Developing Electronic Student Worksheet based on Probing Prompting Learning Method using Google Form on Social Arithmetic

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Abstract

This study aims to feasibility electronic student worksheet with the Probing Prompting learning method using Google Form on social arithmetic material for valid, practical, and effective. This research was used an ADDIE model, that consist of analyze, design, development, implementation, and evaluation. The research instrument include of validation sheets, practicality sheets, and tests of mathematical problem solving abilities. This research produced an electronic student worksheets based on probing prompting usng Google Form on social arithmetic material. of seventh-grade students was included in the following criteria: 1) Very valid based on content assessment, construct assessment, language assessment, media assessment; 2) Practical based on 11 aspects of assessment; 3) Effectiveness based on classical learning mastery, namely 90% of students who complete score ≥70 and the results of the N-Gain calculation of problem solving abilities with an average N-Gain of 0.77 are in the high category.

Keywords: ADDIE; Electronic Worksheets; Google Form; Probing Prompting; Problem Solving;

Abstrak

Penelitian ini bertujuan untuk menghasilkan lembar kerja peserta didik berbentuk elektronik dengan metode pembelajaran Probing Prompting menggunakan Google Form materi aritmatika sosial yang valid, praktis, dan efektif. Penelitian ini adalah penelitian dan pengembangan model ADDIE, yaitu analisis, desain, pengembangan, implementasi, dan evaluasi. Instrumen penelitian ini terdiri dari lembar validasi, lembar kepraktisan, dan tes kemampuan pemecahan masalah matematis. Penelitian ini menghasilkan LKPD elektronik berbasis probing prompting menggunakan Google Form pada materi aritmatika sosial peserta didik kelas VII memenuhi kriteria: 1) Sangat valid berdasarkan aspek penilaian isi, aspek konstruk, aspek bahasa, aspek media; 2) Praktis; 3) Efektif berdasarkan ketuntasan belajar klasikal yaitu 90% peserta didik yang tuntas memperoleh nilai ≥70 dan hasil perhitungan N-

Gain kemampuan pemecahan masalah dengan rata-rata N-Gain 0,77 berada pada kategoti tinggi.

Kata Kunci: ADDIE; Google Form; LKPD Elektronik; Probing Prompting; Pemecahan Masalah

Introduction

The aims of learning mathematics at school is to fostering students to think logically, analytically, systematically, critically, and creatively and collaboratively (Daryanto & Raharjo, 2012). Learning mathematics also encourage problem solving ability the ability to solve mathematical problems. This is in line with Cooney's view that problem-solving abilities help students think more critically in making decisions in everyday life. (on Laia, 2019).

Various program to improve mathematical learning have not been in line with the results for mathematical problem solving abilities. This is proven by the results of the PISA (Program for International Student Assessment) test in mathematics organized by the OECD (Organization for Economic Co-operation and Development). PISA is an examination system to evaluate the education systems of 79 countries around the world which is held every 3 years and is taken by students aged 15 years who are randomly selected with three main basic competencies, namely reading, mathematics and science (OECD, 2018). The PISA mathematics process requires abilities consisting of the ability to formulate problems mathematically, the ability to use concepts, facts, procedures and reasoning in mathematics, as well as the ability to interpret, apply and evaluate the results of a mathematical process (Kemendikbud, 2020). All of these abilities are the abilities needed in solving mathematical problems. Based on PISA data in 2018, Indonesia was ranked 73rd out of 79 countries with a mathematics score of 379 from the average score for all countries, namely 478. This score shows that the results obtained by Indonesia are still low (Kemendikbud, 2018). These results also showed that students' understanding of concepts and mathematical problem solving abilities in Indonesia still need to improve. Even though mathematical problem solving abilities are closely related to students' daily lives.

The low test of students' mathematical problem solving abilities can be seen from the test results in Seventh G-Grade of SMP Negeri 11 Bengkulu City which showed an average result of 52.74 with a standard deviation of 6.12. These results indicate that students' mathematical problem solving abilities were still low. Observations at the school showed that the school is implementing the 2013 Curriculum which hopes that students will be able to solve problems independently

and increase students' knowledge. In the 2013 curriculum learning is essentially student-centred learning. However, learning process that occurred in the school still used teacher centered approach. So that in the learning process students only listen, look or read, then take notes. Apart from that, the teaching materials used in mathematics learning are printed books as learning materials and the use of Student Worksheets is not optimal. Educators never developed student worksheets that facilitates students' mathematical problem solving abilities. The student worksheets used is less attractive because it only contains questions, so there are very few opportunities for students to play an active role in learning in class.

However, difficulties and mistakes in solving problems often occurred. For example, a study by Epran et al. (2022) found four mistakes that students made when completing social arithmetic descriptions. There were conceptual errors, lack of understanding of the meaning of the matter due to language interpretation, failure to solve problems with correct and correct steps, as well as calculation errors. Therefore, the selection of appropriate learning methods and teaching materials to enhance problem-solving skills is essential.

Probing prompting is one of the learning methods that has been proven to have a positive influence on the improvement of the ability to solve mathematical problems of students (Mustika & Buana, 2017). Other research also found that probing prompting positively influenced the students' ability to solve mathematical problems with the average result of each mathematics problem-solving indicator achieving a score of 99.36 on the problem-understanding indicator and on the indicator implementing the plan scores 99.36. (Jumroh et al., 2022). Learning probing prompting is done in the way educators present a series of questions that are guiding and digging so that there is a thinking process that associates the knowledge of the students and their experience with new knowledge that is being learned (Huda, 2014). The process of probing prompting encourages students to think critically and actively in learning, students can question back things that are less understood so that there is a discussion between students in submitting opinions. Therefore, probing prompting is considered effective for mathematical problem-solving abilities because it contains a series of questions that are of guiding and dig the ability to solve problems of learners in particular on social arithmetic material.

An appropriate learning approach is needed to achieve learning objectives, namely increasing students' ability to solve mathematical problems in social arithmetic material. One of them is probing prompting. Probing is a strategy of asking questions to make students justify, or at least explain more about the students' answers. Meanwhile, prompting is a questioning strategy that can be

applied to help students construct answers that could not be applied previously (Jacobsen et al, 2009). So, probing prompting is learning in which educators present a series of questions that are guiding and probing so that a thinking process occurs that links students' knowledge and experiences with the new knowledge that is being studied (Huda, 2014). The probing prompting process can activate students in the learning process because the questions asked can attract and focus students' attention (Purnamasari, 2017). The questions asked are to explore students' knowledge in depth.

One of the teaching materials that can facilitate probing prompting and the ability to solve problems is using student worksheet. The student worksheet is a printed media source made with the development of book technology and loaded with visual material that includes material summaries and exercises along with an explanation of answers, filling lists and test forms (Prastowo, 2016). Electronic worksheets gives students the opportunity to play an active role and also helps students to understand mathematics learning as well as facilitate interaction with the given material. (Astuti, 2021). However, student worksheets has weaknesses: it needs printing costs, is easy to break down, and is less flexible. Therefore, the electronic worksheets form of electronic teaching materials is considered as a solution to enhance problem solving capabilities.

The development of science and technology (IPTEKS) in Indonesia is very challenging especially in the field of education. Technology plays an important role in everyday life, especially in education, which should also evolve according to its times (Jamun, 2018). That was due to the increasing use of the Internet in Indonesia. Here were data on Internet usage in Indonesia in the age range of 10 years to over year according to the main activities.
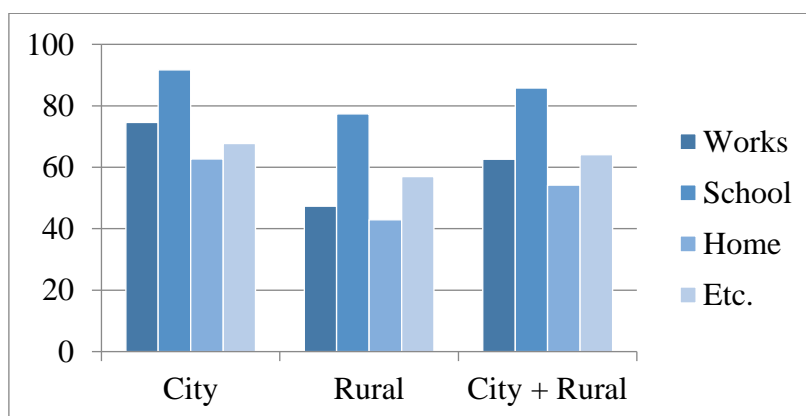

Figure 1. Internet Usage in Indonesia 10 Years Up According to Main Activities (BPS, 2021)

The use of electronic student worksheets on the learning process of mathematics can have an impact on the process. There are can make boredom becoming fun and motivated students to be more enthusiastic in learning (Puspita & Dewi, 2021). Thus, the use of electronic sudent worksheets should be optimized as it can make the learning process more efficient and enjoyable as well as encourage learners to participate actively during the process of learning so that it is expected to improve the ability to solve mathematical problems. The above data shows that Internet use in Indonesia for school purposes is the majority of which is 85.82% Internet access. The same thing happened in urban and rural areas, with 91.71% and 77.37% of the population using the Internet as a school destination. Therefore, from such data can encourage learning activities by optimizing the use of the Internet and technology in the school one of them with electronic student worksheet.

One application that can support the development of electronic student worksheets is Google Forms. Google Forms is a web application that can be used to provide answers or answers to internet-based questions via a computer, laptop or smartphone (Parinata & Puspaningtyas, 2021). Google Forms has a variety of features including embedded photos, videos, titles, profiles, and more so that the form view can be made interesting. In addition, Google Forms has various types of tests, such as double-choice, drop and down, short answers, paragraphs, and more so that users are free to choose the type of test used. To answer the questions that will be answered students only need to access the pages that have been created by educators who are connected to the internet. Therefore, with the advantage of Google Forms assessed practically with the results of the analysis of elevation response students average 88.4% and teacher response average elevation 87.4% (Sadewa et. al., 2020). The exposure of the problem above encouraged the author to conducted research with the title "Developing Electronic Student Worksheet based on Probing Prompting Learning Method using Google Form on Social Arithmetic".

Method

The type of research used in this study was research and development (R&D). The stages undertaken to make electronic student worksheets on this research was the ADDIE development model, namely Analysis, Design, Development, Implementation, and Evaluation. (Branch, 2009).
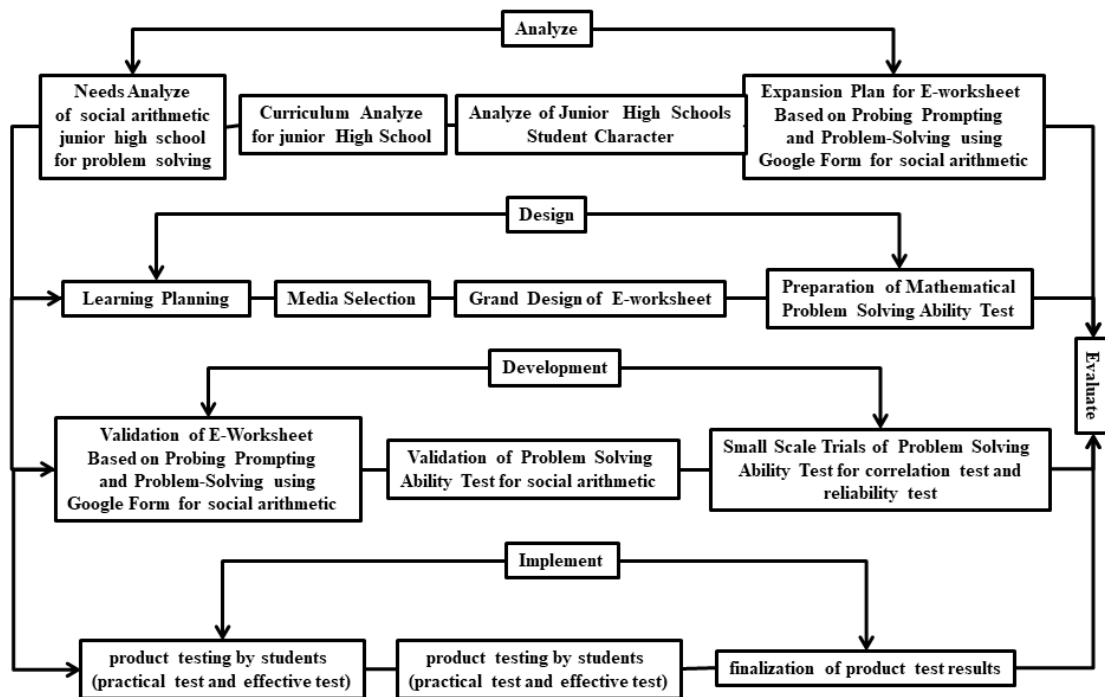
Figure 2. ADDIE Model

The analysis phase on the ADDIE development model consists of three phases of analysis and one phase of planning. The analysis of needs aims to analyze problems that occur in the learning process such as the analysis of teaching material, teaching materials, and learning processes. This analysis is based on the results of observations, interviews, and documentation. Based on the results of the analysis, there are mistaken in solving social arithmetic issues, the application of the non-optimal 2013 curriculum, the teaching materials used are only printed books and electronic student worksheets that only load issues that do not facilitate the ability to solve problems. The design stage aims to create learning planning based on syntax probing prompting and problem solving, media selection on the learning process using Google Forms to create electronic student worksheets grand design, and to compile tests on problem-solving ability. Stage of development, logical validation of electronic research instruments such as electronic student worksheets and problem solving testing. Subsequently, an empirical validation of the problem-solving ability test was carried out through a small-scale test. Small-scale tests are carried out for correlation tests, resulting in a reliable problem-solving test. The implementation stage will be tested on the field against electronic student worksheets based probing prompting for practical and effective problem-solving

capabilities. The evaluation phase is carried out to evaluate each stage of ADDIE and look at the effectiveness of the research instruments.

There were two types of validation performed in this study, namely electronic student worksheets validation and validation of problem-solving ability tests. To analyze the validation data, descriptive analysis was used by revising the electronic student worksheets based on suggestions and notes from the validator. At the LKPD validation stage, logical validation will be carried out which will be analyzed using the Ainkens index.

$$V = \frac{\sum s}{n(c-1)}$$

(Susanto, 2019)

Information: $s = r - I_0$
V: Item validation index
r: score given by validator
I_0: Lowest validity assessment score
c: Highest validity assessment score
n: The number of validator

Table 1. Validation Criteria

V	Category
$0{,}80 < V \leq 1{,}00$	Very Valid
$0{,}60 < V \leq 0{,}80$	Valid
$0{,}40 < V \leq 0{,}60$	Quite Valid
$0{,}20 < V \leq 0{,}40$	Less Valid
$0 < V \leq 0{,}20$	Invalid

(Susanto, 2019)

The media validated by three experts consisting of two lecturers of mathematics education and one high school math teacher. Validation sheets include aspects of content, construction, language, and media validation. Validation of mathematical problem-solving skills was carried out in terms of content, construction, and language validation. The validity test technique that will be used in this research is the product moment correlation test proposed by Pearson. With the following formula:

$$r_{xy} = \frac{N \sum XY - (\sum X) \cdot (\sum Y)}{\sqrt{[N \sum X^2 - (\sum X)^2] \cdot [N \sum Y^2 - (\sum Y)^2]}}$$

(Source: Susanto, 2019)

Information:

r_{xy} = Correlation coefficient between question item scores (X) and total score (Y)

N = The number of subjects

X = Score of the question item

Y = Total score

The results of the correlation coefficient calculation will be matched using the correlation coefficient criteria in the following table:

Table 2. Correlation Coefficient of Validity of Mathematical Problem Solving Ability Test

Correlation coefficient	Category
$0,80 < r_{xy} \leq 1,00$	Very High
$0,60 < r_{xy} \leq 0,80$	High
$0,40 < r_{xy} \leq 0,60$	Enough
$0,20 < r_{xy} \leq 0,40$	Low
$0,00 < r_{xy} \leq 0,20$	Very Low

(Source: Susanto, 2019)

To determine whether a test item was valid or not, r_{count} needs to be compared with r_{table}. To determine r_tabel, the product moment correlation table was used by looking at df = N – 2 and a significance level of 5% with the interpretation $r_{xy} \geq r_{table}$ of so the correlation is significant.

To determine the reliability coefficient of a test in the form of a description, the Cronbach Alpha formula was used as follows:

$$r_{11} = \left(\frac{k}{k-1} \right) \left(1 - \frac{\sum SD_i^2}{SD^2} \right)$$

(Source: Susanto, 2019)

Information:

r = Reality coefficient

k = The number of questions

SD_i^2 = Variant score of item i

SD^2 = Total score

The benchmark for interpreting the degree of reliability of mathematical problem solving ability tests was determined based on criteria according to Guilord (1956) as follows:

Table 3 Reliability Correlation Criteria for Mathematical Problem Solving Ability Tests

Correlation coefficient	Category
$0,80 < r_{xy} \leq 1,00$	Very High
$0,60 < r_{xy} \leq 0,80$	High
$0,40 < r_{xy} \leq 0,60$	Enough
$0,20 < r_{xy} \leq 0,40$	Low
$0,00 < r_{xy} \leq 0,20$	Very Low

(Source: Susanto, 2019)

Based on the criteria above, a question item was said to be reliable if r is at least in the high category with an interval of $0,60 < r_{11} \leq 0,80$.

When a mathematical problem solving test was valid, a small-scale test was carried out to see the correlation and reliability of the ability test. Electronic student worksheets practical data is obtained from practical sheets by students who follow the field test. Analyze the instrument's practicality sheet using.

$$\overline{P} = \frac{\sum x}{n}$$

Information:

$\overline{P}$ = The average practicality score of students

$\sum x$ = total score obtained

n = The number of questions

The results of calculating the average score assessed by the students are seen using practical criteria based on the following table:

Table 4. Practicality Criteria of Electronic Student Worksheets

$\overline{P}$	Category
$\overline{P} > 4,2$	Very Practical
$3,4 < \overline{P} \leq 4,2$	Practical
$2,6 < \overline{P} \leq 3,4$	Quite Practical
$1,8 < \overline{P} \leq 2,6$	Less Practical
$\overline{P} \leq 1,8$	Impractical

(Widoyoko, 2019)

Based on the criteria above. Electronic student worksheets was said to be practical if P⁻ was in the practical category $3,4 < \overline{P} \leq 4,2$.

Efficiency data was obtained from the results of pre-test and posttest of mathematical problem solving skills. The effectiveness of Electronic student worksheets was was based on mathematical problem solving abilities in the posttest

given to students to determine the percentage of students able to solve problems with the condition that students have a correct answer of ≥ 70.

$$N_i = \frac{\sum S}{n} \times 100$$

(Susetyo, 2012)

Keterangan:

N_i = Student problem solving test score i

$\sum S$ = The total score of questions answered correctly

n = Maximum test score

Meanwhile, learning completeness per class or percentage of classical completeness was obtained by calculating the percentage of the number of students who have completed it individually. A class is said to have completed learning if PKK ≥ 80%, the percentage can be calculated using a formula.

$$Completeness = \frac{number\ of\ students\ who\ have\ completed\ their\ studies}{The\ total\ number\ of\ students} \times 100\%$$

The criteria that state students have been able to solve problems if there were 80% of students who take the mathematical problem solving ability test get a minimum score of 70. Meanwhile, students can be declared capable of solving mathematical problems if they have fulfilled the minimum good category based on the following criteria.

Table 5. Mathematical Problem Solving Ability Mastery Category

Score Interval	Category
$X > \bar{X}_i + 1{,}8sb_i$	Very Good
$\bar{X}_i + 0{,}6sb_i < X \leq \bar{X}_i + 1{,}8sb_i$	Good
$\bar{X}_i - 0{,}6sb_i < X \leq \bar{X}_i + 0{,}6sb_i$	Good Enough
$\bar{X}_i - 1{,}8sb_i < X \leq \bar{X}_i + 0{,}6sb_i$	Less good
$X < \bar{X}_i - 1{,}8sb_i$	Not Good

(Widoyoko, 2019)

Information:

X = Empirical score

$\bar{X}_i$ = Ideal average = $\frac{1}{2}$(score maxs ideal + score min ideal)

sb_i = ideal standard deviation = $\frac{1}{6}$(score maxs ideal - score min ideal)

To see that the electronic score developed was effective for students' mathematical problem solving abilities, calculations are used:

Table 6. Implementation Effectiveness Criteria

$N - Gain$	Category	Treatment Criteria Using Electronic Student Worksheets
$N - Gain > 0,7$	High	Effective
$0,3 \leq N - Gain \leq 0,7$	Middle	Effective enough
$N - Gain < 0,3$	Low	Ineffective

(Lestari & Yudhanegara, 2018)

Based on the criteria above, the electronic student worksheets is said to be effective if the N-Gain value is in the N-Gain category ≥0.70. The calculation of the N-Gain value is also supported by the normality test, homogeneity test and average difference using the t-paired test with the help of SPSS.

In parametric statistical data analysis, one of the prerequisite tests to fulfill the normality assumption is the normality test. This test was carried out to determine whether the data distribution was normally distributed (Lestari & Yudhanegara, 2018). Normality calculations in this study used the Shapiro Wilk test due to the small sample size and ratio scale data. The hypothesis is as follows:

H_0 The posttest and pretest are normally distributed

H_1 Posttest and pretest are not normally distributed

The Shapiro Wilk (T_3) formula used in the normality test is as follows:

$$T_3 = \frac{1}{D} [\sum_{i=1}^{n} ai(X_{n-i+1} - X_1)]^2 \text{ dengan D} = D = \sum_{i=1}^{n}(x_i - \bar{x})^2$$

(Cahyono, 2015)

Keterangan :
T_3 = *Shapiro Wilk*
ai = test coefficient *Shapiro Wilk*
X_{n-i+1} = Data n-i+1
x_i = data i
$\bar{x}$ = average data

Next, T_3 is compared to the p-value, if $T_3 > p\text{-}value$ then the data is normally distributed, and if $T_3 < p\text{-}value$, the data is not normally distributed. Based on descriptive statistics, the normality test can be seen from the skewness value, if the skewness ratio is between -2 to 2 then the data is normally distributed. Normality testing can be done using SPSS software. The test criteria are if the significance value > real level (α) = 0.05 then the data is normally distributed and if the significance value ≤ real level (α) = 0.05 then the data is not normally distributed.

Data homogeneity means that the data has the same variance or diversity of values statistically. Homogeneity testing aims to find out whether the objects (three or more samples) under study have the same variance. The hypothesis used is as follows.

H_0 Posttest and pretest are homogeneous

H_1 Posttest and pretest are not normally distributed

$$F = \frac{Largest\ variance}{Smallest\ variance}$$

(Lestari & Yudhanegara, 2018)

The test criteria are H0 is accepted if $F_{count} < F_{table}$, otherwise H0 is rejected if $F_{count} < F_{table}$, at a real level 5% ($á = 0,05$).

$$F_{tabel} = F_{(a)(dk1,dk2)}$$

In the t-paired test the hypothesis used in this case is:

H0 = There is no significant increase in students' mathematical problem solving abilities

H1 = There is a significant increase in students' mathematical problem solving abilities

Test testing criteria $t - paired\ test$ determined as follows.

1. If the significance value is <0.05 then H0 is rejected and H1 is accepted.
2. If the significance value is > 0.05 then H1 is rejected and H0 is accepted

Results

The results of this study will be described as follows.

Analyze

In the research analysis, consist of three phases of analysis and one phases of planning based on the ADDIE model.. The analysis of needs aims to analyze problems that occured in the learning process such as the analysis of teaching material, teaching materials, and learning processes. In this material, the student still has difficulties and mistakes in solving social arithmetic issues. Errors involve conceptual errors, lack of understanding of the meaning of matters that affect the interpretation of language, students cannot solve problems with correct and correct steps, as well as calculation errors (Epran dkk 2022). On the aspects of teaching materials, students used printed books and LKS that only carry a collection of

materials and groups of questions that have not facilitated the ability to solve problems.

In the Indonesia Curriculum (2013 curriculum) still have many problems in implementation. In addition, the use of the Internet in the learning process for teaching materials is less used optimally. Curriculum analysis aims to analyze basic competencies and core competencies on the social arithmetic material that is subsequently structured in sequence as a reference for the delivery of material to the student. Analysis is carried out on the basic competence and selected indicators.

Analysis of student characteristics aims to know the academic abilities, knowledge, and character of the student. Academic abilities and background knowledge students of the secondary school generally have high, medium, and low abilities. At the age of 12 to 17, students still need training to abstract the knowledge they have, especially in everyday life. previous studies showed that children at the middle age enter the phase of formal reasoning characterized by formulating ideas, abstract ideas, and questioning about what will happen at that phase students can formulate the best assumptions to solve problems (Aini & Hidayati, 2017).

The preparation of the development plan was carried out through the development of basic competencies, learning indicators, and the allocation of learning hours. The results of the analysis are used as considerations of title, sequence, number, and problem-solving indicators for each electronic student worksheets. The development plan on the research is divided into four electronic worksheets of social arithmetic material, namely electronic student worksheets 1 – Profit and Loss electronic student worksheets 2 – Single Interest, electronic student worksheets 3 – Discount and Tax, electronic student worksheets 4 – Bruto, Netto, and Tara.

Design

At the design stage involves the planning of material learning, media selection and preparation of mathematical problem-solving skills tests. The results of the three stages of design are described as follows.

Material learning planning was tailored to basic competencies and learning indicators divided into four meetings structured in the RPP. Each electronic student worksheets used by probing prompting syntax that has the ability to solve mathematical problems based on Polya stages.

The selection of electronic forms of electronic student worksheets was expected to be used as a flexible teaching material that can be used in form learning in the network. In Bengkulu, a computer lab with adequate internet access is

available and the use of smartphones is allowed for students if necessary while supporting the learning process. In addition, through this electronic student worksheets is also expected to help students in the process of solving mathematical problems on social arithmetic material.

Construction on each electronic student worksheets contains title, Basic Competence, learning indicators, time allocation, instructions for use, and work orders (Prastowo, 2016). Construction on electronic student worksheets also uses the syntax of the learning method, namely probing prompting for the ability to solve mathematical problems of students based on the stage of Polya with four indicators: understand problems, plan solutions, solve problems, and re-examine.

Based on the above description, one of the platforms that facilitates electronic student worksheets and needs to be optimized for its use was Google Forms. Google Forms has a variety of features embedded photos, videos, titles, profiles, and more so that the form view can be made interesting. In addition, Google Forms has various types of tests, such as double-choice, drop and down, short answers, paragraphs, and more so that users are free to choose the type of test used. Based on the model of the worksheet, the researchers will use the work sheet of the narrative model accompanied by visualization through images in accordance with the context of the learning material by using the type of double-choice test, check-out selection, short narrative, and paragraph. Here are the results of the design display used on the electronic student worksheets using Google Forms.
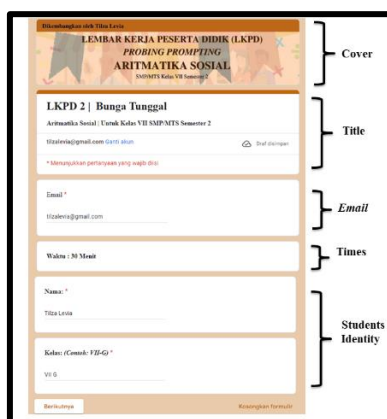

Figure 3. First page of electronic student worksheets

In Figure 3, it is seen that the design of the electronic student worksheets 2 on the first page consists of a cover in the form of a header, the title of the electronic student worksheets, Email, time allocation and the identity of the student. Next, an

example of the electronic student worksheets design on the second page will be shown as follows.
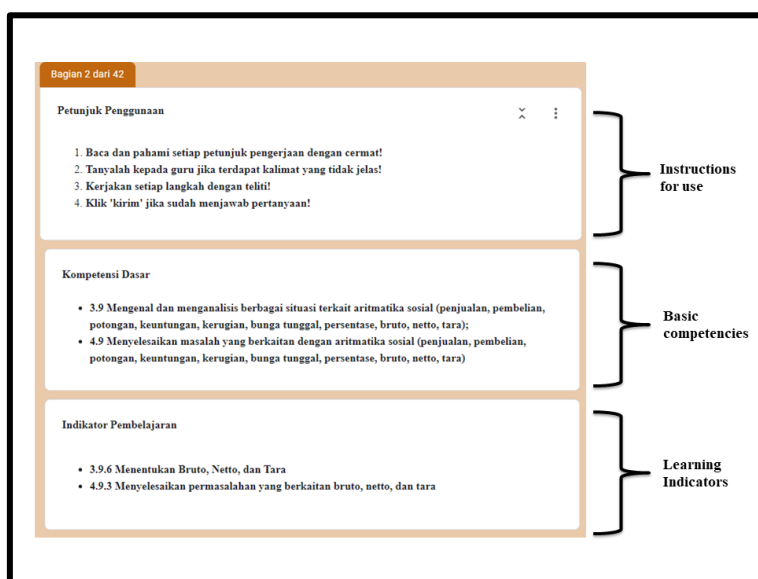

Figure 4. Second page of electronic student worksheets

In Figure 4, it is seen that on the second page of the electronic student worksheets 4, instructions for the use of electronic student worksheets, basic competencies, and learning indicators are shown. The following examples of design results will be displayed on the third page on the e-worksheet as follows.

Figure 5. Third page of electronic student worksheets

In Figure 5 it is seen that on the third page of the electronic student worksheets 3 contains a summary of the material on the sub-materials discount and

tax. In addition, on this page is also equipped with formulas that are described in the form of images to attract the attention of students so that the electronic student worksheet is more interactive. A summary of the material is made to make it easier for students to remember the material to be learned. The last is an example of the e-worksheet display on the issue of training as an enrichment for the students as follows.
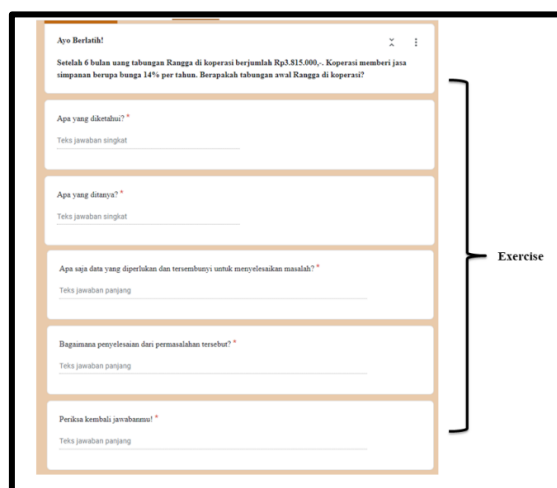

Figure 6. electronic student worksheets Exam

In Figure 5, it is seen that on the last page of the electronic student worksheets 2 there is a question of training that is supplemented with questions for enrichment of problem solving students based on the stage of Polya.

The preparation of the test at the design stage is a test of the ability to solve mathematical problems that will be tested to the student against the learning process that has been done using the developed electronic student worksheets. Results of the test preparation steps are based on the results of the analysis stages in the specification of the learning objectives. The test used in this study is a mathematical problem-solving ability test that is systematically structured according to the learning indicators of 6 tests.

Development

This stage of development includes the stage of validation of instruments to be developed and small-scale testing on the test of mathematical problem-solving ability. This stage will produce draft I of the electronic student worksheets as well as the test of the ability to solve mathematical problems that are ready to be used in the learning process. The results of this stage of development are described as follows.

The phase of electronic student worksheets validation embedded carried out on four aspects, namely content validation, construction validation, language validation and media validation. The following is a grid of practicality sheets filled in by students

Table 7. Student Practicality Grid

The Aspects	Number
Ease of use	1-3
Clarity	4-5
Suitability of steps for using	6-9
Display	10
The attractiveness	11

(Tazkia et. al., 2019)

The validation test was carried out by the validator, the lecturer of mathematics education and the teacher of math in the school. Based on the evaluation of the validator against the four electronic student worksheets, the results performed using the Aikens formula with the category are very valid. This means that the draft 1 electronic student worksheets developed is worthy of use and can be continued on field trials. Here are the results of the validator assessment against the four draft 1 Electronic student worksheets.

Table 8. Validation Result of electronic student worksheets

ELECTRONIC WORKSHEETS	Validation of instruments					
	Material	Construct	Lenguage	Media	Avarage	Category
1	0.89	0.87	0.88	0.83	0.89	Very Valid
2	0.90	0.88	0.88	0.83	0.87	Very Valid
3	0.90	0.88	0.88	0.83	0.87	Very Valid
4	0.88	0.88	0.88	0.83	0.87	Very Valid
Avarage	0.89	0.88	0.88	0.83	0.88	Very Valid

Based on Table 1, the results of the validator assessment calculations related to content validation, construction validations, language validation and media validation developed were categorized as highly valid according to the validity assessment aspects.

The logical validity test of the mathematical problem-solving ability of the student consists of three aspects of material, construction, and language. validator fills out a validation sheet consisting of 12 aspects that include the material, building and language aspects. Here are the results of the evaluation given by the validator on the question of the ability to solve mathematical problems of the students.

Table 9. Logical Validation Results for Problem Solving Ability Test

Test	Result of Aikens V	Category
1	0.83	Very Valid
2	0.81	Very Valid
3	0.81	Very Valid
4	0.83	Very Valid
5	0.82	Very Valid
6	0.84	Very Valid
Average	0.82	Very Valid

Based on Table 4.8 results of validator assessment of mathematical problem solving ability test students obtained Aikens V index of 0.82 which was classified as very valid so that the mathematics problem solve ability test is suitable for use.

The mathematical problem solving ability test of students who have been validated and revised based on the advice of the validator has been ready to be used in the next stage of empirical validation or small-scale testing. Empirical validation includes product moment correlation tests and rehabilitation tests. Here are the correlation and reliability tests. The correlation test aims to see the validity of questions based on the results of small-scale trials in the class that has studied the material that will be tested, which will be carried out on March 25, 2023 in the Class IX-A of the 11th Municipality of Bengkulu with a total of 21 pupils. Here is the result of the work of the students on the problem solving ability test through product correlation test with r_{table} 0,456.

Table 10. Correlation of Product Moment

Number Test	r_{11}	Cryteria	Category
1	0.99	Valid	Very High
2	0.99	Valid	Very High
3	0.99	Valid	Very High
4	0.98	Valid	Very High
5	0.99	Valid	Very High
6	0.97	Valid	Very High

Based on the data of the test results and the calculation of the correlation product moment it was obtained that questions 1 to 6 meet valid criteria with very high category. It is proven by comparing the results of $r_{calculation}$ and r_{table}. To determine used r_{table} correlation product moment by looking at df = 19 and a significant level of 5%. Questions will be valid when $r_{calculation} \geq r_{table}$, so questions 1 to 6 are criteria valid and can be proceeded to the next stage.

The next stage of empirical validation is the test of the feasibility test determined using the crobach alpha formula. The rehabilitation test aims to see the consistency of the problem-solving ability test on social arithmetic material. The

results of the rehabilitation test analysis interpreted the degree of feasibility of the test based on the Guilord (1956) criteria as seen in Table 3.12. The reliability analysis result using SPSS 23 is 0.752 in the high category so the test element is said to be reliable and can be used in the electronic student worksheets effectiveness test.

Implementation

The implementation stage was a field test stage against electronic student worksheets based probing prompting using Google Forms for the ability to solve mathematical problems of students. The electronic student worksheets that has passed the field test phase will be continued to the practicality test. Draft II electronic student worksheets that has been repaired after the validation stage will be tested for its practicality and effectiveness. The purpose of the practical test is to know the evaluation of the user who is a student about the ease of electronic student worksheets developed. The evaluation of the practicality of electronic student worksheets was seen from the practical sheet filled by students of grade VII-G Junior High School Number 11 City of Bengkulu with the number of students 20 people. The results of the practicality test of the use of electronic student worksheets based probing prompting using Google Forms for the ability to solve mathematical problems of the students showed that the four electronic student worksheets meet the very practical category with an average practicality ranging between 4.10 – 4.21.

Evaluate

One of the ADDIE stages was the evaluation carried out at each other stage. For each stage of evaluation, the results of the analysis, design, development and implementation phases will be described as follows.

Evaluation to the analysis stage showed the results of the analysis of needs, curriculum and characteristics of students have produced a product development plan in the form of electronic student worksheets based probing prompting using Google Forms that facilitates problem solving capabilities. This plan is also evaluated basic competencies and indicators to match the objectives of learning mathematics in the junior high school.

Evaluation of the design stage includes the results of the planning stage of material learning, media selection and preparation of mathematical problem-solving skills tests. At the design stage, the results of the development plan are also examined to match the analysis stages that facilitate problem-solving capabilities. The result of this design phase is to create a design of four electronic student

worksheets based on the structure, probing prompting syntax, and problem-solving capability stages based on Polya stages using Google Forms.

The stage of development, validation of electronic instruments is electronic student worksheets and the ability to solve mathematical problems testing will be developed. Validation of instruments on electronic student worksheets consists of 4 aspects of validation namely content, construction, language, and media validation with each validator totaling 3 people. Next, the validation of the problem-solving ability test is carried out on the basis of 3 aspects of the assessment: content, construction, language, and media with 3 expert validators. At this stage of validation, after making a review and discussion with the validator, validator evaluates according to the aspects so that the instrument used is said to be valid. On the instrument on the test ability to solve problems students have carried out a small scale test stage to determine the correlation and reliability of the test so that it is worth using in the field test. Reliable testing is carried out at the implementation stage.

The implementation stage was a field test on the instrument that begins with a pretest against the problem solving mathematical problem test of the students. After the pre-test, the field test phase is carried out using 4 Draft II electronic student worksheets probing prompting based using Google Forms for the ability to solve mathematical problems of students according to the development plan. At the field test, the students were asked to fill in the electronic student worksheets Drat II that had been provided through the links provided by the researchers. After conducting the electronic student worksheets test, the students are asked to fill in a practical sheet with 11 business aspects that include ease of use of electronic student worksheets, clarity of electronic student worksheets, suitability of the Electronic student worksheets use steps, appearance performance of the electronic student worksheets. After conducting field tests and testing of the practicality of electronic student worksheets, and the effectiveness of electronic student worksheets was conducted.

Effectiveness tests were conducted to see the effects obtained after using electronic student worksheets. Testing the effectiveness of the learners on the electronic student worksheets seen from the improvement of the ability to solve problems of the students and the student's classical learning intensity on the posttest. Here are the results of the test of the effectiveness of the students on the electronic student worksheets.

In this study, the level of student ability was reviewed from the ability to solve mathematical problems. The level of such resolution ability, measured by

testing using the test that has been compiled. Here is a description of the average result of the problem solving ability of the students.

Table 11. Results of Mathematical Problem Solving Test

Identifying	Result of Posttest
Top Score	94.87
Lowest Score	61.54
Average	82.24
Median	82.69
Standar Deviasi	8.26
Skewness	-0.98

Based on Table 5, the average posttest result of the students' mathematical problem solving ability was 82,24. If it is categorized based on each ability, then the level of mathematical problem-solving ability obtained by the students in the posttest can be seen in the following table.

Table 12. Ability to Mathematical Problem Solving

Interval of Score	Numbers of Students	Persents	Category of Ability
$80.06 < X \leq 100$	13	65%	Very Good
$60.02 < X \leq 80.06$	7	35%	Good

Based on Table 4.12, the ability to solve mathematical problems of students on the posttest results is not categorized enough, less or not good, meaning the most dominant is the highest category. Furthermore, post-test results show that only 10% (2 out of 20 students) are not satisfied with their ability to solve mathematical problems. In classical student intelligence, i.e. 80% of students who follow learning are able to a score of more than 70, then it can be concluded that the results of students' intelligence on the ability to solve problems of students have met effective criteria.

Comparison of results from the pre-test and posttest analyzed to find out the ability to solve mathematical problems of the students is shown in the following table.

Table 13. The Result of Mathematical Problem Solving

Identifying	Result of Pretest	Result of Posttest
Top Score	20.96	94.87
Lowest Score	3.85	61.54
Average	20.96	82.24
Median	22.44	82.69
Standar Deviasi	11.69	8.26
Skewness	0.14	-0.98

Results of the analysis of mathematical problem solving ability of the students on the pretest and posttest showed that the average improvement in the ability to solve mathematic problems of students was 82.24. Furthermore, it can be seen that the data skewness is normal because the value is between -2 and 2.

Furthermore, the description of improved ability to solve mathematical problems of students using electronic student worksheets can be seen in the following table.

Table 14. Test Average for Each Indicator

Indicators	Problem Solving Ability Results			
	Score maxs	Pretest	Posttest	Increased
Understand the problem	3	43.83	58	14.17
Planning the solution	4	8.67	71.33	62.66
solve the problem	4	2	67.67	65.67
Looking Back	2	0.5	13.17	12.67

Increased ability to solve mathematical problems of students occurs in each indicator. At the level of understanding the problem, the students at the time of the pretest have been able to understand the problem by writing what data the students know and after the application of electronic student worksheets increased 14.17. Increased ability to plan, complete and re-examine looks high. The improvement of the ability to solve mathematical problems of students is seen from the hasill pretest, which is the initial ability of students before following the development and posttest, that is, the ability for solving problems of learners who follow learning and are given electronic student worksheets with probing prompting on the social arithmetic material using N-Gain with a result of 0.77 with a high category. Therefore, the use of the developed Electronic student worksheets is assessed as effective for each of its indicators.

In addition, the effectiveness of electronic student worksheets was supported by the average difference test using t-paired test with the help of SPPS which produces a sig value or p-value = 0,00 < 0,05. Before testing the t-paired test, a normality test and homogeneity test of the pretest and posttest data were carried out. In the results of the pretest data normality test it was found that the sig value or $p\text{-}value = 0{,}268 > 0{,}05$ and in the posttest data normality test it was found that the sig value or $p\text{-}value = 0{,}138 > 0{,}05$. Which means that H_0 was accepted and H_1 rejected. Apart from that, in testing the homogeneity of the pretest and posttest data, it was found that the sig value or $p\text{-}value = 0{,}142 > 0{,}05$, which means that H_0 was accepted and H_1 was rejected. The test results show that the pretest and posttest data are normally distributed and homogeneous.

There was a significant improvement in the ability to solve mathematical problems of the students, then it can be concluded that there are differences in the skills of solving mathematic problems of students before and after the electronic student worksheets is given. Therefore, the use of electronic student worksheets affects the effective class. This is in accordance with the development research of electronic student worksheets whose effective criteria are measured with a sig value or p-value with the result of the sig value = 0,00<0,05, which means that there is an improvement in the ability to solve mathematical problems before and after electronic student worksheets is given. (Dinda dkk., 2021).

Discussion

The phase of electronic student worksheets validation was carried out on four aspects, consist of content validation, construction validation, language validation and media validation. The validation test was carried out by the validator, the lecturer of mathematics education and the teacher of math in the school. Based on the evaluation of the validator against the four electronic student worksheets, the results performed using the Aikens formula with the category were very valid. However, based on the results of discussions between researchers and validators, electronic student worksheets still needs some improvements. Here is an example of an improvement concerning the content (full) of the choice of answers to the double choice on the electronic student worksheets 1. On the content of the choice of the answers it is seen that the first option "Rp180,000,-", the second option "Rp500,000,-", and the third option "Pp150,000,-," according to the validator of the range of options of the answer will be easily guessed by the student so it needs to be changed. Based on the advice of the validator, then there is a change in the choice of the first answer to "Rp130,000,-", the second option to "Pp140.000,-", and the option "RP150,000,-". Here is a question view at the solution planning stage after the revision.
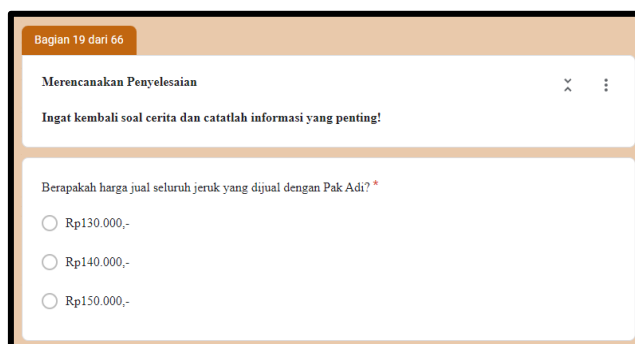

Figure 7. Option Answer After Revision

Based on the devolepment processes, it has been obtained that the electronic student worksheets based probing prompting using Google Forms on social arithmetic material has been declared practical. The practicality of electronic student worksheets was obtained from a sheet of practicality that includes the ease, clarity, suitability of the use steps, the appearance, and the efficiency of electronic student worksheets. On this aspect, the students assessed that in the practical aspects of electronic worksheets are categorized as practical in the learning process with an average calculation of 4.14. Therefore, it can be concluded that the electronic student worksheets that has been developed meets the practicality as expected. This was supported by Nieveen's statement stating that practicality is reviewed from the suitability and ease of teachers and learners in using and using the products developed. (Tazkia dkk, 2019).

The effectiveness of electronic student worksheets was seen from the results of the test ability to solve problems of the students.

Figure 8. Examples of mathematical problem solving skills tests

Based on the results of the test, the students were given a controversial question. Students were asked to identify the known and requested data. Then students were asked to calculate hidden data based on known data to solve the problem. At the final stage, students were asked to re-examine and conclude answers based on problem solving. Therefore, the learner can solve problems according to the stage of problem solving based on Polya's stage.

Conclusion

Based on the results of developing the media, the conclusion was obtained that the Electronic Students Work Sheet was included in a valid category with the calculation results using the Aikens V formula 0.88 with a very valid Category with a valid content validation aspect of 0.89 category very valid, on the construction

aspect of 0,88 with very valid category, the language aspect with the result of 0.88 category is valid, and on the media aspect with a 0.83 result very valid.

The electronic student worksheet was in a very practical category with a practical score of 4.14 by the student with practical categories. This electronic student worksheet includes the effective reviewed from classical learning suitability, i.e. 90% of students obtained a score ≥70 and the N-Gain mathematical problem solving ability with an average of 0.77 was in the high category as well as the electronic student worksheet. Effectiveness is supported by the T-Paired Test with a sig or p-value value of 0.00 < 0.05. Testing supports the effectiveness of electronic student worksheets, so that has an influence in learning.

References

Astuti, A. (2021). Pengembangan Lembar Kerja Peserta Didik (Electronic worksheets) Berbasis Problem Based Learning (PBL) untuk Kelas VII SMP/MTs Mata Pelajaran Matematika. *Jurnal Cendekia : Jurnal Pendidikan Matematika*, 5(2), 1011–1024.

Branch, R. M. (2009). *Instructional Design : The ADDIE Approach*. Springer.

Daryanto dan Raharjo, M. (2012). *Model Pembelajaran Inovatif*. Yogyakarta: Gava Media3

Dinda, D., Ambarita, A., Herpratiwi, H., & Nurhanurawati, N. (2021). Pengembangan Electronic worksheetsMatematika Berbasis PBL Untuk Peningkatan Kemampuan Pemecahan Masalah di Sekolah Dasar. *Jurnal Basicedu*, 5(5), 3712-3722.

Epran, E., Siagian, T. A., Utari, T., Agustinsa, R., dan Irsal, N. A. (2022). Diagnosis Kesalahan Peserta Didik dalam Menyelesaikan Soal Uraian Aritmatika Sosial. *Jurnal Penelitian Pembelajaran Matematika Sekolah (JP2MS*), 6(2), 286-297.

Huda, M. (2014). *Model-Model Pengajaran dan Pembelajaran*. Jakarta:Bumi Aksara.

Jacobsen, D. A., dkk. (2009). *Methods for Teaching (Metode-metode Pengajaran Meningkatkan Belajar TK – SMA*). Pustaka Belajar

Jumroh, J., Hartono, Y., & Aulia, Y. (2022). Pengaruh Model Pembelajaran Probing-Prompting Terhadap Kemampuan Pemecahan Masalah Matematis Siswa Sma. Indiktika: Jurnal Inovasi Pendidikan Matematika, 4(1), 83-91.

Kemendikbud. (2020). *Mari mengenal PISA*

Kemendikbud. (2018). *Laporan Nasional PISA 2018 Indonesia.*

Laia, H. (2019). Hubungan Motivasi Berprestasi Terhadap Hasil Belajar Matematika pada Materi Pokok Operasi Hitung Bentuk Aljabar Terhadap Siswakelas VII

SMP Negeri 1 Teluk dalam Tahun Pembelajaran 2018/2019. *Jurnal Education and Development Institut Pendidikan Tapanuli Selatan*, 7(4).

Lestari, & Yudhanegara. (2018). *Penelitian Pendidikan Matematika.* Refika Aditama.

Mustika, H., & Buana, L. (2017). Penerapan model pembelajaran probing prompting terhadap kemampuan pemecahan masalah matematika siswa. *MES Journal of Mathematics Education and Science, 2(2*).

OECD. 2018. "What 15-Year-Old Students in Indonesia Know and Can Do." Programme for International Student Assessment (PISA) Result from PISA 2018: 1–10. http://www.oecd.org/pisa/Data

Parinata, D., & Puspaningtyas, N. D. (2021). Optimalisasi Penggunaan Google Form terhadap Pembelajaran Matematika. Mathema: *Jurnal Pendidikan Matematika*, 3(1), 56-65.

Polya, G. (1973). *How to Solve It (2nd ed.).* Princeton, New Jersey: Princeton University Press.

Prastowo, A. (2016). *Panduan Kreatif Membuat Bahan Ajar Inovatif. (D. Wijaya, Ed.) (8 ed.).* Jogyakarta: DIVA Press.

Purnamasari, K. (2017). Pengembangan Perangkat Pembelajaran untuk SMP Kelas VII Materi Segitiga dan Segi Empat melalui Pendekatan Kontekstual dan Model Pembelajaran Probing Prompting. *Jurnal Pedagogi Matematika*, 6(1), 18-30

Puspita, V., & Dewi, I. P. (2021). Efektifitas Electronic worksheetsberbasis Pendekatan Investigasi terhadap Kemampuan Berfikir Kritis Siswa Sekolah Dasar. *Jurnal Cendekia: Jurnal Pendidikan Matematika, 5(1), 86-96.*

Sadewa, I. W. A., Suharta, I. G. P., & Astawa, I. W. P. (2020). Pengembangan Lembar Kerja Siswa (LKS) Berbantuan Google form pada Pokok Bahasan Bangun Ruang Untuk Mengoptimalkan Hasil Belajar. *Jurnal Mercumatika: Jurnal Penelitian Matematika Dan Pendidikan Matematika, 5(1), 34-45.*

Susanto, E., Susanta, A., & Rusdi. (2021). *Penelitian Pendidikan Matematika untuk Mahapeserta didik Perguruan Tinggi* (1 ed., Vol. 1). Pendidikan Matematika FKIP Universitas Bengkulu.

Susanto, E. & Rusdi. (2019). *Evaluasi Pembelajaran Matematika Berbasis Project Learning Dilengkapi Penggunaan Ms. Excel & SPSS*. Pendidikan Matematika FKIP Universitas Bengkulu

Susetyo, B. (2012). *Statistika Untuk Analisis Data Penelitian* (R. Refika, Ed.; 2nd ed.). PT Refika Aditama.

Sugiyono, S. (2015). *Metode Penelitian Pendekatan Kuantitatif, Kualitatif, dan R&D*. Bandung: Alfabeta.

Tazkia, Z., Sahyar, & Juliani, R. (2019). Kelayakan Multimedia Interaktif Berbasis Web di Tingkat SMA. *Jurnal Pendidikan Fisika*, *8*(1), 19–28.

Widoyoko, Prof. Dr. S. E. P. (2019). *Evaluasi Program Pembelajaran (10th ed.)*. Yogyakarta: Pustaka Pelajar.

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