Development of problem-based student worksheet with authentic assessment to improve student's physics problem solving ability

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Abstract. Student problem solving abilities have not fully developed. Student motivation and activity has not been seen to increase in learning activities. One is the unavailability of teaching materials that allow students to grow and develop. This study aims to develop Student Worksheets based on valid authentic issues, practical, and effective. This type of research is development research. audits of the Revees model (2006), Mc Kenney (2001), Niev een, et al. (2006) and Plomp (2013). In the early stages of the study is to perform needs analysis, learner analysis, curriculum analysis, concept analysis, and analysis of existing teaching materials. In the prototype phase, validity and practicality are carried out formative evaluations that include self-evaluation, and one-to-one. At the evaluation stage, a brief evaluation is conducted to determine the effectiveness of the product. However currently discussed at the beginning of preliminary research there is only preliminary research. From this research will be produced learning support devices based on problems with authentic assessment. These models and support systems meet the valid and practical criteria and are worthy of use.

1. Background
The main point of education is not to teach reading, writing or arithmetic, but to teach how to use thinking skills such as not only creativity but also quality problem-solving skills (Segal, Chipman & Glaser, 1985), ability to comprehend scientific and technological literacy (Lawless & Brown, 2015; Tortop, 2013) as it is a skill that is required for sustainability and lifelong education in addition to basic education. So this skill should describe how students should be more creative and able to solve their problems in the proper learning process.

The role of creativity in learning is most often associated with problem-solving activities, which means creativity is measured by students’ ability to approach problems in new ways (Fasko, 2001). Problem-based learning provides conditions for improving critical thinking skills as well as analysis, and solving complex problems in real life (Corebima, 2010). In the modern world, to improve the capacity of students in solving problems and critical thinking is presented as an educational goal in all fields (Olszewski-Kubilius & Thomson, 2015; Paul & Elder, 2012).

Problems about the low ability of problem solving mathematical learners need to find a solution so that no more learners are able to solve the problem. mathematically low. The way that can be done is to carry out improvements in the learning process. One of the determinants of the success of the learning process and the success in achieving the objectives of learning mathematics is learning tools.
Learning tool is a set of tools or komponen used in the learning process consisting of syllabus, learning implementation plan (RPP), teaching materials, and test learning outcomes. One of the printed materials used in the learning process at school is the Student Worksheet. Student Worksheet is a guide for learners to conduct investigation or problem solving activities. This Student Worksheet can be a guide to develop cognitive and guiding aspects to develop all aspects of learning. Problem-based Student Worksheet with authentic assessments are Student Worksheet that can help learners find concepts. In learning using Student Worksheet berbasismeasalah charged authentic assessment, the concept can be found independently by learners. Student Worksheet is one of printed materials that can make it easier for learners to interact with the given material. Student Worksheet can facilitate teachers in implementing the learning process. Student Worksheet is also rich in the task of practicing. In addition Student Worksheet can also help learners to be active in the learning process because it contains activities that involve learners. At the school Student Worksheet serve as a tool that helps learners in constructing their knowledge.

Many efforts have been made by the government in order to improve the quality of learning tools. One of them is by facilitating the teacher forum to do the preparation of teaching materials similar to the Student Worksheet as a container to train students during the learning process takes place. In teaching materials similar to the Student Worksheet, the material is presented at the beginning of the learning process and followed by giving practice questions. In the teaching materials have also listed problems that are declared as problem-solving problems. However, the problem declared as a problem solving problem is not in accordance with the criteria that must be owned by the problem-solving problem. Problem solving problems presented are not contextual, routine, and not open-ended. In order to achieve the goal of physics learning which one of them is the problem solving ability, it needs to be given new innovation to Student Worksheet which aims to construct learners knowledge. In addition, the Student Worksheet needs to present problem solving questions that fit the criteria of problem solving that are contextual, authentic and problem-based. Further learners also need to be taught the steps in solving the problem. This is based on the opinion of Arends which states that teachers who require learners to have mastery of problem-solving skills which means it can solve problems, then the teacher should teach how learners should solve the problem. Innovation conducted on the Student Worksheet is in the form of the use of a model or learning strategy that serve as a foundation in developing Student Worksheet. Student Worksheet will be more optimal if based on one of the models or learning strategies that have a goal to improve the problem solving skills of learners and teach how to solve a problem. One of the learning models / strategies that can be used to achieve that goal is through problem-based learning with authentic assessments. Barrows and Tamblyn (1980) others, believe that the assessment of masalah-based learning should focus on process-oriented tasks (Swanson, Case, & Van der Vleuten, 1991), which means that assessments should check whether students know how from what.

An assessment should allow students to apply abstract concepts from course topics to real examples and to construct logical arguments derived from course topics to explain realistic situations. In addition, the exam questions should describe situations similar to those experienced during PBL meetings and in triggering issues to help students activate the relevant parts of their long-term memory. This has important implications for course and developer coordinators, which should therefore develop course trigger issues along with course judgment and think of them interrelated rather than sequentially, or even separately. (Virginie FC Servant, Gera Noordzij, Emely J. Spierenburg, Maarten A. Frens: 2015).

To realize it needs to be supported with an authentic assessment. According to Festiyyet (2015) Authentic assessment will be meaningful for teachers to determine the best ways for all students to achieve the final result, albeit with different time units. The construction of attitudes, skills and knowledge is achieved through task-solving where learners have played an active and creative role. The involvement of learners in carrying out the task is very meaningful for their personal development. Wiggins (1993) asserts that traditional assessment methods for measuring achievement,
such as multiple-choice tests, false correct, matching, and others have failed to know the true performance of learners.

Through Student Worksheet based on authentic issues of authentic assessment, it is expected to assist teachers in facilitating learners to develop problem solving skills of participants. Student Worksheet which is characterized by a learning model that makes the problem as a starting point can also make learners gain meaningful learning, because the problems presented come from everyday learners and something that can be imagined and thought by the students. In addition, Student Worksheet based on authentic issues of authentic assessment can also improve communication skills, group work and to interpersonal skills of students well.

2. Method
In this study, the development model used is adapted from the model developed by Plomp. Plomp Model consists of three stages, namely the preliminary analysis stage, the stage of development or manufacture of a prototype (or Prototyping Development Phase), and the assessment phase (Phase Assessment). Preliminary analysis is conducted to obtain information about the problems found in the world of education. In addition, through preliminary analysis, the researchers obtained a tentative picture of the developed product. In the preliminary analysis phase, needs analysis, learner analysis, curriculum analysis, conceptual analysis, and analysis of existing teaching materials are performed.

Needs analysis is conducted by observation and interview. Interviews were conducted with teachers, and some students. Information taken related to the learning process that took place during this, either from the aspect of whether or not achieved the learning objectives set in the curriculum, the description of learning activities in the classroom, and the presence or absence of teaching materials that can facilitate the development of students’ mathematical problem solving skills. Student analysis is done to examine the characteristics of learners. Characteristics to be considered include the level of thinking, and the tendency of learning styles. At this stage also asked what kind of Student Worksheet wanted learners. This analysis is taken as a consideration in designing Student Worksheet based on authentic issues of authentic assessments. The curriculum analysis aims to analyze two supporting aspects of SK and KD. At this stage a review of the curriculum is conducted. This analysis was conducted to study the range of materials, learning objectives, and materials which can be presented at Student Worksheet Based on authentic issues of authentic assessments. Conceptual analysis is the identification of the materials discussed in the lesson. These materials are arranged systematically by linking a concept with another concept relevant to form a concept. This analysis aims to determine the content and the material lessons are needed so that it can help learners in achieving that competence desirable is the ability to solve mathematical problems. Concept analysis equipped with concept map creation. At the stage of analysis of existing teaching materials, the collection is done information on teaching materials used by teachers in the learning process in the classroom. Information gathering is done through observation, documentation, and interview.

| Table 1. Activity Summary At step Preliminary research |
|-----------------------------------------------------|
| Research activities     | Research focus                                                                 |
| Needs Analysis          | • What is the purpose of physics learning contained in the curriculum has been achieved? |
|                        | • How is the learning process so far?                                          |
|                        | • Whether the teaching materials used in the learning process can achieve the learning objectives that have been set |
| Analysis of learners    | • What are the characteristics of class X learners with physics learning      |
|                        | • Student Worksheet teaching materials what students want                      |
| Analyze the curriculum  | • Which material (SK, KD) can be presented at Student Worksheet Based on authentic issues of authentic assessments? |
|                        | • Is the material sufficient to achieve the curriculum objectives? If         |
Concept Analysis

- Is the material well ordered? If not, what should be the sequence? Why is that?
- What essential concepts are needed for learning (obtained on the basis of curriculum analysis) so as to assist in achieving the desired competencies?

Analysis of existing teaching materials

- What is the concept map of the concepts?
- What inspiration can be drawn from existing teaching materials?
- What changes and/or improvements will be made to overcome the weaknesses of available materials?
- What characteristics will be highlighted in the teaching materials to be designed?

3. Results and Discussion

This section contains results or research data, analysis of research data, answers from research questions, and analysis of findings during the study. Preliminary analysis was conducted on the students of class X SMA Negeri 9 Padang. The results of the preliminary analysis are divided into the results of needs analysis, the results of the analysis of learners, curriculum analysis, concept analysis, and the results of analysis of teaching materials that already exist.

3.1. Results of Student Analysis

Students of class X become subject of research in Student Worksheet test based on authenticated authentic issues. The analysis was done on the students of class X SMA Negeri 9 Padang. The first characteristic is that learners are in formal operation stage. Students are aged in the range of 15-17 years. Based on Piaget's research, it is concluded at this age that a child's cognitive development has been in the formal operation stage. At the stage of formal operation, the child is able to solve problems, and reasoning by using abstract things. The use of concrete objects is no longer necessary. Budiningsih suggests that the main characteristic of development at this stage is the child has begun to think abstractly and logically. Scientific thinking models with the ability to draw conclusions, interpret, and develop hypotheses have been owned by children at this stage. Characteristics of the second learner, based on interviews and observations made, it is known that learners prefer to learn with peer tutors. This is seen when the learning process takes place, if learners do not understand the subject matter taught by the teacher, then most learners prefer to ask with friends. According to learners, asking with friends who have understood can help them to understand the material learned. Students tend to ask their friends, and do not dare to ask directly to the teacher. The third characteristic is that the learners are less concentrated and not even focus on the learning process delivered by the teacher. Many learners who tell a friend with a seat when the teacher explains the subject matter in front of the class. When teachers reprimand they pay attention to what the teacher explains, but after a few minutes they will return to tell their friends. The fourth characteristic is that most learners like to group when doing an activity, such as shopping to the canteen or go to a place. This character indicates that learners prefer to do an activity together. Based on the characters encountered, the researchers feel the need to develop Student Worksheet based Problems authentic penned authentic which can accommodate the character of the learner in a positive direction in the learning process. Student Worksheet based Authentic penned issue is a learning resource that can accommodate learners' lively characters, and does not focus on what the teacher describes during the learning process. Learning by using Student Worksheet based Problems are authentic authoritative invites learners to be active from the beginning of the learning process. In addition, learners are also taught how the steps in solving problem-solving problems. If there are some learners who prefer to study individually, Student Worksheet based Problems are authentic authoritative will also guide learners to actively construct their knowledge independently.
3.2. Results of Curriculum Analysis

The curriculum analysis is conducted on competency standard (SK) and basic competence (KD) which are listed in the 2006 content standard. This analysis is a guideline for doing development of Student Worksheet based Problems are authentic authorized for physics material semester 1 class X SMA. Analysis is done to see what material (SK, KD) can be presented on Student Worksheet based on authentic authentic issues. In addition, curriculum analysis is conducted to determine whether the material (SK and KD) that exist on the curriculum has been well sorted, as well as to know whether the material has been sufficient for the achievement of the curriculum objectives of developing students' mathematical problem solving abilities. Based on the analysis, then obtained SK in accordance with the learning process Problem -based Authentic penned issues are SK 2 and 3, that is, to understand the straight and vector motion and to use it in problem solving, and to use vector analysis in problem solving. In both SK, the minimum ability of learners that is expected to be achieved is able to use the material (straight and vector motion) is in problem solving. This means that problem-solving ability is a major goal in the learning process. While SK understands the shape of motion of objects, speed, acceleration does not emphasize the problem-solving process. Analysis of the SK and KD furthermore, indicates that the order of the basic competence is changed, this is done to adjust the interrelationship between each concept. In addition, in order to achieve the learning objectives of developing the problem solving ability of learners, then the order changes. The sequence change occurs in the basic competence for straight motion material. The result of basic competence analysis can be seen in Table 2.

Table 2. Basic Competence Analysis

| Basic Competence Analysis | According to the Curriculum | Change |
|---------------------------|------------------------------|--------|
| 1. Complete the system of linear equations of two variables | 1. Make a mathematical model of the real problem relating to the system of two linear equations |
| 2. Creating a mathematical model of the problem related to the system of linear equations of two variables | 2. Completed the mathematical model of the real problem relating to the system of linear equations of two variables |
| 3. Completed the mathematical model of the problem relating to the system of linear equations of two variables and its interpretation | 3. Solve the system of linear equations of two variables by means of graphical methods, substitution methods and methods of elimination |

In Table 2, it is seen that in the first KD sequence, learners are expected to make Physical model of the real problem related to the first straight motion. This matter done so that learners can understand the meaning of each model m fisika contained in the motion straight. The physics learning model found on the straight materigerak comes from the related model with everyday learners or who can already be thought by the learners. After learners can make physics models of real problems related to the straight motion, the participants students are expected to complete the learning model by way of trial-error or by trial and error. Furthermore, learners are guided to complete linear material using graphical methods, determining equations, and experimenting. Through it, then the learner's view that physics is the application of the formula, and the use of that procedure rigid can be improved through the activities of finding solutions of the problems provided.

3.3. Concept Analysis Results

Concept analysis aims to determine the content and materials needed in developing Student Worksheet. The main concept is to understand the motion of straight and use it in problem solving, and use it in problem solving. On the subject of the straight motion of the object, all the material contained in the subject is presented on the Student Worksheet based authentic authentic issue.
3.4. Results of the Analysis of Existing Material

Teaching materials used by teachers in the process of learning in class X SMA 9 Padang is a package of physics and teaching materials and training learners obtained from school. Based on the content analysis of the package book, especially on straight and vector material, in each chapter has presented the learning objectives of the material to be submitted, SK, KD, and prerequisite materials for each chapter. Furthermore, each chapter describes the subject matter, sample questions, and exercises to do. In each exercise there are also problem solving questions. However, as has been stated in the background, the teaching materials can not optimally facilitate learners to develop the ability to solve physics problems. So also with teaching materials provided at school. The teaching materials have not been able to optimally facilitate learners to develop their problem-solving skills of physics. This is because the questions given do not match the criteria of problem solving. In the teaching materials are also not presented steps that can teach learners how to solve problem-solving problems. Based on the results of the analysis of existing teaching materials, also obtained the inspiration that can be taken and used in designing Student Worksheet based Authentic authentic issues, that is the purpose of learning delivered in each chapter. In addition, as presented in the textbooks and materials, the Problem Based Student Worksheet is authentic authoritative also equipped with a competency test at each sub-topic, and competency test chapters presented in each chapter. Changes made when compared with the previous material occurred in terms learning approaches. If the existing teaching materials have not optimally make learners to be active in finding and developing the concepts of the lesson, then the Student Worksheet based Problems are authentic penilliant content developed, students are required in total to be active in the learning process, the participants students will be guided to solve problems related to the subject matter. If the previous teaching materials, the subject matter is given at the beginning of learning and the problem is given at the end of the learning, then the Student Worksheet based Problems are authentic penilliant content, the problems serve as the starting point of the learning process. In addition, learners are also taught steps or ways to solve a problem. Learning using Student Worksheet based Problems are authentic authoritative will provide meaningful learning for learners.

4. Conclusion

Based on the results of the preliminary analysis (Preliminary Research) it could be concluded that in order to hone the skills of problem solving physics learners, teachers need a learning device that can help facilitate learners to grow and develop problem-solving abilities fisikannya. Through Student Worksheet based or one of the proven strategies or approaches to improve problem solving capability that is problem-based learning contained authentic assessment, it is expected to help learners develop problem-solving abilities. In addition, learners also need Student Worksheet that can raise their spirits to learn in this case viewed in terms of form and content of Student Worksheet based authentic authentic issues charged. Some learners also state that through the presentation of problems related to the real world can make them enthusiastic in learning, because the lesson is not only fixated to memorize the formula.

Based on the analysis of learners, it also obtained the conclusion that learners need Student Worksheet based Authentic penilled issue which can accommodate the characteristics of learners such as the tendency to learn by peer tutors. In addition, based on the analysis of curriculum also obtained the material (SK, KD) in accordance with Student Worksheet based Authentic issues charged authentic, the material Motion Straight and Vector in semester 1 class X SMA.

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