Development of Contextual Mathematics teaching Material integrated related sciences and realistic for students grade xi senior high school

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Abstract. Mathematics is often applied in physics, chemistry, economics, engineering, and others. Besides that, mathematics is also used in everyday life. Learning mathematics in school should be associated with other sciences and everyday life. In this way, the learning of mathematics is more realistic, interesting, and meaningful. Needs analysis shows that required contextual mathematics teaching materials integrated related sciences and realistic on learning mathematics. The purpose of research is to produce a valid and practical contextual mathematics teaching material integrated related sciences and realistic. This research is development research. The result of this research is a valid and practical contextual mathematics teaching material integrated related sciences and realistic produced.

1. Introduction
Graduate competencies in the curriculum 2013 that need to be developed are three, namely good character, related knowledge, and relevant skills. It means that educational graduates should have full competence so useful in their lives.

Mathematics one of the basic science is flexible that always evolves in accordance with the demands of the times. At this time mathematics has evolved and applied to various fields and disciplines. Mathematics is not only a tool for mathematics itself, but many of its concepts are indispensable to other sciences, such as chemistry, physics, biology, engineering and pharmacy. Given the importance of mathematics it is not surprising that mathematics has been studied extensively and fundamentally since primary school.

Mathematics and science have a close relationship. Science provides problems that need to be investigated and analyzed with mathematics, while mathematics provides a useful tool for analyzing data. Often the abstract patterns learned in mathematics are very useful in science. Science and mathematics both try to find patterns and general relationships. The significance of mathematical concepts is evident when used in solving problems of science, technology and everyday life. Given this, in mathematics learning in schools, teachers should link mathematics lessons with other subjects, technology, and everyday life.

The reality in the field shows that the learning of mathematics has been an independent lesson that is separate from other knowledge. Mathematics learning in schools is highly theoretical and mechanistic. Mathematics learning only emphasizes mathematical theories and concepts without its application to other fields such as economics, science, technology, and everyday life. Such learning
causes students not to know for what they are learning math. In other words math subjects felt less meaningful to his life. As a result, the learning of mathematics felt less meaningful for the students so that they could cause them less interest in mathematics.

Mathematics learning in practice usually begins with an explanation of concepts accompanied by examples, followed by practice questions. This approach of learning is dominated by the presentation of mathematical problems in a closed form of mathematical problems formulated in such a way that it has only one correct answer with one solution. In addition, these closed issues are usually presented in a structured and explicit manner, beginning with what is known, what is being asked, and what concepts are used to solve the problem. Ideas, concepts and patterns of mathematical relationships as well as strategies, techniques and problem solving algorithms are given explicitly, so students can easily guess the solution. This kind of learning approach tends to only train basic mathematics skills in a limited and isolated way.

Another fact that is found is that the problems presented in most books do not relate mathematics to the context of everyday life so that the learning of mathematics becomes away from the lives of learners. In other words, mathematical learning becomes less meaningful. Less significant learning for learners in mathematics lessons is thought to be the cause of the low interest and achievement of learning mathematics learners.

One alternative solution to solve the problems that have been expressed is to develop contextual mathematics teaching materials integrating related sciences and realistic. With this solution, learning takes advantage of real-world situations, engages students actively, and links mathematics with other relevant knowledge. Learning enables students to build and develop ideas and understanding of mathematical concepts widely and deeply, understand the interrelation of mathematics with other fields of science, and be able to apply to various problems of life and life.

Mathematics education should be linked to real-world contexts. Mathematics learning [1] that offers realistic learning characteristics is Realistic Mathematics Education (RME). RME [2] is a mathematical learning approach that uses real situations or contextual problems in accordance with the reality or environment encountered and has been conceived or imagined by students. This means that mathematics is relevant to everyday life.

Realistic mathematics learning has five characteristics, using context, using models, using student contributions, interactive, and integrated with other learning topics [4]. In implementing the RME, learning begins with something tangible so that students can engage in a meaningful learning process. Students can re-construct the findings in the field of mathematics through the activities and exploration of various problems, both problems in everyday life and problems in mathematics itself [5]. Through RME [6] it is expected that students are not only active individually, but there is joint activity among them.

There are three key principles in realistic mathematics learning that can be used as a basis in designing learning. First, the guided discovery and the increasingly mathematical process. Based on the principle of discovery, students are given the opportunity to experience a process similar to the process when mathematics was discovered. The history of mathematics can be used as a source of inspiration in learning materials. Second, phenomena containing didactic charge. Based on this principle the presentation of mathematical topics contained in the learning of realistic mathematics presented on two considerations that raises the variety of applications that must be anticipated in the learning process and its suitability as being influential in the progressive mathematizing process. Mathematical topics presented or contextual issues to be raised in learning must consider two things, namely the application. Third, the formation of the model by the students themselves. Based on this principle of learning while working on contextual problems [7] students are given the opportunity to develop their own models that serve to bridge the gulf between their informal and formal mathematical knowledge.

Based on the above, the development of contextual mathematics teaching materials that integrate related sciences and realistic. The purpose of this study is to analyze the validity, practicality and effectiveness of developed teaching materials.
2. Research methods

The type of research is Research and Development (R & D). R & D is a research method used to produce a particular product, and test the validity, practicality, and effectiveness of the product [8]. The development model used is Borg and Gall.

Objects in the research there are two, that are contextual mathematics teaching materials to integrate related sciences and realistic and students. Research activities are prioritized to produce contextual mathematics teaching materials to integrate related sciences and realistic that is valid, practical, and effective. Trial use of teaching materials done to students of class XI SMA Negeri 1 Payakumbuh.

Instrument of collecting data in this research there are four kinds, that are validity test sheet, test of practicality sheet, attitude observation sheet, and test result sheet. There are four kinds of data analysis techniques used, namely descriptive statistical analysis, graph method, linear regression analysis, and comparison analysis.

3. Results and discussions

Prior to contextual mathematics teaching materials integrating related sciences and realistic was developed, conducted a preliminary study of the characteristics of students in mathematics learning, Lesson Plan (LP) used by teachers and their implementation in learning, mathematics books were used, and supporting factors for the development of teaching materials. The purpose of this activity is to analyze the development needs of contextual mathematical teaching materials to integrate related sciences and realistic. The preliminary study results concluded that it is necessary to develop contextual mathematics teaching materials to integrate related sciences and realistic for the students' learning in grade XI SMA.

Characteristics of students is something to know in order that contextual mathematics teaching materials integrate related sciences and realistic on learning mathematics can be used. There are five indicators reviewed, that are a) student's background, b) student's interest in learning mathematics, c) student's attitude in learning mathematics, d) student's learning motivation, and e) student's learning style. In the indicator of attitude and learning style, although more than 85%, but based on the questionnaire obtained information that they do not have the confidence in solving math problems. Only 59% of the students have it. In addition, 35% of the students do not like the discussion in learning mathematics and explain it.

Students have no difficulty in learning mathematics in terms of characteristics,. Thus, the characteristics of students support the development of contextual mathematical teaching materials integrating related sciences and realistic. However, for the use of teaching materials the characteristics of students that determine the learning outcomes is the learning style of students. The linear regression model with the regressor background variable (L), interest (MI), attitude (S), motivation (MO), learning style (G) and learning response response variable (H),

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\begin{align*}
H & = 9.3 - 0.016 L - 0.240 MI + 0.198 S + 0.035 MO + 0.673 G \\
\end{align*}
\]

The regression model obtained has not shown any linear relationship between learning outcomes with at least one of the background variables, interests, attitudes, motivations, and learning styles. This can be seen from F obtained, ie 0.89. When seen t0 values obtained for each variable, that are t0L = -0.03, t0MI = -0.47, t0S = 0.28, t0MO = 0.07, and t0G = 1.53, then together none of these variables that give effect to the learning outcomes. None of these variables seem to affect the learning outcomes, if other variables also participate in the model. If the variables are made a combination of relationships and tested its significance, then obtained some meaningful linear relationship as follows.
Indicators that influence student learning outcomes directly for the development needs of contextual mathematics teaching materials integrating related sciences and realistic are learning styles. While the background of students is a basic factor that will generate interest factors, attitudes, and motivation in learning mathematics.

Based on need analysis at the beginning of research, it is designed of contextual mathematics teaching material to integrate related sciences and realistic for high school student of class XI. The teaching materials that have been made are validated. Feedback and input from experts are used as the basis for improvement of teaching materials. Validation results from experts are used to determine the feasibility and guidance in revising the teaching materials. Components of the assessment of teaching materials used are the feasibility of content, language, presentation, and graphics. According to experts, the contextual mathematics teaching materials integrating the related sciences and realistic produced have been valid.

Tested the practicality of teaching materials after repaired. The teaching materials were trial used in mathematics learning in class XI MIPA 6 and XI MIPA 8 SMA Negeri 1 Payakumbuh. The assessment component used is the ease, effectiveness, efficiency, and benefits of using teaching materials. Based on the questionnaire results, there are several indicators that need to be considered for improvement of the teaching materials. In this case less than 65% of students who assessed the teaching materials can be used. The indicator is that students feel more efficient learning with contextual mathematics teaching materials (55.6%), evaluation in contextual teaching materials more efficiently improve students’ mastery of mathematics (63.9%), with contextual learning target learning material that is planned to be achieved well (63.9%), and contextual teaching materials can motivate students in learning mathematics (63.9%). Thus, it can be concluded that the contextual mathematical teaching materials integrating the related sciences and realistic produced can be used with attention to some improvements in the efficiency of material presentation, evaluation, timing, and some concrete examples related to the student environment.

After teaching materials are tested to be used in mathematics learning in class XI MIPA 6 and XI MIPA 8 SMA Negeri 1 Payakumbuh, then at the end of learning seen student learning outcomes in the class. Learning results are used to see the effectiveness of the use of teaching materials. In class XI MIPA 6 is given contextual mathematics teaching material to integrate related sciences and realistic in mathematics learning, while in class XI MIPA 8 uses teaching materials commonly used by teachers in learning mathematics. The learning outcomes of the two classes before the use of teaching materials on learning mathematics is based on the value of the final exam of the odd semester of the academic year 2016/2017. The following is given the results of learning both classes before and after the use of teaching materials, as in Figure 2.

The test statistic used to determine the difference in learning outcomes of the two classes prior to the use of teaching materials is the t-test. The result of the t-test is 0.52 with a P-value of 0.604. This means that the average score of of the final exam of odd semester of the year 2016/2017 of grade XI MIPA 6 students is not different from the average of XI grade MIPA 8 exam. Thus, it can be concluded that both sample classes have the same initial ability.
The students’ learning outcomes of both classes are seen after contextual mathematics teaching materials integrate related sciences and realistic given in learning in class XI MIPA 6. The test statistic used is Mann-Whitney test. Mann-Whitney test result is 1812.0 with P-value obtained 0.0000. This means that the median grade of XI MIPA 6 students' exam score is different from the median of XI grade MIPA 8 exam. Thus, it can be concluded that the two sample classes have unequal end capabilities. Thus, contextual mathematics teaching materials to integrate related sciences and realistic produced can be said to be effective, that is, can change student learning outcomes for the better.

4. Conclusion
Based on the results of research that has been done can be argued that the contextual mathematics teaching materials integrate related sciences and realistic has been produced is valid, practical, and effective to use. As for the use of teaching materials for learning will be more meaningful if adapted to the learning style of students, in order to achieve the expected results.

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