

## DEVELOPMENT OF TEACHING MATERIALS USING THE MICROSOFT EXCEL-ASSISTED DISCOVERY LEARNING MODEL IN STATISTICS

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### ABSTRACT

*This study aims to develop a worksheet (LKPD) using a discovery learning model assisted by Microsoft Excel that meets the criteria of feasibility and practicality. This study uses the R&D method with the ADDIE model consisting of the stages of analysis, design, development, implementation, and evaluation. The research subjects were 30 eighth-grade students at SMP Negeri 3 Ngamprah. Data collection was carried out through expert validation questionnaires and student response questionnaires, with data processing using Microsoft Excel. Based on the research findings, the LKPD development process was in accordance with the ADDIE model, and the resulting LKPD was considered very valid by experts and very practical based on student responses.*

Penelitian ini bertujuan agar mengembangkan LKPD dengan model *discovery learning* berbantuan *Microsoft Excel* yang memiliki kriteria kelayakan dan kepraktisan. Penelitian ini mempergunakan metode R&D dengan model ADDIE yang terdiri atas tahap analisis, desain, pengembangan, implementasi, dan evaluasi. Subjek penelitian adalah 30 siswa kelas VIII di SMP Negeri 3 Ngamprah. Pengumpulan data dilakukan melalui angket validasi ahli dan angket respons siswa, dengan pengolahan data mempergunakan *microsoft excel*. Berdasarkan temuan penelitian, proses pengembangan LKPD telah sesuai dengan model ADDIE, dan LKPD yang dihasilkan dinilai sangat valid oleh para ahli serta sangat praktis berdasarkan respons siswa.

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## INTRODUCTION

Mathematics is a branch of science that is taught at all levels of education. Mathematics is studied, among other things, to make it easier to overcome and find solutions to various problems encountered every day. This statement is in line with (Rahmah, 2013), who states that the material in mathematics subjects, such as measurement, geometry, trigonometry, and algebra, can hone skills in calculation and the use of various mathematical formulas that are useful in everyday life.

Statistics is included in the mathematics curriculum. This subject is very useful and can be applied in various fields of science, such as economics, sociology, health, and even the office world. However, many students find it difficult to understand statistical concepts. Based on the results of a study (Thirafi in Sriwahyuni & Maryati, 2022) it was found that the majority of students had difficulty solving statistical problems, as evidenced by the very low student statistics of 48.6%.

According to (Dewi et al., 2020) students' difficulties in understanding statistics are particularly evident in their ability to determine average values and analyze available data. These obstacles are influenced by various factors, including a lack of understanding of basic statistical concepts, carelessness in reading and understanding questions related to statistics, and limited problem-solving skills. In line with this, according to (Novitasari & Wilujeng, 2018) the difficulties students face in learning statistical material can be categorized into two types of factors, namely internal and external. Internal factors include a lack of understanding of the material, embarrassment to ask questions, and a low level of initiative to study with friends who understand the material better. Meanwhile, external factors are caused by teaching methods or low test levels, as well as an environment that does not support the learning process. As a result, students experience obstacles in developing the ideas, concepts, and conceptual understanding needed to solve the statistics questions given.

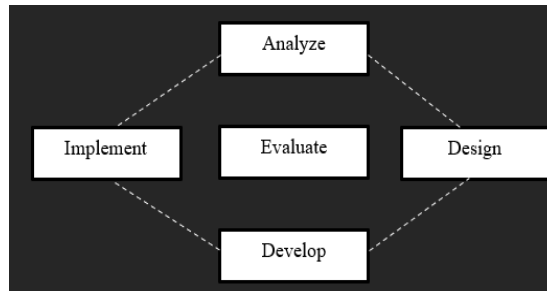
The success of students' absorption of mathematics material greatly depends on the selection of appropriate learning strategies and methods by teachers, tailored to the conditions of the students. One of the essential competencies of teachers is the ability to plan and implement learning models that are in line with the teaching topics. The use of accurate models is expected to optimize student understanding. In this process, students are encouraged to think independently and not passively receive material from the teacher. Therefore, a learning method that provides space for student interaction needs to be implemented, as this has the potential to increase students' interest and appreciation for teaching and learning activities (Manalu, 2022).

The learning model relevant to the above problem is discovery learning. This is in line with the research by Jana & Fahmawati, (2020) and Yasmin, Haenilah dan Fatmawati, (2019), which shows that the implementation of the discovery learning model can improve skills in solving mathematical problems. The implementation of learning with the discovery learning model involves several stages, including: 1) Stimulation; 2) Problem Statement; 3) Data Collection; 4) Data processing; 5) Verification; 6) Generalization (Mulyati & Wardono, 2019). According to (Sani in Wahyuni et al., 2018), discovery learning is a learning process that deliberately does not present material in a finished form. This aims to enable students to independently organize and draw conclusions from a series of data they collect through observation or experimentation. In line with this, according to (Fitriyana & Purwasi, 2020), the discovery learning model also plays a role in helping students find solutions to problems they face and build meaningful and valuable knowledge in the learning process.

In order to deepen students' understanding of statistics, an innovative learning approach and quality learning resources are needed, with optimal use of technology. One form of innovative learning is the use of microsoft excel in teaching statistics to eighth-grade students. The use of microsoft excel is expected to make it easier for students to deepen their understanding of statistical concepts, make it easier for teachers to understand the process of delivering material, and attract students' interest in learning (Abdi, Murni & Saragih, 2021).

**METHOD**

This study uses a research and development method. The development used is LKPD development based on Microsoft Excel. The development model used in this study is ADDIE, namely: analysis, design, development, implementation, and evaluation (Branch & Varank, 2009). The development process in the ADDIE model can be explained visually through the following chart.



**Image 1.** ADDIE Development Model Source: Branch & Varank, (2009)

The analysis stage is the first step aimed at identifying problems or needs that arise during the learning process. This step begins with an analysis of student characteristics, including their knowledge and skill development. Next, an analysis of facts, concepts, principles, and procedures is conducted to identify learning materials relevant to the development of LKPD. This stage is followed by an analysis of learning objectives, which is the process of determining the competencies that students must master after participating in learning activities.

The design stage includes setting learning objectives and designing interactive LKPD, which is compiled using Microsoft Excel to support the evaluation process. In this stage, researchers design LKPD using the Canva application, which is then used to create tables or statistical diagrams using Microsoft Excel and enter the results of these tables or statistical diagrams into the LKPD sheet. The design stage that has been carried out will be a reference in the development process.

Development stage: This stage involves the process of realizing the LKPD based on previously designed ideas and concepts. The LKPD product is then analyzed and validated by experts to determine whether it is suitable for use. During the implementation stage, the designed LKPD is applied in classroom learning. Although the material has been designed in accordance with the curriculum and initial design, preparation of the schedule, classroom, and equipment is still necessary before teaching and learning activities are carried out.

The evaluation stage is the final stage in which researchers collect feedback and suggestions from LKPD users. This feedback is used to improve and refine the LKPD. This research was conducted at SMP Negeri 3 Ngamprah in May of the even semester of the 2022/2023 academic year with eighth-grade students as the subjects. The trial was conducted in three stages, namely an individual trial involving three students, a small group trial with ten students, and a field trial with 30 students.

Data collection instruments used validation sheets, questionnaires, and tests. To process expert validity and questionnaire data, a four-point Likert scale was used, with a minimum score of 1 and a maximum score of 4. After obtaining the scores, the average expert validation score was calculated using the following formula:

$$V = \frac{f}{N} \times 100\%$$

In this case, V refers to the final value, f indicates the score obtained, and N is the maximum score. After the validity value is calculated, interpretation is carried out by referring to the assessment criteria according to Riduwan (Sugandi, Sofyan & Maesaroh, 2021) as presented in the following table:

**Table 1.** Validity Criteria

Interval	Validity Level
81% - 100%	Highly Valid
61% - 80%	Valid
41% - 60%	Moderately Valid
21% - 40%	Not Valid
0% - 20%	Highly Invalid

Student response data was obtained through scores given on questionnaires that had been distributed. Data processing was carried out by calculating the average score. The average score was then converted into a percentage to facilitate data interpretation. The formula used was as follows:

$$NP = \frac{\text{Total score obtained}}{\text{Maximum score}} \times 100\%$$

The results obtained are then interpreted using the categories in the following table.

**Table 2.** Product Practically Criteria

Interval	Validity Level
81% - 100%	Highly Valid
61% - 80%	Valid
41% - 60%	Moderately Valid
21% - 40%	Not Valid
0% - 20%	Highly Invalid

To analyze the data in order to determine the level of effectiveness, the following formula is used.

$$E = \frac{f}{N} \times 100\%$$

E refers to the final score, f is the total score obtained, and N is the maximum score. Interpretation is then carried out with reference to the categories according to Riduwan (Sugandi, Sofyan & Maesaroh, 2021) as listed in the following table.

**Tabel 3.** Category of LKPD Effectiveness

Interval	Validity Level
81% - 100%	Highly Valid
61% - 80%	Valid
41% - 60%	Moderately Valid
21% - 40%	Not Valid
0% - 20%	Highly Invalid

## RESULTS AND DISCUSSION

### Result

This study was conducted to create and test the feasibility and practicality of student worksheets for statistics material. The development of these worksheets was carried out through five stages in the ADDIE model, namely: analysis, design, development, implementation, and evaluation. The following are the results of each stage.

*Analyze*, conducted through interviews with mathematics teachers to determine curriculum needs. The results show that interactive student worksheets are not widely used in schools, while the curriculum implemented is the 2013 Curriculum.

*Design*: The design stage began with collecting data and analyzing issues related to the LKPD. Based on this information, researchers created an LKPD design tailored to learning indicators and objectives. The material was organized in an interesting way to make it easier for students to understand. In addition, the LKPD was designed using Microsoft Excel to make it more attractive and interesting.

Next is the development stage, where researchers implement the plan that has been made previously. The LKPD is created with the help of Canva for layout design and Microsoft Excel for the evaluation section. The completed LKPD will be submitted to the supervising lecturer and then given to the validator to assess its feasibility. *Development*, aimed at creating and validating learning resources to be used. Based on the validation results from experts, several parts of the LKPD were found to require revision, as shown in the following image:

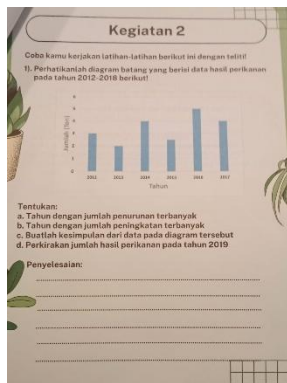


Image 2. Pre-revision Worksheets

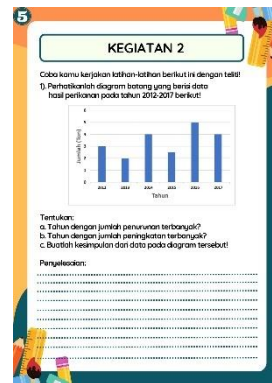


Image 3. Post-revision Worksheets

Based on the image above, several parts of the design layout were found to need revision because they were not in line with the learning material, contained inappropriate words, and included questions that would be used. The researchers redesigned the LKPD by adjusting the revisions and input from the validators. These changes are reflected in the LKPD image, which displays a design, word selection, and questions that are more relevant to the learning material.

*Validation*, researchers compiled a validation sheet containing aspects of assessment for LKPD. This validation sheet was given to subject matter experts and teachers. In addition, researchers also compiled a response questionnaire for students to determine their responses and the practicality of using LKPD assisted by Microsoft Excel after it was used in the learning process.

This study produced two main findings, namely the process of developing Statistics teaching materials using the discovery learning model supported by Microsoft Excel, and the results of limited trials which showed that the teaching materials were considered valid based on the validation results.

**Table 4.** Results of Phase 1 Validation Testing

No.	Aspects assessed	Percentage (%)			Average Percentage (%)	Criteria
		V1	V2	V3		
1	Appropriateness of material to learning outcomes	70,00	80,00	70,00	73,33	Valid
2	Accuracy of material	80,00	80,00	80,00	80,00	Valid
3	Sequential presentation of material	60,00	80,00	80,00	73,33	Valid
4	Appropriateness to student abilities	80,00	80,00	70,00	76,66	Valid
5	Appropriateness to discovery learning	65,00	75,00	80,00	73,33	Valid
6	Appropriateness of Microsoft Excel use in material	80,00	80,00	80,00	80,00	Valid
7	Consistency of language and sentence structure	80,00	75,00	70,00	75,00	Valid
8	Identity of teaching materials	75,00	75,00	75,00	75,00	Valid
9	Design of student worksheets	77,00	80,00	80,00	79,00	Valid
Average Percentage					76,18	Valid

The average validity score reached 76.18% and was classified as “Valid,” with variations in scores for each aspect, including 73.33% for material suitability, 80% for material accuracy, 73.33% for material consistency, 76.66% for student ability, 73.33% for discovery learning suitability, 80% for the suitability of Microsoft Excel in the material. 75% for language and sentence structure, 75% for teaching material identity, and 79% for worksheet design.

After revisions based on the results of the first stage of validation testing, the LKPD was revalidated by experts and mathematics teachers before implementation. The following are the final validation results:

**Table 5.** Stage II Validity Test Results

No.	Validator	Score Achieved	Maximum Score	Percentage	Criteria
1	Validator 1	99	125	79,2%	Valid
2	Validator 2	109	125	87,2%	Highly Valid
3	Validator 3	110	125	88%	Highly Valid
Average Percentage		398		85%	Highly Valid

The validation results from the experts in Table 5 show an average score of 85% and are declared “Highly Valid.” Both experts and teachers stated that the LKPD is ready for use without the need for revision, so it can be immediately applied in the learning process.

In preparation for the widespread implementation of LKPD, a pilot test was conducted. This test aimed to collect preliminary data and consisted of individual, small group, and field tests. The individual test was conducted on three students with varying levels of ability, classified as good, average, and poor.

**Table 6.** Individual Testing

No.	Aspects assessed	Scores achieved	Maximum scores	Percentage	Criteria
1	Usefulness	48	60	80%	Practical
2	Ease of use	36	48	75%	Practical
3	Helpfulness	46	60	77%	Practical
4	Attractiveness	59	72	82%	Very Practical
Average Percentage				78,5%	Practical

Based on Table 6, the trial results showed an average percentage of 78.5% with an interpretation of “Practical.” This figure shows that the LKPD was well designed and influenced learning in the classroom. The LKPD will then be trialed on a small group of 10 eighth-grade students to test its practicality.

**Table 7.** Small Group Test

No.	Aspects assessed	Scores achieved	Maximum scores	Percentage	Criteria
1	Usefulness	160	200	80%	Practical
2	Ease of use	116	160	72,5%	Practical
3	Helpfulness	157	200	78,5%	Practical
4	Attractiveness	161	240	67%	Practical
Average Percentage		594	800	74,2%	Practical

The student survey results show that LKPD falls into the “Practical” category with a score of 74.2%. Each aspect was assessed differently, namely 80% for usefulness, 72.5% for ease of use, 78.5% for helpfulness, and 67% for attractiveness. A field test was then conducted on 30 students as a follow-up stage to assess the feasibility of the developed LKPD.

**Table 8.** Results of the Practicality Test of LKPD

No.	Aspects assessed	Scores achieved	Maximum scores	Percentage	Criteria
1	Usefulness	494	600	82%	Very Practical
2	Ease of use	402	480	84%	Very Practical
3	Helpfulness	492	600	82%	Very Practical
4	Attractiveness	616	720	85%	Very Practical
Average Percentage		2.004	2.400	83%	Very Practical

The results of the questionnaire given to students show that the LKPD developed is “Very Practical” with an average assessment percentage of 83%. The details of the assessment for each aspect include usefulness at 82%, ease of use at 84%, helpfulness at 82%, and attractiveness at 85%.

The designed LKPD was then implemented directly. The implementation of the LKPD was carried out in class VIII-I of SMPN 3 Ngamprah. The researcher used the discovery learning model as the main approach in the learning process in the classroom. In addition, before the learning process began, students were given a pre-test to measure their initial ability to solve mathematical problems.

These pre-test results will later be compared with the post-test results obtained after the learning process. The effectiveness of using LKPD is assessed based on the improvement in the post-test results. The following are the results obtained.

**Table 9.** Result of the Effectiveness Test of LKPD

Test	Score achieved	Maximum scores	Percentage	Criteria
<i>Post-test</i>	2.353	3.000	78%	Effective

The table above shows an average percentage of 78% with the criterion “Effective.” This proves that mathematics LKPD with the discovery learning model assisted by Microsoft Excel is effective in learning.

The Evaluation stage is the stage where researchers review the validators' assessments and students' responses to the worksheets. The results of this evaluation are then used to identify important information related to the Microsoft Excel-assisted worksheets. The evaluation results show that the worksheets meet the validity criteria and can therefore be implemented in learning activities. In addition, the positive responses from students prove the practicality of the worksheets, which have also been shown to facilitate the learning process and increase student interest and motivation.

## Discussion

Based on the research that has been conducted, a statistics LKPD developed with the help of Microsoft Excel has been successfully created. The results of data processing show that this LKPD has a rating in the highly valid category. This validity is based on the opinion (Puspitasari, 2019), which explains that a learning instrument is said to be valid if it can measure the objectives set. In this case, the LKPD is considered valid because the material presented is relevant to the curriculum (content validity), the activity stages facilitate the discovery learning model, and the language used is easy for students to understand.

Assessments from experts (validators) confirm that these worksheets are suitable for use in learning. In addition, these findings are supported by research (Marsila, Connie & Swistoro, 2019), which shows that discovery learning with worksheets can increase student motivation, activity, and learning outcomes.

In addition, according to (Minarni, Napitupulu & Kusumah, 2020), research using learning tools that integrate the discovery learning model with Microsoft Excel can increase student activity in finding and processing data, which is the core of Discovery Learning Syntax.

The assessment of LKPD using the discovery learning model assisted by Microsoft Excel was declared to be highly valid because it was based on an assessment of the suitability of the material, basic competencies, the accuracy of the material, the sequence of presentation of the material, suitability for student abilities, suitability for discovery learning, suitability of the use of Microsoft Excel in the material, consistency in the use of language and sentences, the identity of the teaching materials, and the design of the LKPD. The LKPD was deemed suitable for

testing on students after undergoing a revision process based on input from experts. After receiving approval, this LKPD was then used in a learning trial at SMP Negeri 3 Ngamprah. This trial phase involved two groups, namely 10 eighth-grade students for a limited trial and 30 students for an extensive trial.

The results of the student response questionnaire show that LKPD with the discovery learning model assisted by Microsoft Excel is considered practical because it is deemed useful, easy, helpful, and interesting. This conclusion is reinforced by Sugiyono's research (in Cahaya, Fauziah, Ferozona & Hidayati, 2024), which states that questionnaires or surveys can be used to measure the suitability of a developed product.

Students responded positively during the learning process using the discovery learning model worksheet with the help of Microsoft Excel, commenting that the worksheet was interesting because of its design and analysis activities that encouraged students to actively participate in the learning process. In line with the research conducted (Abdi, Murni & Saragih, 2021), it is hoped that the use of Microsoft Excel will make it easier for students to understand statistics and for teachers to deliver the material, as well as attract students' attention to learning.

## CONCLUSION

The development process of this LKPD uses a discovery learning model assisted by Microsoft Excel, which is carried out in stages from analysis to evaluation. Based on assessments from experts and teachers, this LKPD is considered highly valid and has received positive responses from students, who indicate that it is practical and easy to use in terms of its benefits, ease of use, helpfulness, and attractive appearance. The researcher's suggestion for future researchers is to develop this LKPD for other mathematics subjects and not limit it to statistics.

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