



Development Of Student Worksheets (LKPD) Based On The Problem Based Learning (PBL) Model On Statistical Material In Class X Of It High School

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Abstract. Researchers are interested in conducting research with the title "Development of Student Worksheets (LKPD) Based on Problem Based Learning on Statistics Material for Class X SMA IT". This type of research is Research and Development (R&D) because this research will develop the development of Student Worksheets Based on Problem Based Learning on Statistics Material for Class X SMA IT. Research and development methods used to produce certain products, and test the effectiveness of these products. The location of this research was carried out at Lhokseumawe City IT High School in the odd semester of the 2023/2024 academic year. This research uses the ADDIE development model. (1). The validity of the results of the media expert validation questionnaire on the Problem Based Learning-based Student Worksheet in the Statistics material class X obtained an average percentage of 91.89% with very valid criteria and the results of the validation of the material experts on the Problem Based Learning LKPD the Statistics material of class X got an average percentage of 80.14% with valid criteria (2). The level of practicality from the results of small group educators' responses to the Problem Based Learning-based LKPD in the Statistics material of class X obtained an average percentage of 95% with very practical criteria (3). The level of effectiveness of the results of student completeness classically obtained an average percentage of 44% with fairly effective criteria and the response of large group students with an average percentage of 96% with very practical criteria. Therefore. So tis reserch valid, practices and effective with Problem Based Learning LKPD on Statistics class X material is effectively used.

Keyword: Problem Based Learning, LKPD

1. 1. Introduction

Education is an important activity for human life because it turns people into professionals and skilled in their fields. As the purpose of national education is to develop the potential of students so that they become human beings who believe and fear God Almighty, have noble character, are healthy, knowledgeable, capable, creative, independent, and become democratic and responsible [1] based on [2]. With the existence of education, students will become educated so that they have broad insight to build their character. Character education according to [3] is education to shape a person's personality through ethics education, the results of which can be seen in a person's real actions, namely good behavior, honesty and responsibility, respect for the rights of others, hard work, and so on. Aristotle argued that character is closely related to habits that are often manifested in behavior [4]. One of the tools that can support educational activities is books, interesting books can attract the interest of readers and books that can clearly increase students' desire in learning so that they can increase the understanding of the students.

Statistics cannot be separated from other sciences and is the basis for decision-making. Therefore, statistical science is a must for all circles, especially decision-makers. Statistics can be interpreted as, the quantity in a sample (used to estimate population parameters) that can provide information about a symptom or phenomenon [5]. According to [6] Mathematics is one of the most important subjects, mathematics can be



said to be a subject that cannot be separated in daily life. According to [7] also argues that mathematics also has an important role in the advancement of human thinking, and in the field of information and communication technology. So, teachers not only condition the situation but can create a new breakthrough in the field of learning, one of which is creating learning media.

Problem Based Learning (PBL) is one of the learning models that supports learning, because the PBL model can direct and foster curiosity about the material being studied [8]. PBL in student learning is given a real problem regarding the material being studied, then students are directed to solve a problem, understand the problem, and find the answer to the problem given, and the teacher's position is only as a facilitator [9]

In addition, one of the teaching materials that helps learning is the Student Worksheet (LKPD) [7]. LKPD can be a support for teachers in achieving learning goals [10] LKPD plays an important role in because it can help increase student involvement in learning and make it easier for teachers to guide students to explore a concept through independent activities. Based on the above background, the researcher is interested in conducting research with the title "Development of Student Worksheet Development Based on Problem Based Learning in Class X Statistics Material at SMA IT". As an educator, it is very important to provide a fun learning process and keep up with the times.

2. Method

This type of research is Research and Development (R&D) because the research will develop the development of LKPD based on PBL of Statistics material for class X of Lhkseumawe City IT High School. According [11], the research and development method or in English Research and Development is a research method used to produce certain products, and test their effectiveness. The location of this research was carried out at Lhkseumawe City IT High School in an odd semester, the 2023/2024 school year. This study uses the ADDIE (Analysis, Design, Development, Impelementation, and Evaluation) development model. According to [12], ADDIE is product development concept. The steps for research and development of the ADDIE model are as follows: 1) Analysis : The analysis stage in the development of PBL-based LKPD for Statistics material for class X of Lhkseumawe City IT High School aims to analyze the problems faced in the field related to the statistics books used so far. 2) Design: The design stage is the stage of designing a PBL-based LKPD for Statistics material for class X of Lhkseumawe City IT High School to improve the competence of prospective mathematics education teachers who will be developed by researchers. 3) Development: The stages carried out by the researcher in the development of PBL-based LKPD for Statistics material for class X of Lhkseumawe City IT High School are seen in terms of design, images and language which will later be different from the learning media used in schools. Conducting a review of the learning LKPD by validating the learning statistics book by 2 teams of media experts and 2 teams of material experts. 4) Impelementation: In the impelementation stage, the researcher carried out 2 stages. 5) Evaluation.

At the evaluation stage, a final revision is made to the product developed based on the suggestions and input of students given during the implementation stage. The assessment of the feasibility of learning media was obtained from the validation of media experts and material experts. The assessment of the practicality of learning media was obtained from the results of student responses. The assessment of the effectiveness of learning media was obtained from the results of students' answers on the test instruments. The E-Module product trial was carried out with the aim of finding out the level of validity and practicality. The product trial referred to in this content is a small group trial conducted on students with a total of 9 students. Furthermore, large group trials were carried out on students with a total of 22 students. The types of data taken in this study are qualitative and quantitative data. Qualitative data is data that cannot be analyzed in the form of numbers. While quantitative data is data expressed in the form of numbers. Qualitative data in the form of evaluation questionnaires of media experts and material experts and student response questionnaires.

Data collection techniques are various ways used by researchers to collect data, collect, retrieve or capture research data. In this development research, the data collection techniques used by the researcher are questionnaire. According to [11], a questionnaire is a data collection technique that is carried out by giving a set of questions or written statements to respondents to answer. The questionnaire aims to obtain data on students' backgrounds as one of the materials in analyzing their behavior and learning process. In this study, a questionnaire was used to obtain data related to the validity and practicality of the E-Module

developed. Validity questionnaires are given to validators, educational technology experts, and learning material experts. Meanwhile, a practicality questionnaire was given to students.

Stated that a research instrument is a tool used to measure the value of the variable to be studied [12]. In more detail, research instruments are tools or facilities used by researchers in collecting data so that the work is easier and the results are better, meticulous, complete, so that it is easier to process. The instruments used in this study include: The instrument shown to expert lecturers is also in the form of an assessment questionnaire that uses the Likert scale calculation scale format. This expert lecturer assessment questionnaire is used to find out whether the E-Module that has been developed has good quality or not. The assessment scale of the questionnaire is as follows: strongly agree is given a score of 4, agree is given a score of 3, disagree is given a score of 2, and strongly disagree is given a score of 1. [12] The validation instrument given to material experts also uses the Likert scale calculation scale. This learning material expert assessment questionnaire is used to find out whether the E-Module that has been developed is in accordance with the material and concept of mathematics learning or vice versa. The assessment scale of the questionnaire is as follows: strongly agree to be given a score of 4, agree to be given a score of 3, less Agree is given a score of 2, and strongly disagree is given a score of 1. Here is a grid of E-Module validation sheets for material experts.

E-Module with Realistic Mathematics Education (RME) based on Pancasila Students in the Independent Curriculum that was developed was tested for feasibility by providing validation sheets to media experts and material experts. The formula used by Ismiyanti, [13]. Furthermore, to classify the validity level of the Acehese culture-based literacy and numeracy modules, the researcher used a likert scale with the weight of score in the Eligibility Criteria for Interpretation. LKPD based on PBL Statistics material for class X of Lhkseumawe City IT High School. Practicality LKPD is based on PBL from student responses. According to [14] formula used to determine the level of practicality of PBL-based LKPD. Furthermore, to classify the level of practicality of PBL-based LKPD, the researcher used likert scale and the Criteria for the Practicality of Interpretation of Modified Media. The effectiveness analysis was carried out by measuring the level of student learning completeness after using the PBL-based LKPD developed by the researcher. [15] said to see the completeness of student learning is calculated using a formula. Furthermore, to classify the level of effectiveness of PBL-based LKPD, the researcher uses the criteria of classical completeness, namely a class is said to have completed its learning (classical completeness) if in the class there are 85% of students who have completed their studies. Criteria for the Effectiveness of Media Interpretation [16].

3. Result and Discussion

The product resulting from this research is a Student Worksheet (LKPD) based on Problem Based Learning on Statistics material for class X SMA IT Lhokseumawe City. This research uses a 4D model consisting of 4 stages, namely: Definition; Design; Development (develop); and Dissemination. At this stage, the researcher explained four analyzes namely curriculum analysis, student analysis, material analysis, and needs analysis. Analysis of the curriculum implemented in the Lhokseumawe City IT High School is an independent curriculum, the researchers found adjustments using the independent curriculum published in learning media, namely LKPD. This analysis includes an analysis of Core Competencies (KI) and Basic Competencies (KD) regarding what will be included in learning media.

Material analysis was carried out to identify material that was difficult for students to understand, based on interviews with teachers who taught in class X of Lhokseumawe City IT High School that the material that was difficult for students to understand was Data Centralization Statistics. At this stage, the researcher analyzed the character of students in class X of Lhokseumawe City IT High School. The results of observation and interviews are that students have a low willingness to learn because students tend to be passive and less involved when learning mathematics takes place. This can be seen when given questions or opportunities to ask questions, students are more silent and do not try to answer questions or ask questions about learning materials that are poorly understood.

Needs analysis aims to be a solution to the learning problems that are being faced. Learning activities that are still centered on educators, teaching media that are still lacking and students tend to be passive and lack participation. Therefore, it is necessary to develop a mathematics learning medium on statistical materials, namely Student Worksheets (LKPD) based on Problem Based Learning. At this stage, researchers began to design LKPD based on Problem Based Learning on statistical materials to be developed. This planning stage has three steps carried out, namely the preparation of the LKPD, the selection of the LKPD format, and the initial planning of the LKPD.

The preparation of the LKPD is sourced from the Learning Objectives Flow (ATP). The material used from clear sources is in accordance with the package books in the school. The selection of the LKPD format to compile the LKPD parts based on Problem Based Learning on data centralization statistics material. Part of the material At this stage there is material, examples, and independent exercises to complete in accordance with the Problem Based Learning syntax designed using Canva. The closing section contains the author's objectives for developing this LKPD. After designing the product, the researcher then carried out the stage of giving a product validation questionnaire to material expert validators and media experts from lecturers and teachers with the aim of assessing the validity of the product developed by the researcher. The Student Worksheet (LKPD) that has been developed will be validated by material experts, media experts and tested in small groups to determine the quality of the product being developed. The validation of the material expert is Mrs. Bepi Maulida, S.Pd., M.Pd Principal of Lhokseumawe IT Junior High School. The following are the results of the validation assessment from material experts:

Table 1. Material Expert Validation Results

NO	Assessment Aspects	Lecturer Subject Matter		
		Score Retrieved	Percentage (%)	Validity Level
1	Feasibility Fill	4,55	91,11%	Highly Valid
2	Serving	4,42	88,57%	Highly Valid
3	Linguistics	4,8	96%	Highly Valid
Average amount		4,59	91,89%	Highly Valid

Based on the table in the form of the mathematics worksheet above, the results of the material expert's assessment show that it is categorized as "very valid". So it can be concluded that the LKPD for mathematics learning based on Problem Based Learning is included in the "valid" category and can be used as a new learning resource in schools.

Validation of media experts, namely Mrs. Lia Rista, S.Pd., M.Pd as a lecturer in Mathematics Education at Bumi Persada University The following are the results of validation research from media experts:

Table 2. Media Expert Validation Results

NO	Assessment Aspects	Media Expert Lecturer		
		Score Retrieved	Percentage (%)	Validity Level

1	Size	4	80%	Valid
2	Design Cover	4	80%	Valid
3	Design Contents of LKPD	4,42	88,57%	Highly Valid
4	PBL Assessment	3,6	72%	Valid
Average amount		4,05	80,14%	Valid

Based on the table in the form of a mathematics learning LKPD above, the results of the media expert's assessment show that it is "valid". So it can be concluded that the LKPD for mathematics learning based on Problem Based Learning is included in the "valid" category and can be used as a new learning resource in schools. The draft module before and after revision is based on suggestions and comments from media expert validator I and media experts.

Table 3. Results of the Revised Results of Media Experts

Before the Revision	Revision

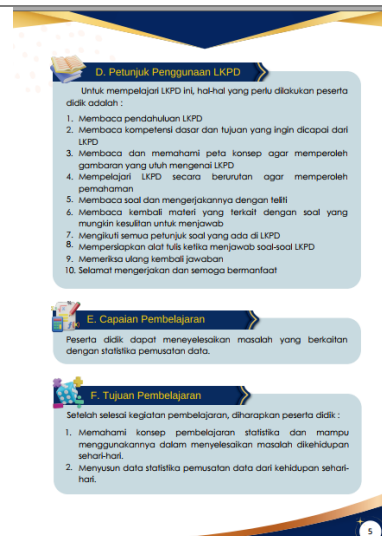
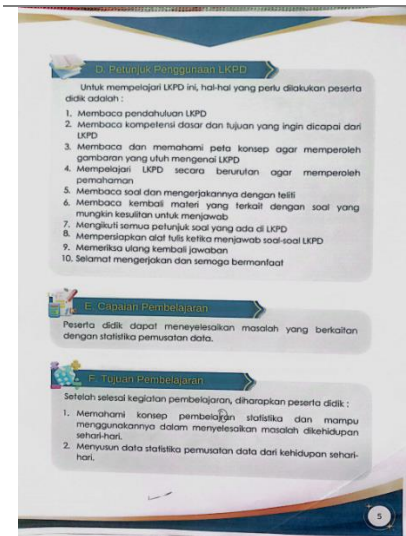
In the LKPD in the problem orientation section, there is no PBL in the problem.

Based on the advice from the validator in the problem orientation section, improve your critical and creative abilities so that it becomes an open ended problem, so that the PBL is alive.

The draft module before and after revision is based on suggestions and comments from material expert validators.

Table 4. Revision Results of Material Experts

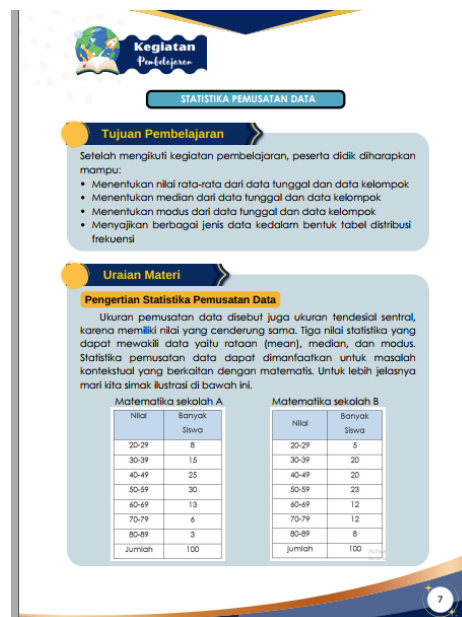
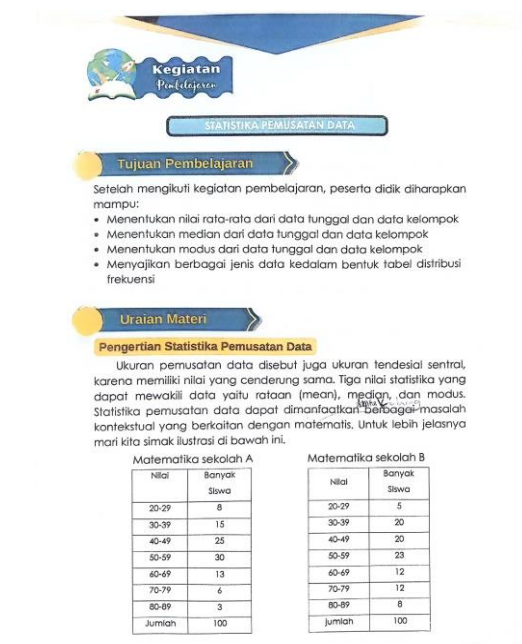
Before the Revision	After the Revision
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Based on

In the learning objectives section, there is a typo in the part of the word "learning"

suggestions from validators that need to be improved.



In the material part, the LKPD is less connected and replaced with the word connected.

Based on the suggestion from the validator that the word connected is replaced with "for".

A small group test was carried out to improve the product, by taking a sample of 6 students from class X of Lhokseumawe City IT High School. Furthermore, the researcher distributed the LKPD to be viewed, read and completed, after which students were asked to give an assessment using a questionnaire to assess the LKPD. The following are the results of filling out the questionnaire for small group trials conducted by students, which can be seen in the following table:

Table 5. Results of Students' Responses in Small Group Trials

No	Aspek Pe	Results of Product Trial Values to groups	Criteria
1.	Display	95%	Very Practical
2.	Material	92%	Very Practical
3.	Learning	97%	Very Practical
	Average	95%	Very Practical

In the table above, the results of the small group trial given to 6 students obtained an average of 95% with very practical criteria, so that the Student Worksheet (LKPD) Based on Problem Based Learning in the Statistics material of class X SMA IT Lhokseumawe City can be used after improvement according to the suggestions of the small group trial students.

At this stage of dissemination, it was carried out in a limited manner, namely a large group trial was carried out in class X of Lhokseumawe City IT High School with a total of 30 students. Large group tests are carried out with the aim of seeing whether the product is practical or not in accordance with the students' responses to this deployment. The following are the results of filling out the assumption questionnaire carried out by students, which can be seen in the following table:

Table 6. Results of Students' Responses in Large Group Trials

No	Aspek Pe	Results of Product Trial Value to Batches	Criteria
1.	Display	96%	Very Practical
2.	Material	97%	Very Practical
3.	Learning	95%	Very Practical
	Average	96%	Very Practical

Based on the results of the percentage of 29 students, an average percentage of 96% was obtained with very practical criteria. In accordance with the results of students' responses to the Student Worksheet (LKPD) based on Problem Based Learning in the Statistics material for class X of Lhokseumawe City IT High School developed by the researcher, it has very practical criteria and received positive responses from students. At this stage, a large group test is also carried out to see whether it is effective or not according to the completeness of students' learning in this classically in this deployment. The completeness of students individually is seen from the average results of LKPD.

The assessment was carried out on all class XI students by providing a test instrument in the form of 10 multiple choice questions taken from the questions already on the LKPD. After the students completed the questions, the researchers obtained classical completion test results in large group trials of 48% in the "quite effective" category. So based on the percentage of classical learning completeness, the Problem Based Learning LKPD is effective to use. The conclusion of the achievement of the problem formulation can be seen in the table below.

Table 7. Recapitulation of Problem Formulation Achievement

No	Aspek	Persentase	Criteria
1.	Validity of Materi	91,89%	Valid
2.	Validity of the Expert	80,14%	Valid
3.	Practicality from to group	95%	Very Practical
4.	Large Group Practicality	96%	Very Practical
5.	effective	44%	Sufficiently Efficient

The research and development carried out has 3 objectives. The first objective is to determine the validity of the Problem Based Learning mathematics learning worksheet based on statistics material focusing on data as a new source in schools. At the validity stage of the LKPD for mathematics learning based on Problem Based Learning, statistical material focusing on data as a new learning resource in schools, researchers distributed validation questionnaires and LKPD that had been designed/printed to material experts and media experts who were lecturers. Based on research that researchers have conducted, it shows that the percentage of media expert validation results is 91.89% which is categorized as "very valid" and material expert validation results are 80.14% which is categorized as "valid".

The second objective is to find out the practicality of Problem Based Learning mathematics learning LKPD based on statistics material focusing on data as a learning resource in schools. The practical value of LKPD for mathematics learning based on Problem Based Learning, statistical material, centralizing data as a new learning resource in schools. Researchers distributed response questionnaires and LKPD that had been designed/printed to small groups of 6 students to assess the practicality of LKPD. Based on research that researchers have conducted, it shows that the response results in small group trials were 95%, which was categorized as "very practical". So it can be concluded that the Problem Based Learning LKPD that the researchers developed has a practical category for use as a learning resource.

The third objective is to determine the effectiveness of the Problem Based Learning mathematics learning worksheet based on statistics material focusing on data as a new resource in schools. At the effectiveness stage of the Problem Based Learning-based mathematics learning module, data-focused statistical material as a new learning resource in schools, researchers distributed 10 multiple choice questions taken from existing questions on the Problem-Based Learning-based mathematics learning worksheet, data-focused statistical material to all class students. X to assess the effectiveness of the LKPD. Based on the research that the researchers have conducted, the researchers obtained classical completion test results in large group trials of 44% which were categorized as "quite effective" and the results of the response questionnaire showed that the percentage of 96% was categorized as "very practical". So it is based on the percentage of classical learning completeness. that LKPD based on Problem Based Learning is effective to use. This is also in line with the theory of the definition of learning media according to [17] which states that learning media is a tool channel that can assist learning activities so that learning objectives can be achieved effectively and efficiently. And in accordance with research theory [18] which states that the product being developed can have a positive and effective impact on mathematics learning abilities. Based on the above statement, it can be concluded that the development of a mathematics LKPD based on the PBL learning model on data-centric statistical materials can help the learning process and can help students to be motivated to learn independently. In line with the most recent researchers [19].

4. Conclusion

Based on the results of the research, it can be concluded: (1). The validity of the results of the media expert validation questionnaire on the *Problem Based Learning-based Student Worksheet* in the Statistics material class X obtained an average percentage of 91.89% with very valid criteria and the results of the validation of the material experts on *the Problem Based Learning Student Worksheet* in the Statistics material of class X got an average percentage of 80.14% with valid criteria, then the LKPD Didik based on *Problem Based Learning* in the Statistics material of class X is suitable for use (2). The level of practicality from the results of small group educators' responses to the Problem Based Learning-based Student Worksheet in the Statistics material of class X obtained an average percentage of 95% with very practical criteria, so the LKPD of Students based on *Problem Based Learning* in the Statistics material of class X was practically used (3). The level of effectiveness of the results of student completeness classically obtained an average percentage of 44% with fairly effective criteria and the response of large group students with an average percentage of 96% with very practical criteria. Therefore, the *Problem Based Learning LKPD* on Statistics class X material is effectively used.

Acknowledgments

With great gratitude, we would like to express our deepest gratitude to all team members and all parties involved in this research activity. We appreciate the dedication, hard work and commitment that each team member has provided. Every contribution and role you play has had a major impact on the smoothness and success of this research. We also express our gratitude to the institutions and institutions that have supported, both technically and materially, so that this research can be carried out well. The assistance

provided was very meaningful in expediting every stage of the research, from preparation to completion. Without solid support and cooperation from various parties, the results of this research would not have been achieved as they should be. We hope that this collaboration can continue in the future to produce scientific works that are beneficial for the progress of science and society.

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