DEVELOPMENT OF PROBLEM-BASED LEARNING WORKSHEET ON TRIGONOMETRIC MATERIALS FOR CLASS X SMA

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ABSTRAK

Penelitian ini bertujuan untuk menghasilkan suatu perangkat pembelajaran matematika berupa Lembar Kerja Peserta Didik (LKPD) dengan menggunakan model *Problem Based Learning* (PBL) pada materi trigonometri kelas X SMA yang valid. Dalam pengembangan LKPD ini menggunakan model ADDIE yang terdiri dari lima tahap, yaitu tahap *Analysis* (analisis), tahap *Design* (desain), tahap *Development* (pengembangan), tahap *Implementation*(implementasi), dan tahap *Evaluation* (evaluasi). Tetapi dikarenakan situasi pandemi COVID-19 model pengembangan ADDIE yang dilakukan hanya 3 tahapan saja, yaitu: *Analysis* (analisis), *Design* (desain) dan *Development* (pengembangan). Instrumen pengumpulan data yang digunakan adalah lembar validasi LKPD. Teknik pengumpulan data yang digunakan adalah teknik nontes berupa angket. Data validasi dari 2 Dosen Pendidikan Matematika FKIP UIR dan 1 guru matematika SMA Negeri 14 Pekanbaru. Teknik analisis yang digunakan adalah analisis deskriptif. Dari hasil penelitian diperoleh hasil validasi LKPD adalah 90,79% dengan tingkat validasi sangat valid. Berdasarkan penelitian ini diperoleh Lembar Kerja Peserta Didik dengan model *Problem Based Learning* (PBL) pada materi trigonometri di SMA Negeri 14 Pekanbaru yang valid.

Kata Kunci: Lembar Kerja Peserta Didik, *Problem Based Learning (PBL)*.

ABSTRACT

The purpose of this study is to produce a mathematical learning tool in the form of Students Worksheets (LKPD) using a model Problem Based Learning (PBL) on valid trigonometry material for class X in SMA. In developing this LKPD using the ADDIE model which consists of five stages, there are the Analysis stage, the Design stage, the Development stage, the Implementation stage, and the Evaluation stage. However, due to the COVID-19 pandemic situation, the ADDIE development model was carried out only 3 stages, namely: Analysis (analysis), Design (design) and Development (development). The data collection instrument used the LKPD validation sheet. The data collection technique used is a non-test technique in the form of a questionnaire. Validation data from 2 Lecturers of Mathematics Education FKIP UIR and 1 mathematics teacher at SMA Negeri 14 Pekanbaru. The analysis technique used is descriptive analysis. From the results of the study, the results of the LKPD validation were 90.79% with a very valid validation level. Based on this research, it was obtained that the Student Worksheet with the model Problem Based Learning (PBL) on trigonometry material at SMA Negeri 14 Pekanbaru was valid.

Keywords: Student Worksheet, Problem Based Learning (PBL).

INTRODUCTION

In a mathematics lesson, teachers need to motivate students so that they are willing and able to solve problems, and if necessary guide them until they can solve them. The guidance in question can be given orally or in writing, but written assistance in the Student Worksheet (LKPD) is much more effective because it can often be read independently by students.

The Student Worksheet is a teaching material in the form of a sheet of paper containing material, summaries, and instructions for implementing learning tasks that must be done by students which are developed by educators in learning (Prastowo, 2016). In addition, the LKPD contains tasks that must be done by students as an exercise that aims to make students able to understand and understand the material being taught. (Ratumanan, Rosmiati, 2019). Learning that leads students to find concepts so that they can solve problems in learning one of them is Problem Based Learning (PBL).

Problem-solving and problem-solving skills that are not developed during learning, cause students to only to remember and repeat the subject matter. Therefore, it is also necessary to select teaching materials, one of which is the Student Worksheet (LKPD) using the Problem Based Learning (PBL) model which can develop students' understanding and develop students' skills in solving and solving problems in learning. LKPD is one of the teaching materials that support learning. The description above shows the need for research to develop learning tools, namely LKPD. Therefore, researchers want to develop LKPD based on Problem Based Learning (PBL). PBL-based LKPD is an LKPD that can help students find concepts independently, make it easier for students to interact with the material presented, and make students active in the learning process. The use of LKPD as teaching materials can help students be more active in learning(Kosasih, 2018). By developing teaching materials for Student Worksheets (LKPD) based on the Problem Based Learning (PBL) model, it is expected to facilitate educators and students in teaching and learning activities, especially in Trigonometry material.

However, at this time the quality of education is facing challenges as a result of the outbreak of the Covid-19 virus. This causes the learning process that is carried out directly to be transferred online. In this online learning process, several aspects of the quality of education such as motivation, interest, quality have decreased(Sadikin & Hamidah, 2020; Sobana, 2020). Therefore, there is a need for innovation in the online learning process so that it continues to run optimally and can achieve learning objectives(Susanti & Suripah, 2021).

One of the learning materials that require innovation in the implementation of the learning process in mathematics. This is because many students have difficulty understanding mathematics learning materials. Whereas mathematics learning is important to be given to students because through mathematics learning students will be trained to think critically, creatively, analytically, and systematically.(Suripah & Retnawati, 2019b). Wulandari (2015)also explained that mathematics is basic science and has an important role in the life of every human being. Through learning mathematics, students are trained to be patient, thorough, and more careful to increase their knowledge(Yudha, 2019).

The factors that cause students to have difficulty in learning mathematics are, (1) the concept of learning mathematics which is considered abstract (Suripah & Retnawati, 2019a), (2) students tend to read the learning material directly without understanding the concept first (Rumasoreng & Sugiman, 2014), (3) students often make calculation errors and do not understand the questions presented (Utari et al., 2019). One of the mathematics materials that is considered difficult by students is trigonometry.

Trigonometry is a mathematical material with the concept of the relationship between angles and sides in a right triangle, and the concept of trigonometry is often used for measuring building heights. (Sholih, 2017). The concept of learning trigonometry is very close to the problems of everyday life, but there are still many students who still have difficulty understanding the formulas and concepts of the trigonometry material. The difficulty experienced when studying trigonometry material is determining trigonometric ratios and formulas in right triangles. (Hayati, 2019).

To overcome the difficulties of students in the mathematics learning process, teachers are required to make more innovative efforts in the learning process (Wibowo & Agia, 2020). One of the efforts that teachers can do is to develop learning tools. Learning tools are important components that teachers must have and must be designed as well as possible before starting the learning process(Masitah, 2018). Purnamasari & Nur Wangid (2016) explained that if the learning device is designed as well as possible, the process of delivering knowledge to students becomes more systematic and optimal. Rando (2017) explained further in his research that with the existence of learning tools the academic potential and social potential of students are more developed following curriculum achievements.

Learning tools include Syllabus, Lesson Plans, and Student Worksheets. One of the learning tools that can help students' learning process is the Student Worksheet (LKPD).

LKPD can be designed with a certain learning model, to help students better understand the material being studied. In this research, worksheets will be developed on trigonometric material. The concept of learning trigonometry is very close to everyday life. Therefore, LKPD will be designed using a Problem Based Learning (PBL) learning model which will help students find various alternative solutions in solving problems.

One of the recommended learning models in the 2013 Curriculum is Problem-Based Learning (PBL). (Kemdikbud, 2013). The PBL model requires students to think critically about a phenomenon. This is what makes this learning model recommended to be used in the 2013 curriculum(Kosasih, 2018). In its application, PBL provides the widest opportunity for students to investigate the problems they face. Learning is not only result-oriented, but the main orientation is the learning process. The learning process is also not just hearing and seeing to gather knowledge, but learning requires doing an activity to master certain competencies. By doing such activities, it will provide experience to solve the problems encountered. Problem-solving can be done in collaboration with colleagues.

Learning that applies the PBL model is learning designed to improve the quality of learning by requiring students to study the material based on the problems presented (Jonassen, 2011). The problems presented are authentic and contextual and new problems so that in the problem-solving process, students may not know and understand all the prerequisite knowledge. To achieve the goals in PBL, students are facilitated to work in small groups(Botty & Shahrill, 2015). Students carry out activities in small groups to solve problems related to real-life(Chakrabarty & Mohamed, 2013). Through these activities, students are facilitated to learn meaningfully, develop creativity and innovation, and also develop collaboration skills(Isrok'atun & Rosmala, 2018).

PBL is carried out about the existing six stages(Isrok'atun & Rosmala, 2018). First, the presentation of the problem by the teacher which will then be solved by the students. Second, students discuss the problem in groups to formulate a solution to the problem. Third, students are given the freedom to formulate problem-solving without guidance from the teacher. Learners can formulate problems based on the knowledge that can be obtained from information sources that they can access. Fourth, students share information in group discussions. Fifth, present the results of the discussion regarding the formulation and solution of existing problems. Sixth, as the final stage, reflection and review of the learning process that has been carried out through problem-solving activities.

Another advantage of the PBL model is that it focuses on a problem at the beginning of learning and discovery activities in the learning process so that students can understand learning and can develop creative thinking skills. (Cahyono, 2017). In line with previous research, some students stated that presenting problems related to everyday life can make them enthusiastic in learning because lessons do not only focus on memorizing formulas. (Zulfah et al., 2018).

The purpose of the study was to produce student worksheets using the Problem Based Learning (PBL) model on valid trigonometry material for class X SMA. This development research has important benefits for students, teachers, and researchers, namely (1) For students, the results of this study are expected to improve student learning outcomes in learning mathematics and provide motivation to students in learning in the classroom and outside class. (2) For schools, this research is useful for additional learning tools and sources of information in making LKPD following the 2013 Curriculum Standards. (3) For researchers,

In connection with the above discussion, researchers are interested in developing learning tools based on the 2013 curriculum in the form of LKPD with the title "Development of LKPD Problem Based Learning Models on Trigonometry Material in SMA".

METHOD

The form of research used is research and development. Research and development is a term used to describe activities related to a new invention, method, new product, or service and using the newly discovered knowledge to fulfill a need or demand. (Son, 2013). The development model used is the ADDIE (Analysis, Design, Development, Implementation, and Evaluation) model. This model was developed by(Mulyatiningsih, 2011). Based on the ADDIE development model, the researcher made a development plan consisting of 3 stages, namely needs analysis (analysis), design (design), and development (development). The implementation and evaluation stages cannot be carried out by researchers due to the COVID-19 pandemic situation.

The instrument used in this study was a material expert questionnaire. The material expert questionnaire is intended to assess the product in terms of the material developed in the PBL-based LKPD. The material expert questionnaire was developed using the Guttman and Likert scales. This questionnaire consists of 22 statement items that represent three aspects of the assessment, namely content feasibility, presentation feasibility, and

conformity with PBL. More specifically, the content feasibility aspect focuses on assessing the suitability of the material with Core Competencies (KI) and Basic Competencies (KD), material accuracy, and material updates. The presentation feasibility aspect focuses on the assessment of the presentation of the material and the coherence of the flow of thought. The aspect of conformity with PBL focuses on assessing the suitability of the contents of the LKPD with the nature and components of PBL.

In the first stage, analysis is carried out, namely needs analysis and curriculum analysis. The needs analysis determines whether or not the development of LKPD is necessary as a learning tool used to see the availability of teaching materials in schools in developing student's creative thinking and collaboration skills. Meanwhile, curriculum analysis is carried out to determine the material to be developed and adjust the competencies that students must achieve in trigonometry material.

Based on observations and interviews conducted at SMA Negeri 14, it was concluded that one of the essential learning objectives of mathematics, namely the ability to solve mathematical problems is still low. This is due to the lack of implementation of the learning process that can develop students' mathematical problem-solving abilities. In addition, the LKPD provided in schools has not optimally facilitated students to achieve learning objectives, especially mathematical problem-solving abilities. Therefore, to hone students' mathematical problem-solving skills, teachers need learning tools that can facilitate students to grow and develop their mathematical problem-solving abilities. One alternative solution to these problems is to provide learning tools, especially teaching materials in the form of LKPD that can support the achievement of the desired learning objectives. LKPD is one of the printed teaching materials that can assist teachers in achieving learning objectives, especially to improve students' mathematical problem-solving abilities. One model/learning strategy that can facilitate students to develop problem-solving skills is Problem Based Learning (PBL). Through PBL-based LKPD, students can hone problem-solving skills. LKPD is one of the printed teaching materials that can assist teachers in achieving learning objectives, especially to improve students' mathematical problem-solving abilities. One model/learning strategy that can facilitate students to develop problem-solving skills is Problem Based Learning (PBL). Through PBL-based LKPD, students can hone problem-solving skills. LKPD is one of the printed teaching materials that can assist teachers in achieving learning objectives, especially to improve students' mathematical problem-solving abilities. One model/learning strategy that

can facilitate students to develop problem-solving skills is Problem Based Learning (PBL). Through PBL-based LKPD, students can hone problem-solving skills.

The design stage is to design a new product concept, design development tools, a design is written for each learning unit and detailed product instructions are written. At the design stage, LKPD uses problems that exist in everyday life. Researchers design LKPD as attractive as possible so that students do not get bored. And can also guide students to find a concept in the material. LKPD developed using the steps with the PBL model, namely (1) Orienting students to problems; (2) Organizing students to learn; (3) Guiding individual and group investigations; (4) Developing and presenting the work; (5) Analyze and evaluate the problem-solving process(Hosnan, 2014). At the design stage, the researcher also developed a research instrument in the form of an LKPD validation sheet.

The development stage is developing the product kits (materials and tools) needed in development, making products that are following the model structure, and making instruments to measure product performance. The data collection instrument used in this study was a validation sheet. In this development stage, the LKPD that the researcher designed previously will be shown to the expert, after reviewing the LKPD designed by the researcher, the expert team can fill out the validation questionnaire provided.

Because this research has only reached the validation stage, the research sites are located in two places, namely the Mathematics Education Study Program, Islamic University of Riau, and SMA Negeri 14 Pekanbaru. The data collection technique in this study was validation data from experts, namely 2 lecturers of mathematics education at FKIP UIR and 1 mathematics teacher at SMA Negeri 14 Pekanbaru. Several aspects will be assessed in the LKPD validation process, namely (1) LKPD technical aspects; (2) content aspect; (3) The language aspect of the LKPD.

1. Data collection technique

The type of data in the research to be conducted consists of qualitative and quantitative data. Qualitative data was obtained from data from observations, and interviews with students. While quantitative data was obtained from a questionnaire.

2. Data analysis technique

The data analysis techniques used in this development research are as follows.

3. Data Analysis of PBL-Based LKPD Validation Results

Data derived from the validation sheet were analyzed using quantitative analysis. The validation results from the validator for all aspects assessed will be presented in tabular form. The analysis was carried out using the Guttman scale and the Likert scale.

The steps are taken to determine the validity of the LKPD based on the data obtained from the validation sheet:

a. Give a score for each scale on the validation sheet, namely a score of 4 = strongly agree, score 3 = agree, score 2 = disagree, score 1 = strongly disagree
b. Determine the value by using the following formula:

$$V=\frac{v_{a1}+v_{a2}+v_{a3}}{3} = \ldots \%$$

The criteria for obtaining the LKPD level of validity are as follows.

Table 1. Criteria for LKPD Validity Level

Effectiveness Criteria	Effectiveness Level
85,01% - 100,00%	Very Valid or very effective (very thorough), can be used without repair.
70,01% - 85,00%	Sufficiently Valid or quite effective (sufficiently complete), usable but needs minor repairs.
50,01% - 70,00%	Less Valid or less effective (less complete), need major repair.
01,00% - 50,00%	Invalid or ineffective (incomplete), can not be used.

RESULTS AND DISCUSSION

LKPD validation was carried out by 3 validators consisting of 2 mathematics education lecturers and 1 mathematics teacher. Before being validated, several parts of the LKPD had been improved or revised based on the validator's suggestions. Suggestions from validators for LKPD improvement can be seen in the table below.

Table 2. Validator Suggestions for LKPD Revision

Validator	Suggestion	Before Revision	After Revision
1	Show steps on a statement or problems that students will work on.	Statement yet show the problem	Statements and questions already Show problem
2	Use sentence on matter clarified.	Information on practice questions independent is not clear.	Questions on self-practice already clarified.
3	Add activity field for find initial concept.	Activities on LKPD in find a solution problem centered teacher's explanation.	Activities at LKPD have been invite students to find problem-solving is in the participant's life educate
4	the letter that used customized with the size standard. Material and Nama writer be included on the cover.	Letter size on LKPD too big	Font size according to standard size in use of LKPD.
5	Pay attention to EYD and identity writing.	There are several uses inappropriate words with EYD, and use of the dot often left behind.	The use of the word already according to EYD and dot on end of sentence

The results of research on the development of LKPD with the Problem Based Learning (PBL) model on trigonometry material will go through several stages. In the first stage, namely the analysis (analysis), researchers get the results of interviews conducted at SMA Negeri 14 Pekanbaru, found several things contained in the school, namely: (1) Teachers still use worksheets provided by publishers as teaching materials; (2) Teachers already know the PBL model, but teachers still rarely use the model; (3) Not all students can do the assignments given by the teacher. (4) Students rarely want to ask the teacher about learning materials and many students are not able to express opinions when doing group assignments. (5) The participation of students in concluding learning is still lacking.

Based on the results of these observations, there is a solution to overcome this, namely by developing LKPD that can support the achievement of the desired learning objectives. LKPD is one of the printed teaching materials that can assist teachers in achieving learning objectives, especially to improve students' mathematical problem-solving abilities. The worksheets provided must be based on a learning approach that leads to a student center and is based on an activity that can develop students' mathematical problem-solving abilities. One of the learning models that can facilitate students to develop problem-solving skills is Problem Based Learning (PBL).

In the second stage, namely the design, the researcher begins to design the learning devices that will be developed. And at this stage, the researcher also made a validation sheet for the LKPD. There are 3 steps at this stage, namely:

1) Preparation of the LKPD Framework

Preparation of the LKPD framework based on the high school mathematics syllabus for class X and adapted to the systematics of LKPD preparation.

2) Reference Collection and Selection

After compiling the LKPD framework, then collect and select several references that will be used as a reference in developing LKPD on trigonometry material.

3) Preparation of LKPD design and features

After determining the references to be used, the next step is to start compiling the worksheets starting from designing the cover, making instructions for use, basic competencies and objectives, concept maps, introductions, learning materials, group assignments, practice questions, conclusions to the bibliography.

The core parts of the development of this LKPD include:

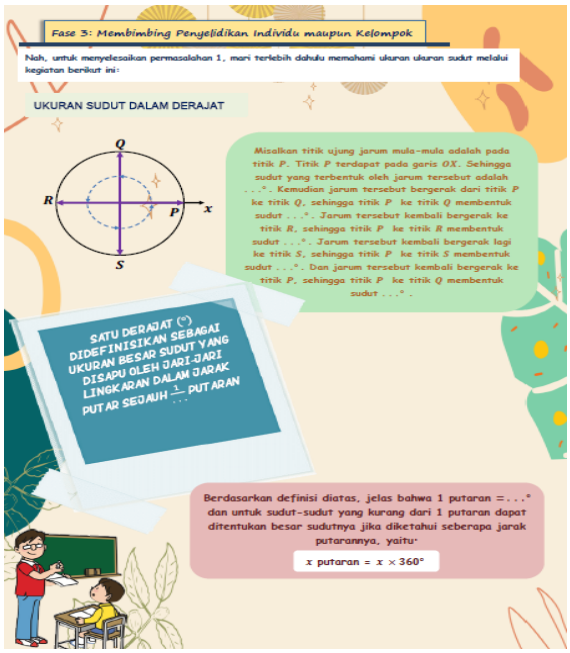
a. Introduction part

The introduction contains several illustrations of trigonometric problems found in everyday life. Here is the view from the introduction

Figure 1. LKPD Introduction Display

b. Learning materials

In the learning materials section, there are five sub-materials according to basic competencies. In each explanation, the material is adjusted to the steps of the PBL model. Here is one part of the display of learning materials.



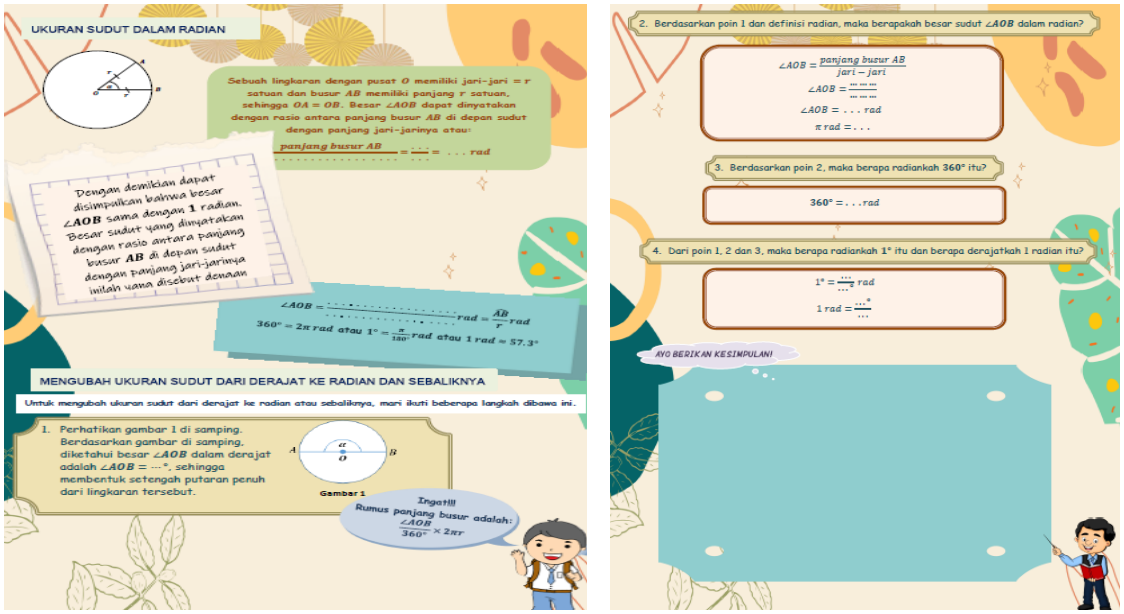


Figure 2. The display of one of the discussions on the LKPD material

c. Examples and Exercises

The examples and exercises contain complete problems and solutions adapted to the four indicators of creative thinking ability and are arranged based on easy to complex problems. So that it can train and develop students' creative thinking skills. The following is an example of a question display with creative thinking indicators, namely fluency and flexibility.

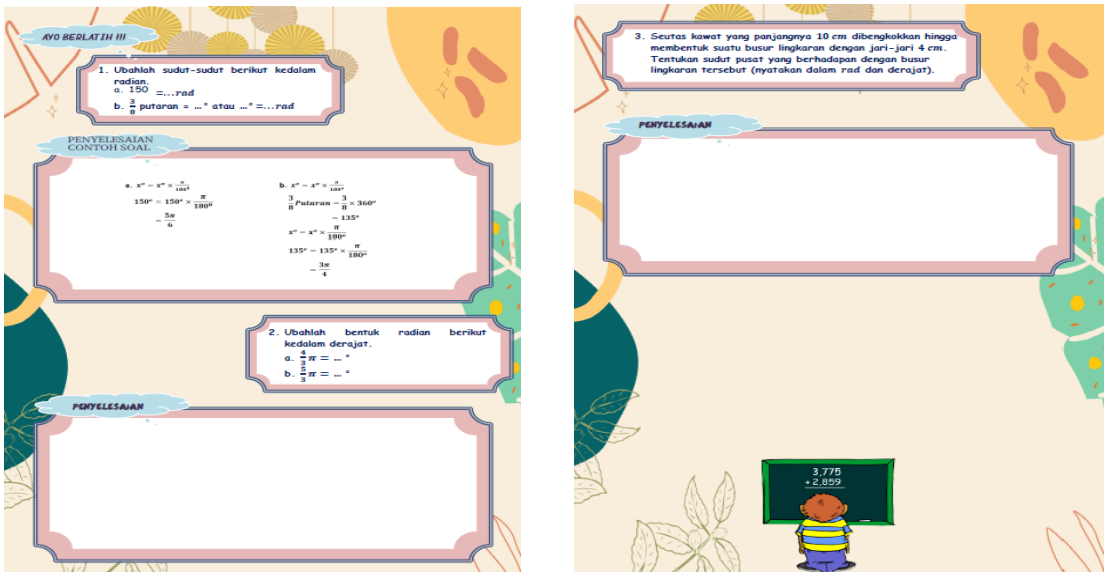


Figure 3. Display of an example of a problem and its solution

In the third stage, namely development, researchers have made a product and validated the product. At this stage, the validation was carried out by two mathematics

education lecturers from FKIP UIR and one mathematics teacher at SMA Negeri 14 Pekanbaru.

LKPD products are made based on the RPP that has been developed. The learning activities contained in the LKPD contain phases in the PBL model and also contain a scientific approach. The validation assessment of the LKPD has 3 aspects and 22 indicators. The following are the results of the calculation of the LKPD assessment from each validator, namely:

Table 3. Results of LKPD Validation Analysis

LKPD	Validation Percentage (%)			Average (%)	Validation Level
	V1	V2	V3		
LKPD -1	93.10	87.93	93.10	91.37	Very Valid
LKPD -2	93.10	87.93	93.10	91.37	Very Valid
LKPD -3	93.10	87.93	91.37	90.8	Very Valid
LKPD -4	91.37	87.93	87.93	89.07	Very Valid
LKPD -5	94.82	87.93	91.37	91.37	Very Valid

Based on the average assessment of the validity of the LKPD in table 3, which is 90.79%, the LKPD is included in the Very Valid category. The LKPD is effective enough to be used in the learning process but needs minor revisions to the product.

This development research resulted in PBL-based worksheets on the topic of trigonometry for students of class X SMA. The stages of PBL can be seen in the activities of the LKPD. The quality of the feasibility of PBL-based LKPD is seen from the assessment of material experts. The PBL-based LKPD that was developed met the appropriate criteria because the material expert's assessment was in the very good category. According to the pre-determined feasibility, the learning media or mathematics teaching materials in the form of PBL-based LKPD with trigonometry material are to be used by teachers in the implementation of learning. Overall, the learning media or teaching materials in the form of PBL-based worksheets are of very good quality and can be used as learning resources for trigonometry material. Judging from the colors used in the LKPD,

Previous studies related to this research, namely the development of learning tools which include the development of PBL-based mathematics worksheets for high school students show that the learning tools are valid in terms of expert judgment. (Angraini, & Masykur, 2018; (Sari, 2020)The practicality of the learning tools in terms of student responses shows that the learning tools are practical. Meanwhile, the development of PBL-based LKPD for seventh-grade students of SMP on the topic of social arithmetic shows that the LKPD is valid and practical. (Ridwan et al., 2016)Validity is known from expert judgment, while practicality is seen from teacher assessments and student responses. This

study succeeded in developing PBL-based worksheets on the topic of trigonometry for students of class X SMA. This study strengthens the results of these studies, that the use of valid PBL-based LKPD is very good for use in learning mathematics for high school students in class X.

This PBL-based LKPD was originally designed for face-to-face learning, but due to the pandemic, learning activities with this LKPD were carried out online. This resulted in some activities that had been designed could not being carried out according to plan, discussion activities carried out online were not effective, and the use of online learning time was also less effective. The solution taken is to carry out online learning activities via WhatsApp. The teacher facilitates students by using the LKPD that has been developed. The teacher assists when students have difficulty. For example, the teacher assists students with trigonometric comparison material. Learning activities using LKPD can be implemented starting from presenting problems, formulation of solutions by students, exchanging ideas related to the solution of a problem, presenting solutions, and reflecting. The material contained in the LKPD is presented coherently. The language used in LKPD is simple and communicative. In addition, students also feel more able to learn independently by using the LKPD developed in this study.

Changes made when compared with previous teaching materials occurred in terms of the learning approach. If the existing teaching materials have not optimally made students active in finding and building concepts from their lessons, then in the PBL-based LKPD that was developed, students are required to be active in the learning process, students will be guided to solve problems related to the learning process. with the subject matter. If in the previous teaching materials, the subject matter is given at the beginning of learning and problems are given at the end of learning, then in PBL-based LKPD, problems are used as a starting point for the learning process. In addition, students are also taught the steps in solving a problem.

This validation is very useful for researchers because with this validation researchers can find out the shortcomings and errors contained in the product so that the resulting product is tested for feasibility. The shortage of researchers is that researchers still lack references in making LKPD which will be used for students later during the learning process. The researcher's error is that the problem presented is still too simple. The results of LKPD validation using the PBL model from each validator have a very valid validation level with a percentage of 90.79%. In other words, the product of mathematics

learning tools in the form of LKPD is quite effective to use with small revisions so that it can be used during the learning process.

The ADDIE development stage used by researchers can only use 3 stages, namely the analysis stage (Analysis), the design stage (Design), and the development stage (Development). Due to the current conditions and situations that make it impossible to carry out research, namely the ongoing Covid-19 pandemic which requires the learning process in schools to be abolished. So, in this study, researchers did not use the implementation and evaluation stages of the ADDIE development model. Due to the limitations in carrying out the stages in the ADDIE development model, the practicality of the LKPD developed cannot be known.

For students, the use of LKPD Trigonometry is very easy, students do it sequentially according to the instructions in the LKPD. In addition to being easy to use, students' learning methods become better and can learn optimally by using LKPD with PBL models that are effective, efficient, and able to provide attractiveness. So that it allows students to be actively involved in finding concepts and principles to solve problems, able to arouse curiosity, and motivate students to stay enthusiastic about learning.

For teachers of mathematics subjects in high school, using the LKPD with the PBL model in the learning process is very easy, the teacher is only tasked with guiding and supervising students in working on the LKPD. Because of the LKPD media learning with the PBL model, the teacher can provide initial information to students before learning activities begin in class through the prepared LKPD. Thus, students already have prior knowledge before learning begins, so that all learning activities in class are more communicative.

For schools, LKPD with the PBL learning model can be used as alternative learning to increase effectiveness, the efficiency of learning and be able to motivate students to stay involved in learning tasks in both mathematics and other subjects.

For other researchers, this Trigonometry LKPD can be used as material for further research or other researchers in the future to produce better and perfect findings so that they can contribute to the diversity of knowledge, especially in the realm of educational technology.

CONCLUSION

Based on the results that have been described, it can be concluded that the Student Worksheet using a Problem Based Learning (PBL) model on trigonometric material is valid with an average value of 90.79%. to be tested on high school or vocational high school students as considered and assessed by expert validators.

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