



# Validity and Practicality of Online Learner Worksheets Based on Students' Mathematical Problem Solving Ability

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## Abstrak

Lembar Kerja Peserta Didik (LKPD) merupakan bahan ajar yang mendorong siswa untuk belajar mandiri yang dibuat secara metodelis berdasarkan silabus tertentu, dikemas dalam satuan waktu tertentu, dan ditampilkan dengan memanfaatkan teknologi pembelajaran online. Tujuan dari proyek ini adalah untuk membuat Lembar Kerja Siswa (LKPD) online untuk siswa yang berfokus pada menjawab masalah matematika. Menggunakan pendekatan penelitian pengembangan (R&D) dengan model 4D (Define, Design, Develop, Disseminate) dalam pembuatannya. Penelitian ini dilakukan untuk mengetahui kevalidan dan kepraktisan LKPD berbasis pemecahan masalah matematika materi garis dan sudut di Kota Sungai Penuh. Instrumen yang digunakan berupa lembar validasi dan lembar praktikalitas. Berdasarkan hasil uji Ahli Materi diperoleh rata-rata skor 93% pada kategori Sangat Valid, dan hasil uji Ahli Media mencapai skor rata-rata 91,81% pada kategori Sangat Valid. Hasil respon guru matematika mendapat skor 100% pada kategori Sangat Praktis dan hasil respon siswa mendapatkan skor rata-rata 89,37% pada kategori Sangat Praktis. Berdasarkan hasil tersebut dapat disimpulkan bahwa Lembar Kerja Siswa (LKPD) online berbasis pemecahan masalah matematika adalah valid dan praktis untuk digunakan sebagai sumber belajar. LKPD online yang valid dan praktis dapat membantu meningkatkan efektivitas pembelajaran dengan memungkinkan siswa untuk belajar secara mandiri dan interaktif dengan bahan ajar yang dirancang sesuai dengan kebutuhan mereka.

## Abstract

Learner Worksheets (LKPD) are teaching materials that encourage students to learn independently that are methodically created based on a specific syllabus, packaged in a certain time unit, and displayed by utilizing online learning technology. The purpose of this project is to create an online Student Worksheet (LKPD) for students that focuses on answering math problems. It uses a development research (R&D) approach with the 4D model (Define, Design, Develop, Disseminate) in its creation. This research was conducted to determine the validity and practicality of LKPD based on mathematical problem solving on line and angle material in Sungai Penuh City. The instruments used are validation sheets and practicality sheets. Based on the results of the Material Expert test, an average score of 93% was obtained in the Very Valid category, and the results of the Media Expert test reached an average score of 91.81% in the Very Valid category. The results of the math teacher's response received a score of 100% in the Very Practical category and the results of student responses received an average score of 89.37% in the Very Practical category. Based on these results, it can be concluded that the online Student Worksheet (LKPD) based on mathematical problem solving is valid and practical for use as a learning resource. A valid and practical online LKPD can help improve learning effectiveness by allowing students to learn independently and interactively with teaching materials designed according to their needs.

## INTRODUCTION

The development of technology has had a significant impact on the use of teaching materials in schools (Hanimoğlu, 2018). The use of technology in learning has improved the interaction between teachers and students, increased student participation, and improved student learning outcomes (Costley, 2014). Technology such as computers, tablets, and smartphones have been used in learning as aids in presenting materials, giving assignments, and providing evaluations (Wali & Omaid, 2020). In addition, technology is also used in the creation

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of teaching materials such as videos, animations, video game, and simulations that can be used to reinforce the concepts taught (Handican & Setyaningrum, 2021). Teaching materials developed with technology can also be accessed online so that students can learn anytime and anywhere (Cook & Sonnenberg, 2014). The development of technology also enables effective and efficient distance learning (Hafeez et al., 2014). Thus, technology has contributed greatly to the development of more effective and efficient teaching materials to support better learning.

As the foundation for other disciplines such as economics, accounting, physics, chemistry, and medicine, mathematics is a field of science that is very important for human life (Wijayanti, Caswita, Sutiarmo, 2019). The existence of abstract objects is one of the characteristics of mathematics (Nurfadilah & Suhendar, 2018). The abstract aspect of math makes it challenging for many children (Soviawati, 2011).

This can be seen from the average value of the National Examination (UN) which is still low, for junior high school students in Indonesia in 2019, the average score of the National Mathematics Exam (UN) was 46.56. When compared to other topics, such as Indonesian Language (65.69), English Language (50.23), and Science, this score comes last (48.79). Therefore, math education needs to be innovative. The use of LKS is one of the advances in mathematics education (LKPD) (Abdillah & Astuti, 2021). Data exposure shows that students' math problem solving skills are still low. This can be seen from the test results obtained by students and also from observations made by teachers. The data shows that students have difficulty in identifying problems, gathering information, and evaluating alternative solutions. Students' ability to apply mathematical concepts applied in problem solving is also still low. This shows that students have difficulty in understanding mathematical concepts as a whole and applying them in problem solving. This is an important concern because mathematical problem solving skills are the basis of STEM (Science, Technology, Engineering, Mathematics) learning needed in everyday life (Milaturrahmah et al., 2017). Therefore, efforts need to be made to improve students' math problem solving skills in order to improve student learning outcomes.

In addition, observations made in one of the junior high schools in Sungai Penuh revealed that books serve as the main teaching resource for students. However, due to the length of material offered, most students have difficulty understanding learning exclusively from textbooks. According to observations, teachers continue to use books that do not help students' problem-solving skills. Low quality and learning outcomes are other issues plaguing our education system today, especially amidst the Covid-19 pandemic that necessitates online learning (Ayu Ardani et al., 2018). Observing that students' achievement on line and angle material is still below average when compared to the teacher's daily test results.

There are several reasons why you should develop Learner Worksheets (LKPD) where LKPD can be used as a tool in the learning process, so that students can learn more effectively and efficiently (Syafitri & Tressyalina, 2020), well-developed LKPD can improve student learning outcomes because students can learn in a more interactive and enjoyable way (Sianturi et al., 2021), LKPD can be used as an evaluation tool and monitoring of student progress, so that teachers can evaluate student development continuously (Gusyanti, 2021), online LKPD can be used as a distance learning tool so that students can learn independently, LKPD developed must be in accordance with the established curriculum so that it can improve student learning outcomes (Melindawati, 2021), and problem-based online LKPD can provide opportunities for students to think logically and critically in solving math problems (Hasanah et al., 2021).

Mathematical problem solving ability is one of the important competencies that students must have for the following reasons; 1) Preparing students to face problems in the real world: Mathematical problem solving skills will help students in dealing with problems that may be faced in everyday life such as financial, technological, and other problems (English, 2010); 2) Enhance creativity and innovation: Mathematical problem solving skills will help students to think creatively and find innovative solutions to problems (Santi et al., 2019); 3) Improve critical thinking skills: Mathematical problem solving skills will help students to think critically and evaluate various solution options (Susanti & Hartono, 2019); 4) Improve math learning outcomes: Mathematical problem solving skills will help students in improving math learning

outcomes because students can understand math concepts better and apply them in problem solving (Rahayu & Agustika, 2020); 5) Support STEM (Science, Technology, Engineering, Mathematics) learning: Mathematical problem solving skills are the foundation of STEM learning as it enables students to think logically and analytically in solving problems (Milaturrahmah et al., 2017).

There are several main differences between online LKPD development research and other LKPD research, including: 1) Technology, online LKPD development research will focus more on the technology used in the development of online LKPD, such as the use of online platforms, applications, and software used. While other LKPD research will focus more on the design, content, and learning methods used (Suryani, 2022); 2) Implementation, online LKPD development research will focus more on the implementation of online LKPD in the classroom, such as how to give assignments, monitor student progress, and student interaction with online LKPD. While other LKPD research will focus more on the implementation of LKPD in the classroom in general (Putri et al., 2020); and 3) Evaluation, online LKPD development research will focus more on evaluating the effectiveness of online LKPD in improving student learning outcomes, such as the level of student activeness, level of concept understanding, and test results. While other LKPD research will focus more on evaluating the effectiveness of LKPD in improving student learning outcomes in general (Damanik & Lubis, 2022).

The research foundation for the development of online Learner Worksheets (LKPD) is based on several things that are important to improve student learning outcomes. This research is based on learning theory which states that problem-based learning is one of the effective methods in improving student learning outcomes. In addition, this research is also based on the needs of students and teachers in learning mathematics by using digital technology and problem solving (Handican & Setyaningrum, 2021). The curriculum needs that require students to be able to solve math problems effectively and efficiently are also the basis for this research. Previous studies related to the development of online LKPD based on mathematical problems are also considered in this study to determine the results obtained from these studies. The development methods used in the process of developing online LKPD such as ADDIE, 4D and design-based research (DBR) are also considered in this study. The evaluation used in this study aims to determine the effectiveness of the developed online LKPD in improving student learning outcomes.

## **METHOD**

This type of research is research and development (RD), which uses the 4-D development model as one of the development research models. A research model for creating teaching materials called the 4-D development model was created by (Sweller, 2021). Define, Design, Develop, and Disseminate are the four stages of the 4-D development research model. However, due to time and implementation constraints, the research process was only completed at the develop stage (Helaluddin et al., 2021).

This development research was conducted in 2021 using research subjects of seventh grade students from one of the junior high schools in Sungai Penuh City. The topic of this research is lines and angles.

The media expert validity stage, material roots, and product experiments by teachers and students are used to conduct the LKPD development product trial stage. Mathematics Education lecturers conducted media expert validity tests, followed by expert tests of Mathematics Education Lecturers on subject matter, and product tests of Mathematics Education Lecturers with VII grade junior high school students. Table 1 displays the characteristics of the test subjects that have been identified.

**Table 1.** Trial Characteristics

Test subjects	Characteristics
Media Expert & Material Expert	Have a minimum competency requirement of S2, majoring in mathematics education, and have a deep understanding of media in mathematics subjects.
Lecture	Lecturer in the Department of Mathematics Education
Teacher	Junior High School Mathematics Teacher
Student	Junior high school seventh grade students

Validity and practicality questionnaires are the data analysis methods used in this study. The data analysis was then evaluated using Likert scales, media expert validity sheets, material expert validity sheets, teacher and student evaluation questionnaires, and other methods. As mentioned in Table 2, the test consists of 4 responses.

**Table 2.** Validity Assessment Scores of Media Experts and Material Experts

Score	Eligibility answer options
1	Strongly Disagree
2	Disagree
3	Agree
4	Strongly Agree

To determine the validity and viability of learning media, the values received from each validity of media experts and material experts are summed up, then the average is determined. Table 3 shows the determination of the validity of the LKPD.

Based on Table 3, if the validation test value reaches a percentage value range of more than 60%, then the determination of the assessment of a learning media can be said to be "valid".

**Table 3.** Criteria for the validity of teaching materials

Percentase (%)	Feasibility	Description
$P \leq 20\%$	Invalid	Revision throughout
$20\% < P \leq 40\%$	Less valid	Partial revision
$40\% < P \leq 60\%$	Valid enough	Revise sufficiently
$60\% < P \leq 80\%$	Valid	No revision
$80\% < P < 100\%$	Very valid	No revision

Based on the questions provided, there are 4 answer options in the questionnaire assessment of teacher and student responses to media use. Each option in each response has a unique value, which represents the level of user suitability for the product. The percentage value (%) will be searched and converted into questions to see the standard of instructor and student answers. The value of the results of the teacher's assessment and each student. The practicality categories in Table 4 illustrate the transformation of values into rating questions used to define practicality.

**Table 4.** Category of Practicality of Learning Media

No	Quantitative score range	Qualitative criteria
1	$P \leq 20\%$	Not Practical
2	$20\% < P \leq 40\%$	Less practical
3	$40\% < P \leq 60\%$	Practical enough
4	$60\% < P \leq 80\%$	Practical

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5

80%<P100%

Very practical

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## RESULT AND DISCUSSION

### Result

The results of making online worksheets based on calculation angles and answering math problems are related to the stages of the 4-D development model. However, due to time and implementation limitations, it is sufficient to do so until the develop stage. Regarding the research objectives, the designed LKPD is in the form of soft files that can be accessed via mobile phones, laptops, or other devices rather than printed LKPD in the form of hardware. Teachers can provide these LKPD teaching resources in the form of liveworksheets when the LKS created using the liveworksheets application is sent as a PDF through the liveworksheets application. The following are the stages of product development carried out:

### *Define Stage Results*

The preliminary analysis phase and the needs analysis phase are both included in the definition phase. Finding problems experienced by teachers and students in the learning process is part of the preliminary analysis phase. As books are the main teaching tool used to facilitate learning, it was found through observations with junior high school mathematics teachers that students have difficulty in understanding the material presented. However, due to the length of the content offered, most students had difficulty understanding the learning material when using the textbook alone. However, many students find it very difficult to grasp abstract math lesson ideas when learning. In addition, students also experience boredom, which lowers their enthusiasm for learning, especially when studying. According to the requirements analysis based on the previous interview findings, teachers and students alike need interesting and interactive learning materials to help them better understand arithmetic concepts and to spark their interest in learning. Therefore, the researcher developed a mathematical problem solving-based learning tool in the form of Online Student Worksheets (LKPD).

### *Results Design stage*

The design of learning resources, such as online worksheets that focus on mathematical problem solving, is part of the design phase. At this point, the online worksheets are in the design stage. Several programs, including Canva and live worksheets, were used to create the worksheets. After the 2013 curriculum was adopted in schools, the LKPDs were redesigned by utilizing the LKS program into interactive LKPDs with line and angle content.

### *Results of the develop stage*

This level includes: 1) evaluating the reliability of media experts, followed by revision; 2) evaluating the reliability of material experts, followed by revision; 3) Media use experiments by teachers and a total of 20 grade 7 students to determine the feasibility of solving problem-based online worksheets. line and angle problems in mathematics.

### *Media Expert Validity*

A lecturer from the mathematics education study program conducted the media expert validity test. Among them are suggestions for online LKS based on mathematical problem solving using line and angle content and assessment in the form of instruments. The LKPD product was modified by the researcher so that it could be used by students after being validated. The results of media expert validation are presented in Table 5.

Based on Table 5, the result of the percentage value of validation of online worksheets based on mathematical problem solving on line and angle content by media experts is 91.81% which is included in the very valid feasibility category.

**Table 5.** Results of Media Expert Validation of online LKPDs

Assessment aspect	Media expert 1	Media expert 2	Average
Content eligibility aspect	91,67%	87,5%	89,58%
Aspects of language feasibility	93,75%	87,5%	90,62%
Presentation feasibility aspect	95,45%	88,63%	92,04%
Aspects of graphical feasibility	95%	95%	95%
Final score	93,96%	89,65%	91,81%
Category	Very valid		

**Material Expert Validity**

A lecturer in the mathematics education program conducted the material expert validity test. Among them are suggestions for online LKS based on mathematical problem solving using line and angle content and assessment in the form of instruments. The LKPD product was modified by the researcher so that it could be used by students after being validated. The results of the material expert validation are presented in Table 6.

The results of the percentage value of 93.10% with a very valid feasibility category based on the results of Table 6 for the material expert validation of the online LKS based on mathematical problem solving of line and angle material.

**Table 6.** Material Expert Validation Results on online LKPDs

Assessment aspect	Media expert 1	Media expert 2	Average
Didactic aspects	100%	87,5%	93,75%
Construction aspect	83,33%	100%	91,66%
Technical aspects	100%	100%	100%
Quality of LKPD material	87,5%	85,71%	87,02%
Final score	92,70%	93,30%	93,10%
Category	Very valid		

**Results of Product Usage Trial.**

After checking the validity by media and material experts followed by revision, the product consumption trial was carried out. Students then tested the new product to find out whether the developed LKPD was useful. The experimental results of product use by students are presented in Table 7.

**Table 7.** Results of Product Usage Trial

No	Student Code	Assesment Score
1	AD	94,27%
2	AM	95,83%
3	ADM	91,14%
4	DMN	91,14%
5	GRU	84,98%
6	JE	81,77%
7	KNA	86,97%
8	MDF	90,10%
9	MA	83,33%
10	MF	84,89%
11	OF	86,97%
12	RA	93,75%
13	RS	95,83%
14	SA	83,85%
15	SKM	89,06%

16	TDA	91,66%
17	THS	89,58%
18	TS	91,66%
19	WA	89,06%
20	ZCD	91,66%
	Total	1787,41
	Percentage	89,37%
	Criteria	Very practical

## Discussion

Centering on the experimental findings of the use of the product by students for online worksheets based on mathematical problem solving involving lines and angles, the percentage score is 89.37% with the standard of very useful. The findings of this study, which are based on the explanation above, show that researchers succeeded in creating learning media, especially online worksheets based on mathematical problem solving on line and angle materials that state accurate information and are actually used in learning.

The resulting LKPD is different from LKPDs that are usually sent to students in the form of paper sheets, which are made in electronic format so that they can be accessed with various devices (Handican & Setyaningrum, 2021). It contains visual elements such as images and learning videos in addition to written content. Quizzes in the form of educational games are another option. It can help students understand the information and develop a passion for learning (Puspitayani et al., 2020). To ensure that the teaching materials made are in accordance with the core competencies, basic competencies, and indicators of competency achievement, these LKPDs are also designed based on the curricular standards used in schools. Teachers can use the results of the LKPD product development design as a tool during the teaching process in the classroom, making LKPD a useful teaching resource for students.

The online Learner Worksheet (LKPD) based on mathematical problem solving can be considered valid by experts because of the following things: 1) The material applied is in accordance with the competencies to be achieved, so that it is in accordance with the established curriculum (Syatriana et al., 2013); 2) The questions given refer to the specified criteria, so that they can be measured properly (Smirnov et al., 1996); 3) The constructs measured are in accordance with the constructs that actually want to be measured, so that the results obtained can be interpreted appropriately (Westen & Rosenthal, 2003); 4) The reliability of the online LKPD is high, so that the results obtained are reliable in evaluating student development (Labuhanbatu, 2022); 5) Problem-based online LKPDs provide opportunities for students to think logically and critically in solving math problems, so that they can improve student learning outcomes (Mulyasari, 2022); 6) This online LKPD can be used as an evaluation tool and monitoring of student development, so that it can be used to evaluate student development continuously (Febriyanti et al., 2021).

The online Learner Worksheet (LKPD) based on mathematical problem solving can be considered practical by users because of the following points: 1) Online LKPD can be used flexibly, students can access online LKPD anytime and anywhere as long as they are connected to the internet (Triasari et al., 2022); 2) Online LKPD allows for better interaction between students and teachers, teachers can provide quick feedback and monitor student progress in real-time (Firtsanianta et al., 2019); 3) Online LKPD can be used as an evaluation tool and monitoring of student progress, so it can be used to evaluate student progress continuously (Febriyanti & Rusmini, 2022); 4) The online LKPD can be used to provide sufficient practice so that students can strengthen the skills applied in learning (Yusuf, 2016); 5) This online LKPD can be used to increase student participation in learning, so that it can improve student learning outcomes (Sianturi et al., 2021); 6) Users can access online LKPD easily and do not require a long time to access, so it can be used efficiently (Indrawan & Yudiana, 2022); 7) This online

LKPD can be used in an online form that allows students to learn independently, so it can be used effectively (Hendrayani et al., 2022).

The development of online Learner Worksheets (LKPD) based on mathematical problem solving is an initiative to improve the quality of mathematics learning by using digital technology. This online LKPD can provide opportunities for students to learn in a more interactive and fun way. By using problem solving as a learning method, students will be invited to think logically and critically in solving math problems. In addition, this online LKPD can also be used by teachers as an evaluation tool and monitoring student progress.

## CONCLUSION

Based on the percentage of the final score of 93.10 and 91.81%, the online Student Worksheet (LKPD) based on mathematical problem solving on line and angle material produced is considered very valid by material experts and media experts. The results of expert validation of eight features of LKPD validation - didactical aspects, construction aspects, technical aspects, material content quality aspects, content eligibility aspects, presentation, language, and readability, and graphics - show the validity of LKPD. With a final score percentage of 100% and 89.37%, the online Student Worksheet (LKPD) based on mathematical problem solving on the content of lines and angles produced was described as very useful by teachers and students. The simplicity of teachers and students in using this LKPD shows its practicality. The four practical characteristics of LKPD - ease of use, time commitment, ease of interpretation, and similarity - illustrate this. In using this online-based LKPD, supervision of students is difficult. This can affect validity and reliability because students can collaborate or look for answers from other sources. so that it becomes a limitation in this assessment.

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