world and make the informed judgments and decisions that a constructive, engaged, and reflective 21st-century citizen needs.

Some examples of KBTT-based learning model activities that can be done are (1) calculating the area of a flat shape, (2) calculating the height of an object, (3) calculating the volume of an object, (4) calculating the circumference of a flat area, (5) determining profit and loss, profit and loss percentage, tax; (6) collection, and (7) how to collect and present data on almost all materials.

In carrying out the activities of the KBTT-based learning model, it is necessary to have preparation and planning in carrying out these activities. The following is an explanation of the steps for the KBTT activities:

a. KBTT-based learning model planning
   1) Formulating the objectives of the KBTT-based learning model;
   2) Determining the object by the purposes to be achieved
   3) Assigning heterogeneous groups of students according to their respective abilities
   4) Planning learning equipment that must be provided

b. Implementation of the KBTT-based learning model

   At this stage is the implementation of learning activities in a place that has been planned with the teacher's guidance. This learning activity must be directed to the goals achieved at the planning stage above. Implementing the KBTT-Based Learning activities must also pay attention to the lesson plans and learning materials. In this activity, students are expected to be literate in mathematics.

c. Follow-up

   At the end of the KBTT-based learning model activity, students have the individual capacity to reason mathematically and to formulate, use, and interpret/interpret mathematics to solve problems in various real-world contexts. It includes concepts, procedures, facts, and tools to describe, explain, and predict phenomena. It helps individuals recognize the role of mathematics in the world and make the informed judgments and decisions required of a constructive, engaged, and reflective 21st-century citizen. In addition, this stage aims to train students with professional

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service results to work through the delivery of ideas in public (a classmate). The skills of communicating these ideas are wrong. One competence sued in the KBTT-based learning model for enabling the student to interact/ collaborate with others.

d. Evaluation stage
Conduct an assessment of the work of students. Assessment systems to measure student activities in the KBTT-based learning model are more varied. In this case, the assessment is aimed at accessing process learning. Because of that, many system evaluations use subjective assessments of student development. The personal data were obtained from student activities (active student activities), assessments of journal construction, tests through assessment rubrics, etc.

4.3. Syntax of KBBT-Based Learning Model

Mathematics learning by applying the KBTT-based learning model begins with apperception, stimulus, and problem-solving with interaction patterns from one context to another, uses the information to solve problems, critically examines/examines ideas or ideas and information, and ends by analyzing and evaluating problem-solving results. In detail, the management of mathematics learning by applying the KBTT-based learning model for each learning stage is as follows.

Phase I: Delivering objectives & apperceptions KBTT-based learning model.

The apperception stage begins with conveying the basic competencies and indicators that students will have after studying the material to be taught. Then the teacher fosters positive perceptions and learning motivation in students through exposure to teaching linkages with the required knowledge prerequisites and the ability to analyze, find, and formulate settlement strategies based on information from the questions provided.

In addition, the teacher assures students that if students are actively involved in reconstructing mathematical concepts and principles, then students will master the material being taught. This is because new information in the form of knowledge lasts longer in students' memories. Learning is more meaningful because mathematical concepts and principles are built based on students' learning experiences and life experiences. Furthermore, the teacher conditions students' activeness in learning (solving problems).

Phase II: Representation of learning through the investigative pattern of the KBTT-Based Learning Model

In the stage of representation and problem solving with an investigative pattern of the KBTT-based Learning Model, the teacher asks students to sit in groups. The formation of study groups applies the heterogeneous principle. The teacher facilitates students with books and student activity sheets (LKS). Next, the teacher poses a problem in the form of HOTS questions in the student book to be solved by each group. Teachers instill knowledge, and reasoning skills, find and formulate strategies for solving problems so that students interact with each other with their thinking skills, motivate and direct the discussion to be more effective, provide instructions and guide student work, and encourage students to work together.

Phase III: Guiding individuals or groups through thinking skills and presentation of work

At this stage, the teacher asks one of the groups to present their work in front of the class and allows the other groups to give feedback in the form of criticism and reasons. The teacher asks questions to test the understanding/mastery of the presenters and how different groups can respond to them. Of course, the questions given are not too difficult. However, it takes creativity to find a solution line of thought. Students need to analyze the facts of the information available in the problem, supported by their knowledge, and then formulate the procedure for solving it. There are various ways that students can do to solve the problem. During the work presentation, the teacher encourages class discussion and students to submit ideas openly by instilling the values of thinking skills. This stage aims to determine the effectiveness of the discussion and group work results in the previous step. Maybe even if it is given to students, they can find another way. If so, the other method must be

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accepted as the correct solution, even though it is different from the alternative answers that the teacher has.

Higher-order thinking skills problems can usually be solved in a variety of ways. Another way that may still be found is through class percentages. This is a challenge and opportunity for students to develop their thinking skills, analyze information, critically find relationships between components, and be creative in finding and formulating completion procedures.

In learning mathematics, higher-order thinking skills do not always have to be contextual or use a stimulus. Completing higher-order thinking skills questions can also be done without a trigger. Of course, the completion requirements must be directed so that students who solve the problem must use high-level skills. In addition, this stage aims to train students to be skilled in presenting their work through conveying ideas in public (classmates). The skill of communicating these ideas is one of the steps to enable students to interact/collaborate with others. The basic character of higher-order thinking skills, of course, does not lie in the presence or absence of a stimulus but in the level of thinking students need to solve the problem.

Phase IV: Analyze and evaluate learning processes and outcomes

Next, the teacher evaluates student learning outcomes through academics. At this stage, the teacher helps students individually review the results of problem-solving, testing students' understanding in discovering concepts and principles. For example, asking students to work on questions without a stimulus, especially questions in the form of "problems," namely non-routine questions where students need to formulate their solutions, not questions that include practice questions or common routine questions by looking at the relationship between the data information presented, then determine the key points to find answers to the questions asked. This is where higher-order thinking skills are needed.

4.4. Management Reaction Principle

The KBTT-based learning model is based on constructivism theory and numeracy literacy which emphasizes student-centered learning so that the teacher's function follows Ki Hajar Dewantoro's principles in learning. This is the teacher's task in managing the class so students' creative ideas can be explored and solutions emerge from any given problem. Individual-type investigative is not like working on something in a hurry or without proper preparation because he never felt sure about any. Because he is too objective in seeing every event, he often ends up hard to make a decision.

4.5. Support system

The teacher must make a learning plan for the KBTT-based learning model to be implemented optimally. The learning design is based on the theory of constructivism and literacy, which is realized in every step (stage) of learning. Therefore, in this study, a model book was developed which contains supporting theories for implementing learning.

4.6. Instructions for Implementation of Learning Outcome Evaluation

Assessment is an important part of learning. In the KBTT-based learning model, various forms of assessment are used. Assessment can be in the form of complex multiple-choice tests, multiple regular assessments, short entries, and descriptions. Assessment at the beginning of learning can be done by exchanging ideas, testing prerequisite material, or asking questions. The aim is to measure whether or not the prerequisite material has been mastered by students and the extent to which students master the material being studied. Assessment during learning is done by observing student activities, student performance, or student interactions while working on individual and group assignments. The goal is to check students' mastery of certain materials currently being studied, how students interact in groups, how students' collaborative skills develop, and how students' KBTT is. At the end of the lesson, an assessment is carried out to check student mastery of the teaching materials studied.

In the KBTT-based learning model, assessment and rewards are more individual-oriented. Each student will try to contribute as much as possible to the score for each assignment given. The test results of each student are then examined and assessed. Because it is oriented to the individual, the

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calculation is based on the assessment rubric. In the KBTT-based learning model, scoring guidelines are used to make it easier for teachers to calculate scores.

AUTHORS' CONTRIBUTIONS

The authors' contribution is developing a literature-based mathematics learning model to develop the character and creativity of junior high school students.

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REFERENCES

Anderson, J. R. (1980). *Cognitive psychology and its implications*. New York: W. H Freeman and Company.

Arends, R. I., Wenitzky, N. E., & Tannenboum, M. D. (2001*). Exploring teaching: An introduction to education*. New York: McGraw-Hill Companies, Inc.

Arends, Richard I. (1997). *Classroom Instruction and Management*. New York: MC Grow-Hill Companies, Inc.

Arikunto, Suharsimi. (1993*). Dasar-dasar evaluasi pendidikan*. Jakarta: Bumi Aksara.

Bishop, A. J. (1985). *The social construction of meaning: A significant development for mathematics education. For The Learning of Mathematics*. New York: McGraw Hill.

----------. (1988). *Mathematics education in its cultural contexts, Educational studies in mathematics*. New York: McGraw Hill.

Bell, Fredrik H. (1981). Teaching and Learning Mathematics (in secondary school). Lowa: Wm, C. Brown Company.

Bodner, G.M. (1985*). Constructivism. A Theory of Knowledge*. (Journal of Chemical Education).

Borich, Gary, D. (1990). *Observation skills for effective teaching*. Englewood Cliffs: Merrill Publishers

Bowers, C.A. (1988). *The Cultural Dimensions of Educational Computing: Understanding the Non-neutrality of technology*. New York: Tead.

Bruning, Rogerh, Schraw, Gregory J. Ronning, Royce R. (1995). *Cognitive psychology and instruction*. New Jersey: Prentice-Hall.

Bush, W. S. (editor) (2000). *Mathematics Assessment. Cases and Discussion for Grades 6-12. The National Council of Teachers of Mathematics, Inc. USA. Cobb, P. (1994).* Constructivism in mathematics and science education.

Educational Research, 23(7),4. Confrey, J. (1990). *What is constructivism implies for teaching. In C. Maher, R.B.*

Davis and N. Noddings (Eds). *Constructivies views on the teaching and learning of mathematics. (Monograph 4)*, Reston, VA: National Council of Teacher of Mathematics, Inc.

----------. (1995). *A theory of intellectual development. For the learning of mathematics*. 15 (1): 38 - 48.

Dahar, Ratna Willis. (1988). *Konstruktivisma dalam mengajar dan belajar (Makalah). Pidato Pengukuhan Jabatan Guru Besar Tetap Pada FPMIPA IKIP Bandung*. Bandung: IKIP Bandung.

Davidson, L. (1993). *Portfolio Assessment and Exhibit: moving from recall to reflective understanding*. Journal of Teacher Education, V.6, No 44.

Davis, Robert, B. (1990). *Learning discovery and constructivism. Rutgers University: Journal of Teacher Education Mathematics*, V.3, No 23.

ISBN: 978-623-7496-62-5
Vol, 11 Issue 4

Djamarah, Syaif Bahri. (2000). *Guru dan anak didik dalam interaksi edukatif*. Jakarta Rineka Cipta.

Eggen, Paul D & Kauchak. (1979). *Strategies for teachers teaching content and thinking skills*. New Jersey: Prentice Hall.

Ernest, Paul. (1991). *The Philosophy of mathematics education. Rasing Stroke*, Hamshire The Falmer Press.

Gardner, H. (2003*). Kecerdasan majemuk*. Batam Center: Interaksara.

Gultom, Dj. Raja Marpodang. (1992). Dalihan Na Tolu nilai budaya suku Bugis- Makassar. Medan: CV. Armanda.

Hiebert, James. (1992). Learning and teaching with understanding. Macmillan: Publishing Company.

Ibrahim, Muslimin dan Nur, Mohamad, (2000). Pengajaran Berdasarkan Masalah, Surabaya, Unesa-University Press.

Irianto, Sulistyowati. (1995). Anakhonki do hamoraon di ahu, Anak adalah harta yang paling berharga. Program Pascasarjana Universitas Indonesia.

Ishida, H. (1984). A study on the representational system in mathematical teaching. Eight International Conference for Psychology of Mathematics Education, Sydney, Australia.

Kinball, St. (1984). Culture and the Educative Progress. New York: Teacher College Press.

Koendjaraningrat. (1986). Pengantar ilmu antropologi. Jakarta: Aksara Baru.

Lesh, R., M. Landau, et al. (1983). Conceptual models and applied mathematical problem solving research. Acquisition of Mathematics Concepts and Processes. New York: Academic Press.

Mahoney, Michael, J. (2003). What is constructivism? http://hpsearch.Uni trier.de/hp/a-tree/h/Haken: Hermann.html.

Marpaung, Y. (2005). Meningkatkan kualitas pendidikan matematika dengan pembelajaran yang manusiawi (Makalah disampaikan pada seminar nasional matematika di FKIP UIM). Malang: Universitas Islam Malang.

Marzano, R.J., Brandt, R.S., Hughes, C.S., Jones, B.F., Presseisen, B.Z., Rankin, S.C., & Suhor, C. (1988). Dimensions of thinking: A framework for curriculum and instruction. Alexandria, Virginia: Association for Supervision and Curriculum Development.

Matlin, M. W. (1998). Cognition. Fort Worth, Harcourt Brace College Publisher. Neimeyer, R. A., & Mahoney, M. J. (Eds.)(1995). Constructivism in psychotherapy. Washington, D.C.: American Psychological Association.

O'Malley, J. M., & Pierce, L. V. (1996). Authentic assessment for English language learners: Practical approaches for teachers. New York: Addison- Wesley Publishing Company.

Ormrod, J. E. (1995). Human Learning. Edisi ke-2, Englewood Cliffs, N. J: Prentice-Hall.

Piaget, J. (1974). Cognitive development research and mathematical education. Proceedings of a conference conducted at Colombia University Oktober 1970. VA: National Council of Teacher of Mathematics, Inc.

Polya, George. (1973). How To Solve It. Princeton NJ: Princeton University Press.

------, --------. (1980). On solving a mathematical problem in high school, Dalam Krulik Stephen & Rays, Robert E. (eds). Problem solving in school mathematics. Reston-Virginia: NCTM.

Puskur. (2002). Kurikulum Berbasis Kompetensi dan hasil belajar mata pelajaran matematika. Jakarta: Puskur. Balitbang. Depdiknas.

Schoenfeld, Alan H. (1985). Mathematical problem solving. New York: Academic Press Inc.

Sinaga, Bornok (1999). Efektivitas model pembelajaran berdasarkan masalah (*Problem-Based Instruction*) pada kelas 1 SMU dengan bahan kajian fungsi kuadrat. (Tesis). Surabaya, PPs IKIP Surabaya.

Sinaga, Richard. (1998). Silsilah marga-marga Bugis-Makassar. Jakarta: Dian Utama.

Slavin, Robert, E. (1994). Educational psychology, theories, and practice. Fourth Edition. Massachusetts: Allyn and Bacon Publishers.

ISBN: 978-623-7496-62-5
Vol, 11 Issue 4

Sobel, Max A. dan Maletsky, Evan m.. (1988). Teaching Mathematics: A Sourcebook of Aids. Activities and Strategies. New Jersey: Englewood Cliffs.

Soedjadi. R, (1994). Memantapkan Matematika Sekolah Sebagai Wawasan Pendidikan dan Pembudayaan Penalaran, (Media Pendidikan Matematika Nasional), N0. 4 Th.3, Surabaya, IKIP Surabaya

----------.(1995). Miskonsepsi Dalam Pengajaran Matematika (pokok-pokok tinjauan dikaitkan dengan konstruktivisme), Surabaya, IKIP Surabaya.

----------. (1999/2000). Kiat pendidikan matematika di Indonesia. Jakarta: Dirjen Dikti Depdikbud.

Solso, R. L. (1995). Cognitive psychology. Washington. DC: Winston: The Loyola Symposium.

Taylor, Lyn (1993). Vygotskyan Scientific Concepts: Implications for Mathematics Education. Focus on Instruction Problems in Mathematics Vol. 15, 2-3.

Usman Pelly. (2004). Pengaruh modernisasi terhadap adat dan budaya di Sumatera Utara. Makalah disajikan pada Seminar Sehari Pelestarian Adat Masyarakat Etnik Sumatera Utara.