The Development of learning devices with realistic mathematics education based in the pharmaceutical program to improve mathematic problem-solving

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Abstract. This study aims of this research to describe the value of learning devices based on the realistic mathematics education that are developed, the improved student ability to solve problem mathematically which is taught through learning devices based on realistic mathematics education developed, and the student’s response to a learning device based on realistic mathematics education developed on a pharmaceutical program for 10th grade vocational high school students. Developed learning tools consisting of the learning implement plan and the student’s worksheet. This study uses development research with the model used is Plomp (Preliminary Research, Prototyping Phase, dan Assessment Phase). The research only did until the preliminary research covered the student’s analysis. Based on a student’s observation that a student’s mathematical problem solving ability is low because the learning tools have not supported the students in improving the problem-solving ability, the learning tools that teachers use are not in accordance with the student’s skill program, only a few teachers present problems reading for practicing the mathematical skills of students. The instrument used in this research is the validity test sheet, practical test sheet, and problem solving ability test.

1. Introduction
Education cannot be separated in the process of national development. The education in the development of science and technology would be easy to assimilate, allowing a nation and a country to progress. Math is one of the foundational sciences that has a major role in education and is the subject that is required to be taught in the vocational school. Dwi Jatmoko [1] says vocational high school is a potential educational institution to prepare human resources that can be assimilated by the workforce. That explanation fits the purpose of vocational high school education in which vocational high school students are prepared to work and have expertise in their expertise. This is based on article 20’s 2003 article 15 [2] bill on the national education system that explains that ”Vocational education is a secondary education that prepares students primarily to work in a particular field”.

The facts in the field indicate that the solving ability of the protégé problem in vocational high school is still inferior. This is supported by the initial observation that researchers have made to see the potential mathematical problem solving of the fifth-grade students at the SMK Genus Bukittinggi,
At first there were 4 bacteria, every 10 minutes the bacteria bisected and every 30 minutes the bacteria died a quarter part. How many bacteria are still alive by the 100th minute? State your answers in the form of information and find another strategy in solving the problem!

Based on the assessment that researchers have given the students answers show that many of the students have not fully understood the problem. It can be seen on several student’s answer sheets below.

Based on the few of the students’ answers, researchers may point out that there is still an indicator of the problem solving ability the problem of the students, some students don’t understand problems very well, because they cannot present the elements correctly and completely. Students also cannot model their mathematical problems. Students cannot apply problems solving strategies so well that they cannot solve problems properly. Researchers may assume that the ability to solve mathematically problem is low learners. Form the data acquired only 30% students have higher marks than 50% of the students have a very low problem-solving ability.

A factor that causes the lack of ability to solve the student’s mathematical problem is the learning process created by the teacher not to introduce a learning process that could increase the interest of vocational high school students’ interest because math learning is not related to their application of the student’s skill program. This coincided with Armiati in La’ia [3] opinions in which states that the cause of the math subjects in the vocational high school is in short demand that the learning tools and teaching materials used by teachers are in the general sense of learning tools and teaching materials used in the same level as the learning tools and teaching materials used in high school. This has also been found by researchers in observation and interviews with teachers at the SMK Genus Bukittinggi, where information is learned that teachers present the matter only available in the math packages in used and teachers still dominated in the learning process so that there is no good interaction between teachers and students as well as others students. Only a few teachers present problems solving test to train the mathematically gifted students. The learning tools that teachers use are not in accordance with the student’s skill program. The learning device created by the teachers is the same for all skill programs and there is no difference in the devices used in one skill program with another skill program, resulting in low interest in learning mathematics from students. The learning implement plan...
also does not reflect character on any skill program at the same grade. The learning implement plan does not also lead teachers to present contextual issues associated with the participants’ expertise program. There is not contextual problems of both expertise and expertise competence programs presented by teachers is in the way of solving the problem of untrained students.

Above it is expected that, the mathematics teachers’ should be able to create a delightful atmosphere of learning to attract, innovative, and to add to students’ interest in learning mathematics. Learning must also be the application in a students’ life at adapting to educational and real-world skills program so that the goal of learning is reached and the ability to solve the sophisticated mathematical problem is improve.

Putting aside the above issues from the low capacity for solving the mathematical problems of the students indicated by the less optimizing learning and teaching plan made by the teacher, these things need to be a solution. Based on the Permendikbud 65 in 2013 [4] about the standards of the primary and secondary learning process called that the creation of mathematical learning tools is part of a learning plan that can enhance students’ learning ability and as proponents of the attainment of mathematical learning. Therefore, there needs to be a repair to the learning devices that are in the vocational high school. One solution is to develop a earning device with a realistic mathematics education approach.

The realistic mathematics education approach is one of the contextual approaches that use the context of daily educational life that can enhance the ability to solve the mathematical problem of students. This has been reinforced by Soedjadi in Lis Holisin [5] it says that learning is with a realistic mathematics education approach make good use of the environment around students both the family and the community school environment. It is supported by a Murniaty [6] study that states "The implementation of a realistic mathematical learning devices is effective in improving the ability to solve students’ problems”. In line with the results of the Mukhlis [7] and Kusumah [8] also says "The ability to solve problems for math students who learn with realistic mathematic education approach is better than the ones who learn with a conventional approach”.

The realistic mathematics education approach was selected because indicators of mathematical problem solving skills can be trained and improved through learning that uses characteristics and principles in the realistic mathematics education approach so that problem solving can be improved. Because of this, realistic mathematics education is fit for vocational high school education because the problem used in learning are related to real situations that learners can develop in themselves such situations as being perfectly understood and imagined by students that could improve the structure of mathematical understanding of students to be no exception for vocational high school’s pharmaceutical programs. Based on the problems above, researchers want to do development research with the title "The Development of Learning Devices with Realistic Mathematics Education based in the Pharmaceutical Program to Improve Mathematic Problem-Solving”.

2. Materials and Methods
The form of research used in this research is Research and Development (R & D). in this study refers to the model of educational development Plomp. Sugiyono [9] notes that development research is a research method used to produce a specific product and test the effectiveness of the product. According Plomp & Nieven [10], development research consists of three stages of that preliminary research, development or prototyping stage, and assessment stage. At the preliminary research there are some activities involved doing an analysis, of the needs analysis, of concept analysis, and student’s analysis. The results of the initial investigation were laid as a foundation for developing a learning
device to be designed. During the development of prototype stage was a product development process developed based on the results of preliminary research. The prototype stage covers the design, development, and formative evaluation. What is done at this stage is the development of a product of learning implement plan and student’s worksheet based realistic mathematics education approach. Formative trial at the development stage are done through evaluation one to one, small group, and field test. The formative evaluation stage is done by doing an evaluation of the content or format of a product designed based on the formative test result. At the test assessment stage that is the assessment stage of a revised prototype that used to perform the practice test times the bag test effectiveness in large groups or limited testing. The evaluation done at this stage is done in the semi summative evaluation.

3. Result and Discussions
The students analysis is done for (1) Gathering information on a fundamental an common problem for math study (2) Knowing the level of need for learning devices based in realistic mathematics education to enhance the ability to solve the student’s mathematical problem (3) Knowing characteristics of the students and their relationship to characteristics and mathematical realistic principles. This is done by observing the mathematical learning process at the SMK Genus Bukittinggi. Based on the results of observations and interviews with a math teacher, it has been informed that the ongoing learning process is still conventional and is not compatible with the 2013 curriculum. Students’ ability to learn is still lo students not active and not enthusiastic about learning because they only accept things that teachers and teachers explain more dominate in the learning process. Next on the learning tool used by the teacher is still common for all skill programs. The planned learning performance plan on a teacher isn’t realized in learning. The teacher used not to be the self-designed protégé worksheet or the publisher’s apprentice worksheet.

To see what researchers’ experts are capable of is also to test the ability to solve mathematical problem. Based on the result of test analysis, it was given that the ability to solve mathematically problem of the students is still low. The data gathered provides guidelines in the development or prototype stage.

The student’s characteristics are one of the considerations to be taken in setting use learning tool. One way that can be done to know the characteristics of students is by doing an analysis. According to the Thiagarajan [11] analysis of learners is a study of student characteristics that correspond to the learning development design. Analysis of students has been done to determine the characteristics of students in conjunction with environmental academic skills of vocational high school students on the late pharmaceutical skills program the tendency to be educated participants in learning such ingredients as the latest education participants’ ability to learn mathematics and realistic mathematics education.

The results of this analysis will then serve as the guide for designing the appropriate student’s worksheet to motivate students to learn. The student’s analysis is done by interviewing and questionnaire for students vocational high school pharmaceutical program. Based on an analysis from a student’s point of view, the students have learned that they do not like math because it is so boring that they lack interest in mathematics. They also have no interest in working on math problems because they consider it irrelevant to the expertise program they took. Besides, complicated math and complicated formulas are hard to learn. This causes students difficulty in learning math and consider mathematics to be a feared and less applied subject in everyday life. A vocational student has a different view of mathematics in that way the student views it as a matter of no benefit than the
Based on the information obtained from the student’s analysis, an effort was made to solve the problems that had been discovered. One solution that can solve these problems is to develop a math learning tool based on realistic mathematics education plan for implementation of learning and a student’s worksheet on a pharmaceutical skills program. Realistic mathematics education is said to be one of the solutions that will solve the problem because of the characteristics of realistic mathematics education in itself can increase the interest of learning mathematics so that it can enhance the ability to solve the sophisticated mathematical problem. The first realistic mathematics education education characteristic is using constant trouble. Learning begins with a contextual problem contextual to the reality or environment faced by learners so that they can help students to from mathematical concepts and can support the mindset of mathematical students. The second characteristic is to use vertical instruments like diagram, schemes, and symbol that are bridges for students to make their own models of real situations into abstract or from informal to formal situation, it means learners are doing their own models in solving this contextual problem. The third characteristic is using the student’s contribution in which the students was given the opportunity to develop his strategies so that all the students thoughts or opinions were deeply cared for a appreciated. The fourth characteristic is an interactive learning process in which teachers give students the opportunity to communicate their ideas through the interactive learning process. A fifth characteristic is to connect with other topics. Interconnectivity between topics or lesson materials will make it easier for students to solve problems.

To further strengthen that realistic mathematics education is the only solution to solving the problems above can be seen in the research that has been conducted by researchers. Research of the Laras Lestari [12], Putri Yuanita [13], and Theresia Laurens [14] says that math solving and understanding of the concept of students is a skill to develop in students and a realistic mathematics education approach that will enhance problem solving and understanding the concept of students. Research of the Asrina Mulyati [15] and Dian Susi Susanti [16] says that the learning tool development of the student worksheet and the art plan for implementation of education based realistic mathematics education can enhance literacy problems.

4. Conclusion
Math learning tools based on realistic mathematics education development in this study have only reached the stage of preliminary research which is the student’s analysis. The Plomp model used in this study consists of three phases of preliminary research, prototyping phase, and the assessment phase is helpful in developing mathematical learning tools based on realistic mathematics education. With any mathematical learning tool based realistic mathematics education it is expected to raise learners to learn mathematics because the tools are designed to match the skill program of the learners. Learners become more active in the learning process and are able to connect lesson materials with their everyday life or other sciences.

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