Implementation of the 21st Century Skills to High Order Thinking Students’ Mathematical in Senior High School Padang

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Abstract. The purpose of this study was to describe the process and results of the development of 21st century learning tools based math problem based learning to improve high-order mathematical thinking students’ in senior high school Padang city and describe the quality of math learning tools of the 21st century based on problem based learning to improve the aspect of validity, practicality. The methods of study is a research development that is used to develop a software product math learning 21st century form RPP and LKPD integrating 4 C which was adapted from the model Plomp. (Plomp and Nieveen, 2013: 30). Subjects tested in this study were class X SMA Padang. The data collection instrument were the sheet analysis, field notes, interview, questionnaire, and test results of learning. Data were analyzed using descriptive analysis that describes the validity and practicality of learning tools are developed. This research data analysis technique used is based on a questionnaire filled by experts then analyzed for the validity of the resulting product. Analysis of the validity of using a Likert scale. The results of the validation of the validator indicates that the device is a valid PBL based learning and practical with some characteristics such as learning devices produced have been adapted to the characteristics of Problem Based Learning (PBL). RPP and LKPD designed as a guideline for teachers in implementing the learning process is valid and practical.

1. Introduction
Skills of the 21st century do with updating the quality of learning, help students develop participation, emphasis on problem-based learning, to encourage cooperation and communication, increase engagement and motivation, develop creativity and innovation in learning, designing learning activities that are relevant to the real world, meta cognitive empower, and develop student-centered learning. During this time, the learning of mathematics more priority to the development of students' cognitive abilities, which is reflected in the development of evaluation questions (preliminary research). The development of these cognitive abilities were limited at the cognitive level of C1, C2, C3, while the cognitive level C4, C5, and C6 are very rarely developed in the preparation of test questions. In fact, to develop high-level mathematical thinking skills needed capability to perform the analysis, synthesis and evaluation of a variety of mathematical problems. Students having difficulty in doing about high-order mathematical thinking skills because they do not understand the meaning of life in the 21st century. To overcome this problem, a device designed mathematics valid, practical, and effective. The purpose of this study was to describe the process and results of the development of 21st century learning tools based math problem based learning to improve high-level mathematical thinking Padang city high school students and describe the quality of math learning tools of the 21st century based on problem based learning to improve high-level mathematical thinking Padang city high school students from the aspect of validity, practicality. Stuin this will involve two students for the purposes of this study and research students will be done in collaboration with high school math teacher and math education
professor. Through these research activities are expected to be obtained by the learning device of the 21st century based math problem based learning to develop the ability to think mathematically high-level high school students.

Based on the literature study is done, according to researchers one appropriate way to resolve these problems is to develop lesson plans and LKPD integrating skills 4K-based problem-based learning, because the problem based learning is the students themselves who construct his own knowledge, so that the learning is done more meaningful. In addition, based on research development carried out by Mahrani et al (2016) obtained 1) The PBM-BKBA valid criteria that have developed, practical and effective; 2) There is an increased ability of mathematical communication and social skills of students using the PBM-BKBA developed; 3) the student answers on trial II trial better than I. This suggests learning tools developed by using problem-based learning is rated practical and efficient use in increasing the high-level mathematical thinking ability of students. Based on the presentation, conducted research on the development of 21st century learning tools based math problem based learning that is expected to make the students more active, creative and motivated so that high-level mathematical thinking skills increase. The purpose of this study was to test the validity and practicalities of the quality of math learning tools of the 21st century based on problem based learning that can improve the ability to think mathematically high degree of Padang city high school students.

2. Learning Strategies For Improving High Thinking Skills

A major factor in the ability of high-level thinking is centered. Students involving high-level thinking skills necessary communication to reduce ambiguity or confusion and improve students' attitudes about the ability to think. The lesson plans include the ability to think, examples of high-level thinking skills, and suitability to the needs of diverse students. Teachers give students support in the early lessons and gradually students to think independently, to help students develop higher learning skills. However, support is too much or too little can hinder improvement. Useful learning strategies including exercise, elaboration, organization, and metacognition. Learning should be specifically designed to teach specific learning strategies. Direct instruction (teacher-centered) should be used sparingly. Presentations should be short (five minutes) and is coupled with practical guidance to teach high-level thinking skills. Teacher or student generated questions about the dilemma, new problems and new approaches need to get the answers have not been studied already. Ramirez and Ganaden in "Creative Activity and Students' Higher Order Thinking Skills” mentions that Tobin, Capie and Bettencourt (1988) review research related to the learning process that involves a high level of cognitive ability. To enhance higher cognitive learning, teaching them to actively engage with the emphasis on "monitoring and maintaining the real engagement of all students" (p. 17). They recommend using less of the whole class and more small groups or individual activities, to engage students more actively.

3. Implementation of the Development of 21st Century Skills Learning Implementation Plan (RPP) and Worksheet Students (LKPD)

Such as lesson plans in general, learning appropriate to the demands of 21st century skills is also planned from the beginning begins by analyzing competencies to prepare lesson plan or RPP (see script development RPP). Character of 21st Century skills can be developed in accordance with the characteristics of KD and the material to be covered. Therefore, in planning lessons that integrate 21st century skills characters, can use the steps as shown in the following figure (Kemendikbud, 2017) Abdul Majid (2008: 176) states that Worksheet (LKPD) is sheets which contains instructions or steps complete a student's work to be done. Meanwhile, according Arsyad (2007: 78), LKPD an intra or curricular activity sheet to facilitate students' understanding of a particular material. LKPD is printed instructional materials in the form of a sheet of paper containing the material, summary execution manual tasks to be done student teaching which refers to the basic competence to be achieved (Andi Prastowo, 2011: 204). The purpose of the LKPD according to the Ministry of Education (2008: 36), namely: (1) assist students in finding a concept, (2) help students apply the concepts that have been found, (3) guided student learning, (4) as a reinforcement, and (5) as manual discovery activity. Thus LKPD is printed instructional materials in the form of a sheet of paper with instructions implementation
of learning tasks are used by teachers to facilitate students to discover or understand the concept of matter and its applications.

4. Research Methods
In accordance with the problems studied, then this type of study is a research development (development research) that is used to develop a software product math learning 21st century form of RPP and LKPD integrating 4 C is critical, creative, communicative, and collaborative, Literacy Digital and PPK application for high school students of class X with problem based learning according to the curriculum in 2013. 21st century learning tools based on problem based learning is developed with a development model which was adapted from the model Plomp. Plomp Development Model consists of three phases: the initial investigation (preliminary investigation), the stage of prototyping (prototyping stage), and the stage of assessment (assessment phase) (Plomp and Nieveen, 2013: 30). Subjects tested in this study were class X SMA Padang. In determining the test subjects at each stage of the study, referring to the procedure development, so determined in accordance with the needs of each stage of the research.

Types of data collected at the research stage of this development is the quantitative data and qualitative data. The data collection instrument at this stage is the sheet analysis / researcher field notes, interview, questionnaire, and test results of learning. Data were analyzed using descriptive analysis that describes the validity and practicality of learning tools are developed. This research data analysis technique used is based on a questionnaire filled by experts then analyzed for the validity of the resulting product. Analysis of the validity of using a Likert scale.

5. Research Result
Based on the results of a needs analysis that has been done in the semester July December 2018/2019 (Ali Asmar, 2018) then developed a mathematical learning devices such as CSP and based LKPD or the first half of class X are arranged in the development stage. On learning tools developed organized learning activities that can facilitate learners to develop the ability to think mathematically high level. Through LKPD based PBL, the teacher can help and facilitate students in developing mathematical abilities, especially the ability to think mathematically high level. LKPD characterized by PBL learning model that makes the problem as a starting point to make learners obtain meaningful learning, because of the problems presented comes from the daily learners. At this stage of development is to design learning device by referring to the standard rules of preparation of learning tools and adapted to the characteristics of PBL based learning tools. The initial design of learning tools that have been developed are evaluated (Ali Asmar, 2018) and was developed through the stages of the formative evaluation. The stages of the evaluation consisted of the evaluation itself, a review of the experts, the evaluation of individual, small group evaluation and field trials. Objectives own evaluation and review of the experts is to get a valid PBL based learning. A valid learning device then tested individually and in small groups, each learner MIA class X SMAN 3 and SMAN 5 Padang to look at the practicalities of the learning device. In detail, the process of development for a learning device that meets the criteria of validity, the practicalities are described in the following discussion.

5.1. Results Validation Learning Tool
Learning tools that have been checked in the evaluation itself once considered good and in line with the expected further discussed by the experts as the validate. Learning devices validated by two validate. Experts who becomes validate comes from two areas of expertise, namely mathematics education. Here are described results of the validation study by experts devices. PBL-based RPP validation results are presented in Table 1.

| No. | Aspects Validation          | Validity Index | Category |
|-----|-----------------------------|----------------|----------|
| 1.  | identity RPP                | 0.92           | valid    |
| 2.  | Core Competence (KI)       | 0.75           | valid    |
| 3.  | Basic Competency (KD)      | 0.92           | valid    |
| 4.  | Indicators of Competence Achievement | 0.75 | valid |
5. Learning objectives 0.75 valid
6. Approach Teaching Materials, 0.71 Valid
7. Models and Methods of Learning 0.67 Valid
8. Learning Activities 0.83 Valid
9. Steps PBL 0.76 Valid
10. Learning Resources 0.67 Valid
11. Appraisal 0.83 Valid

Based on Table 1, it can be concluded that the overall lesson plan based PBL already valid criteria with an average of validity index of 0.78.

5.1.1. Results Validation LKPD
Validation LKPD done by 2 validator consisting of faculty of Mathematics Education to validate the didactic aspect and content aspect. Before validated some parts of LKPD has undergone improvements or revisions based on suggestions from the validator. PBL LKPD validation results based on all aspects can be seen in Table 2

| No. | Aspects Validation | Validity Index | Category |
|-----|--------------------|----------------|----------|
| 1.  | didactic           | 0.83           | Valid    |
| 2.  | Content or Content| 0.78           | Valid    |
| 3.  | Kegrafikan or Display | 0.73 | Valid |
| 4.  | Language           | 0.70           | Valid    |

The Average Validity 0.76 Valid

Based on Table 2, it appears that the general validity of didactic aspect, the aspect of content, and display aspects of the language already valid criteria with an average of consecutive validity index was 0.83; 0.78; 0.73; and 0.70. Overall validity of PBL based LKPD already valid criteria with an average overall validity index of 0.76. Further test the practicalities which aims to determine the extent of the benefits, ease of use and efficiency of time-based usage LKPD by teachers and learners. The results are described as follows LKPD practicalities.

5.1.2. One-to-one Evaluation
After the validation process by experts completed, followed by a revision of the prototype 1. The results of the revision of the first prototype is called a prototype 2. In prototype 2 LKPD be evaluated one by one (one-to-one evaluation). Evaluation of the one done by asking 3 learners each capable of high, medium and low to provide comments and suggestions regarding the prototype 2 LKPD. Each learner is given a prototype 2 LKPD revised, then ask them to work on the prototype 2 LKPD. Based on interviews with the students in the evaluation of one-on-one, it is concluded that, overall, learners can understand the instructions for use LKPD easily. The use of writing, term, color, and image used was sufficiently clear and interesting, just some of the terms are fixed. Thus, it can be said that LKPD based PBL has practical in terms of legibility and ease of use LKPD according to the evaluation phase of one-on-one.

5.1.3. Evaluation Small Group
Results LKPD revision of the evaluation phase will be evaluated again in the phase of a small group or small group evaluation. This evaluation is done 3 times with practice learning device has been designed for learners grade X SMAN 3 and 5 Padang. After the small group trial is completed, the practicalities are given a questionnaire to see the response of learners to use LKPD-based learning PBL. Data generally results practicality questionnaire filled out by students in the small group trial evaluation can be seen in Table 3 below.
Table 3. Data Analysis Questionnaire Results practicalities by Students After Trial Evaluation Small Group

| No. | Into question | Percentage | Category     |
|-----|---------------|------------|--------------|
| 1   | 1st           | 100.00     | very Practical |
| 2   | 2nd           | 83.33      | very Practical |
| 3   | the 3rd       | 95.83      | very Practical |
| 4   | 4rd           | 91.67      | very Practical |
| 5   | 5th           | 100        | very Practical |
| 6   | 6th           | 79.17      | Practical     |
| 7   | 7th           | 79.17      | Practical     |
| 8   | 8th           | 83.33      | very Practical |
| 9   | 9th           | 79.17      | Practical     |
| 10  | 10th          | 83.33      | very Practical |
| 11  | 11th          | 70.83      | Practical     |
| 12  | the 12th      | 75.00      | Practical     |
| 13  | 13th          | 79.17      | Practical     |
| 14  | 14th          | 83.33      | very Practical |
| 15  | 15th          | 87.50      | very Practical |

Average 84.72 very Practical

5.2. Results Assessment Phase (Assessment Phase)

Data practicalities of devices based learning PBL obtained from the questionnaire responses of teachers, the questionnaire responses of learners and learning implementation observation sheet. Data obtained test results are outlined below.

5.2.1. Result Analysis By Questionnaire practicalities Teacher

Questionnaires filled out by the teacher practicalities aims to obtain information about the practicality of learning tools based on the opinions and judgments of teachers. In general, the results of a questionnaire filled out by the teacher practicality can be seen in Table 4 below.

Table 4. Results of the practicalities Questionnaire Responses Teacher

| No. | Aspects Into | Percentage | Category     |
|-----|--------------|------------|--------------|
| 1   | 1st          | 75         | Practical    |
| 2   | 2nd          | 100        | very Practical |
| 3   | the 3rd      | 100        | very Practical |
| 4   | To 4         | 100        | very Practical |
| 5   | 5th          | 75         | Practical    |
| 6   | 6th          | 100        | very Practical |
| 7   | 7th          | 75         | Practical    |
| 8   | 8th          | 100        | very Practical |
| 9   | 9th          | 100        | very Practical |
| 10  | 10th         | 75         | Practical    |
| 11  | 11th         | 75         | Practical    |
| 12  | the 12th     | 100        | very Practical |

Average 89.58 very Practical

Based on Table 4 above shows the average value of practicality was 89.58% categorized as very practical. This means that based on a questionnaire filled out by the teacher practicality devices based learning PBL declared to be practical.

5.2.2. Practicalities Questionnaire Response Analysis of Students

Questionnaire of practically gave to learners after participating in the learning process using PBL-based LKPD. Overall results practicality questionnaire filled out by the students can be seen in Table 5.
Based on Table 5 above, it can be seen the average value practicality was 82.41% categorized as very practical. This means that based on practicality questionnaire filled out by the students after the trial court stated PBL based learning tools have been practical.

5.2.3. Observations lesson with PBL-Based Devices
Data from observation by RPP-based learning activities PBL can be seen in Table 6 below,

| No. | Aspects of Observation      | Percentage | Category     |
|-----|----------------------------|------------|--------------|
| 1.  | Preliminary activities     | 84.03      | very practical |
| 2.  | Core activities            | 84.52      | very practical |
| 3.  | Closing activities         | 88.54      | very practical |

| On average Overall | 85.70 | very practical |

In the table above, it appears that the average level of practical implementation by RPP-based learning activities PBL is 85.70%. Thus, it can be concluded that the device is very practical based learning PBL based on learning activities.

6. Discussion

6.1. The validity of PBL-Based Math Learning Tool
PBL-based math learning tool in the form of RPP declared valid by the validator seen from all aspects of the RPP component. For the lowest average obtained in the aspect of the material presented and learning resources. This is probably due to the material RPP activities are presented in a short and sources used not too varied. As for the highest average was obtained on several aspects of the RPP component. This is because the components of the RPP is complete and in accordance with existing rules. Based on these categories, the overall aspects of the learning device RPP gained validity value is 0.78 with a valid category. This shows that the PBL-based mathematics lesson plan is valid according to experts and can be used in the learning process in the classroom.

LKPD mathematics learning device based PBL declared valid by the validate through several aspects observed were didactic aspect, the aspect of the material / content aspect / appearance, and aspects of language. For didactic aspects of mathematics-based PBL LKPD obtain overall validity value is 0.83 with a valid category. This is because in LKPD already obvious steps that must be done learners in the learning process using the PBL-based math LKPD. To browse LKPD aspects of mathematics-based
PBL gained overall validity value is 0.78 with a valid category. This means that the content in terms of material that is in LKPD is good and complete by validate. In the aspect of mathematics LKPD display-based PBL's overall gain validity value is 0.73 with a valid category. This means in terms display LKPD can already be considered good and interesting. For the mathematical aspects of language-based PBL LKPD overall gain value of 0.70 with a valid category. This means that the use of language in LKPD can already be said to be good and easy to understand.

Based on the validity of the category-category overall average values obtained were in the range of 0.76 to 0.83 with a valid category. The lowest average in some didactic aspects with a category average of 0.67 is valid, it is because the activities on LKPD still visible guiding learners in problem solving. On the content aspect with the lowest average score of 0.67 with a valid category that is on aspects of the images presented to help understanding of the learners. That is because the pictures on LKPD little to mastery material. Display aspects and language to the average obtained in the range of 0.67 to 0.75 with a valid category. Based on the categories obtained by each of these aspects of the overall LKPD PBL-based math obtains validity value is 0.76 with a valid category. It shows that, according to experts LKPD PBL-based math is already valid and can be used in the learning process.

6.2. Based Practicalities PBL Math Learning Tool
Based on analysis of questionnaires filled out by the teacher, the average values obtained practicalities overall for LKPD by teachers was 89.58%, with a very practical category. Thus the study of mathematics-based devices are already practical PBL as a teacher by the user. Moreover, according to this PBL-based LKPD teacher is good and also attractive for use in the learning process. Based on questionnaires completed by the participants or students, in terms of the presentation of the learning device mathematics-based PBL is already interesting because it consists of colors that attract the attention of the learners as well as measures on LKPD has helped the students to understand the material system of linear equations in two variable. In terms of use, for students LKPD based PBL is already easy to use, easy to carry, and the teacher suggested to the students to bring LKPD caused by teachers LKPD mathematics-based PBL is complete, in addition to the matters contained in LKPD also can be done well by learners. In terms of legibility by learners LKPD PBL-based math is already clearly. According to learners of time specified in the mathematical LKPD workmanship is enough.

Based on the analysis of questionnaires completed by the learners, mathematics LKPD based PBL obtain the average value of the practicality that is 82.41%. This means LKPD based PBL own practical mathematics by teachers and learners as a user. Furthermore, based on the observation sheet that is used during the learning process, all of the learning process that has been planned to run well at each meeting. Although there are several obstacles but does not reduce the smooth process of learning.

7. Conclusion
The results of the validation of the validate indicates that the device is a valid PBL based learning and practical with some characteristics such as learning devices produced have been adapted to the characteristics of Problem Based Learning (PBL). RPP and LKPD designed as a guideline for teachers in implementing the learning process is valid and practical.

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