



Development of Digital Student Worksheets Learning Media in Mathematics Learning

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Abstract

This study aims to determine the validity, feasibility, and effectiveness of learning media developed as digital student worksheets. The R&D (Research and Development) in this study aims to produce digital student worksheets that improve students' mathematics learning. The development model used in this study is the ADDIE model (Analyze, Design, Development, Implementation, and Evaluation). This study included 27 high school students and 1 educator as research subjects, comprising 10 small-scale students, 17 large-scale students, and 1 educator. The object of this study was the designed digital student worksheets. Data collection for this study used questionnaires, observation, and assessment tests. This study used data analysis techniques, including (1) product development validation, (2) product development practicality, and (3) product development effectiveness. Based on expert validation, the developed product, namely digital student worksheets, was found to be "highly valid." The results from student and educator response questionnaires also showed percentages of 82.5% and 79.26%, respectively, and student learning outcomes were considered satisfactory at 88.23%. Therefore, it can be said that the use of the digital student worksheets as a learning medium in mathematics is valid, practical, and effective.

Keywords: mathematics education, Student Worksheets, Student Worksheets Digital, e-learning

1. Introduction

Law No. 20 of 2003 concerning the National Education System states that learning is a circle of activities between students, educators, and learning resources. One of the learning activities carried out by educational units is mathematics learning. However, currently mathematics learning is still one of the learning activities that are less popular with some students. This is caused by the material being considered difficult to understand and the teaching methods used by educators tend to be monotonous (Widiyaningsih et al., 2025). This is also confirmed in their journal (Afdillah et al., 2023) that many students think mathematics is difficult to understand and comprehend from elementary school to higher education levels, even though mathematics is a field of science that plays an important role in human life. Therefore, to eliminate this perspective from students, innovative educators are needed in teaching so that students are enthusiastic about

learning (Rhmafani & Sulistyaningrum, 2025). Educators who are less innovative in teaching by only relying on textbooks and lecture learning methods make students less interested in learning (Tambunan et al., 2021). Therefore, to become an educator, one must have the ability to create directed learning in accordance with the objectives and competencies of the material to be studied. In addition, educators must also be able to adapt effective learning according to the conditions of the school, students, and their learning environment (Kamila, 2022).

One way to avoid this is by using effective learning materials, for example, engaging learning media. According to Darwiningtyas (2023), educators need learning media that can support the achievement of material and provide more focused assignments to students. An example of learning media commonly used by educators today is Student Worksheets. With the development of the times, Student Worksheets, which was previously in the form of printed sheets and given in paper/hard form, is now available in digital form, called digital Student Worksheets. Samo et al. (2023) in their journal stated that human life has become more integrated, easier, and faster since the advent of technology because with its existence, everything is more practical and automatic.

Based on the researcher's observations of the MBKM Kampus Mengajar program, batch 2, and the social program held by the Ministry of Education, Culture, Research, and Technology at Saigun State Elementary School, many educators still use the lecture method and rely on the teaching modules owned by the educational unit. This is caused by two factors, namely: the lack of time for teachers to design learning media to be used in the learning process. Furthermore, there are limited funds to support the creation of learning media. As a result, learning media is rarely used in learning activities, so learning tends to be monotonous and less interesting, which has an impact on low student engagement and motivation to learn (Puspitasari et al, 2025).

Therefore, a solution in the form of digital student worksheets is needed to make learning easier, more practical, and interactive (Sariani & Suarjana, 2022). Furthermore, interactive digital student worksheets can increase students' enthusiasm for learning because the learning process is not boring like just reading a book (Zhalila et al., 2024). Based on the description above, research is needed on "Development of Digital Student Worksheets Learning Media in Mathematics Learning" with the aim of producing

learning media that suits students' needs and improves the quality of the learning process.

2. Research Methods

This study uses the R&D (Research and Development) method. (Sugiyono, 2013) states that the R&D (Research and Development) research method is a research method applied to create a product that will be tested for its feasibility in the product. The development model used follows the rules of Dick and Carry since 1996, namely the ADDIE development model using two approaches simultaneously, namely a qualitative approach and a quantitative approach. The total number of subjects to be used in this study is 1 educator and 27 students who are divided into 2 groups of students, namely 10 students for a small-scale trial and 17 other students for a large-scale trial. For the research instruments used in the form of observation sheets, questionnaires, and assessment tests. Before these instruments and development products are used on the main research subjects, they will be tested first on small-scale trial students. Meanwhile, to state the feasibility of the product development in this study, a series of feasibility tests were carried out which included validity, practicality and effectiveness tests. Validity tests were carried out through expert assessments (validators) on aspects of content/material, language and product appearance. Validation data were analyzed using the Gregory formula to determine product validity. Furthermore, practicality testing was conducted through teacher and student response questionnaires after using the product development, which were then analyzed using the practicality level percentage. Effectiveness testing was conducted by analyzing student learning outcomes through assessment tests, which were compared with the learning completion criteria and the improvement in student learning outcomes after using the product. Thus, a product development is declared feasible if it meets the criteria of validity, practicality, and effectiveness (Saputra et al., 2020).

3. Results and Discussion

The results of this research are the development of digital student worksheets utilizing Microsoft PowerPoint and the LiveWorksheets website. This research uses the ADDIE development research method, with the following stages (Jazuli et al., 2023).

a. Analysis

The analysis stage of this research involves analyzing the problems and obtaining information related to the research location. The problems and information obtained by the researcher include: a) The curriculum implemented in grade VIII of MTs Al-Ma'Arif 2 still uses the K13 curriculum; b) The learning methods used in class include lectures, questions and answers, and discussions; c) The media and teaching materials used by educators are student handbooks; d) Students' failure to understand story problems in mathematics lessons; and e) Students' lack of enthusiasm in participating in learning due to the relatively boring and monotonous atmosphere. Therefore, learning media that can play an active role in learning more interactively and engagingly are needed. After analyzing the data obtained, the researcher decided to develop a digital student worksheet learning media with the main topic of basic statistics (Wathani et al., 2022).

b. Design

At this stage, the researcher prepares the initial design of the product that will be used for research, such as determining the learning indicators in the basic statistics material, determining the media design with the help of the Microsoft PowerPoint application and the LiveWorksheet website, and compiling research instruments such as observation sheets, questionnaires, and assessment tests.

c. Development

In the development stage, there are three main steps (Sumalasia et al., 2020):

- 1) Creating a development product (digital student worksheet).

Digital student worksheets are developed using various applications and websites, including Microsoft PowerPoint, YouTube, and the LiveWorksheet website.

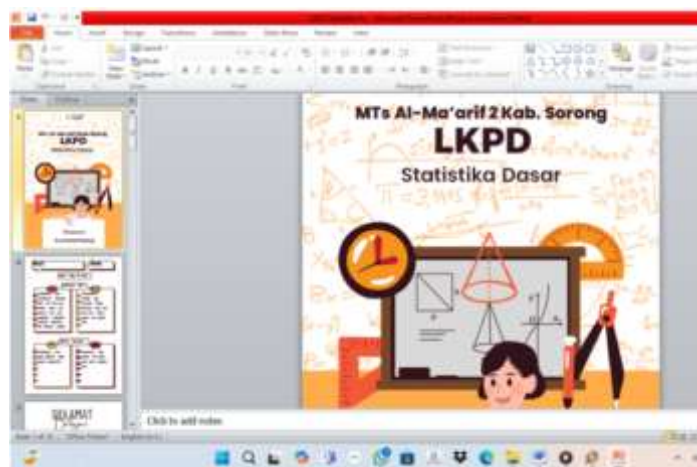


Figure 1. Digital Student Worksheets Design in Microsoft Powerpoint

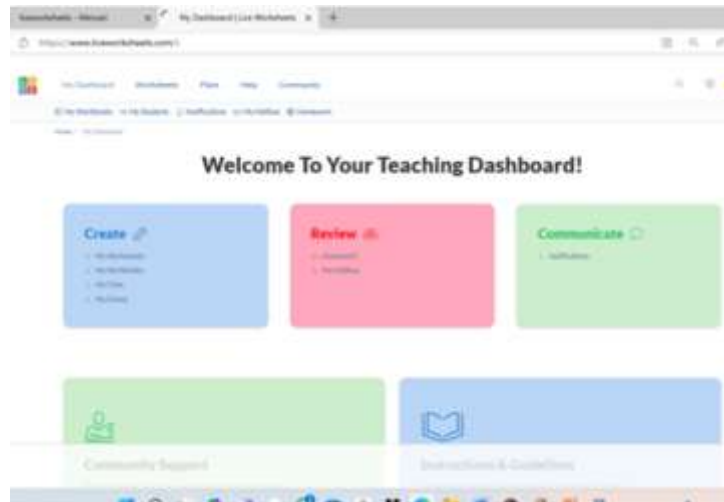


Figure 2. Home View on the Liveworksheets Website for Educators



Figure 3. Home View on the Liveworksheets Website for Students

2) Validation of the development product

This development product was validated by three experts using the Gregory formula. As for the validity criteria (Purba et al., 2022):

Table 1. Criteria for the Validity

Criteria	Category
$0,8 \leq V$	Very valid
$0,6 \leq V < 0,79$	valid
$0,40 \leq V < 0,59$	quite valid
$0,20 \leq V < 0,39$	less valid
$V < 0,19$	Very unreliable

a) Media experts

The developed digital student worksheets were validated by two validators. The cross-tabulation results from Gregory's formula obtained a score of 1, indicating that the developed learning media met the "Very Valid" criteria and could be implemented with students.

Table 2. Media Expert Validation Results

No	Validator 1	Validator 2	Cross Tabulation
1.	3	3	D
2.	4	4	D
3.	3	3	D
4.	4	4	D
5.	4	3	D
6.	4	3	D
7.	3	4	D
8.	4	4	D
9.	4	4	D
10.	3	3	D
11.	4	4	D
12.	4	4	D
13.	3	4	D
14.	4	4	D
15.	4	3	D

$$VI = \frac{D}{A + B + C + D}$$

$$VI = \frac{15}{0 + 0 + 0 + 15}$$

$$VI = 1$$

b) Material Experts

In addition to media experts, the digital student worksheets were also validated by two material expert validators. Based on this, the material validated by both validators received the "Very Valid" criteria, meaning the selected and compiled materials can be used with students.

Table 3. Results of Validation by Material Experts

No	Validator 1	Validator 2	Cross Tabulation
1.	4	3	D
2.	4	4	D
3.	3	3	D
4.	4	4	D
5.	3	3	D
6.	3	3	D
7.	4	4	D
8.	4	4	D
9.	4	4	D
10.	4	3	D
11.	4	4	D

$$VI = \frac{D}{A + B + C + D}$$

$$VI = \frac{11}{0 + 0 + 0 + 11}$$

$$VI = 1$$

c) Linguists

Two linguists were involved in the development of this learning media. The two validators obtained a "Very Valid" rating for the language used in the digital worksheets. Therefore, this learning media is suitable for students.

Table 4. Results of Validation by Linguists

No	Validator 1	Validator 2	Cross Tabulation
1.	4	3	D
2.	4	4	D
3.	3	3	D
4.	4	4	D
5.	3	3	D
6.	3	3	D
7.	4	4	D
8.	4	4	D

$$VI = \frac{D}{A + B + C + D}$$

$$VI = \frac{8}{0 + 0 + 0 + 8}$$

$$VI = 1$$

3) Product Trial Phase

At this stage, the developed product was tested twice using the evaluation (Nurdiyanto et al., 2020):

Table 5. Evaluation Criteria

Criteria	Category
$81\% \leq P$	Very Good
$61\% \leq P < 80\%$	Good
$41\% \leq P < 60\%$	Pretty Good
$21\% \leq P < 40\%$	Not Very Good
$P < 21\%$	Not Good

a) Small-scale trial

Conducted on September 7 and 11, 2024, by 10 eighth-grade students. The developed learning media was implemented in the trial classroom for two consecutive days. The following are the results of the small-scale trial.

Table 6. Small-Scale Trial Results

No	Student Name	Grade	Description
1.	SK 1	50	Failed
2.	SK 2	25	Failed
3.	SK 3	100	Passed
4.	SK 4	90	Passed
5.	SK 5	100	Passed
6.	SK 6	100	Passed
7.	SK 7	100	Passed
8.	SK 8	55	Failed
9.	SK 9	100	Passed
10.	SK 10	100	Passed

$$VI = \frac{\text{Many student passed}}{\text{Number of students}} \times 100$$

$$VI = \frac{7}{10} \times 100$$

$$VI = 70\%$$

b) Large-scale trial

This large-scale trial was conducted by all eighth-grade students on October 26, 2024. The following are the results obtained by the large-scale trial students.

Table 7. Large-Scale Trial Results

No	Student Name	Grade	Description
1.	SB 1	100	Passed
2.	SB 2	100	Passed
3.	SB 3	100	Passed
4.	SB 4	100	Passed
5.	SB 5	100	Passed
6.	SB 6	100	Passed
7.	SB 7	100	Passed
8.	SB 8	97	Passed
9.	SB 9	97	Passed
10.	SB 10	97	Passed
11.	SB 11	97	Passed
12.	SB 12	97	Passed
13.	SB 13	97	Passed
14.	SB 14	97	Passed
15.	SB 15	94	Passed
16.	SB 16	94	Passed
17.	SB 17	94	Passed

$$VI = \frac{\text{Many student passed}}{\text{Number of students}} \times 100$$

$$VI = \frac{17}{17} \times 100$$

$$VI = 100\%$$

d. Implementation

(Sholihatun et al., 2021) During the implementation phase, two methods were used and the criteria are:

Table 8. Criteria of Effective Media

Criteria	Category
$80\% \leq E$	Very effective
$70\% \leq E < 80\%$	effective
$50\% \leq E < 70\%$	Quiete effective
$E < 50\%$	Less effective

- 1) Practicality testing, conducted to assess the practicality of the product (Safitri et al., 2020). This testing involved one teacher and 27 students. At the beginning of the process, the teacher was given a questionnaire related to the potential and problems at the research site. The students were divided into two groups: 10 for a small-scale trial and 17 for a large-scale trial. The questionnaire results from the teachers' questionnaires showed an average score of 80%, categorized as "Very Practical." The average score from the students was 78%, categorized as "Practical." Therefore, the Digital Student Worksheet learning media can be considered practical and can be used as a learning tool for students.

Table 9. Results of Practicality Test by Teacher

No	Aspect	Percentage
1.	Ease and Understanding	75%
2.	Self-regulated Learning	75%
3.	Presentation of Digital Student Worksheet Media	94%
4.	Use of Digital Student Worksheet Media	75%
Mean Criteria		80% Very Practical

Table 10. Results of Practicality Test by Students

No	Aspect	Percentage
1.	Ease and Understanding	79%
2.	Self-regulated Learning	80%
3.	Presentation of Digital Student Worksheet Media	80%
4.	Use of Digital Student Worksheet Media	76%
Mean Criteria		80% Practical

- 2) Effectiveness test, which was taken based on the assessment of skills and attitudes in the lesson plan and the assessment questions that had been prepared. The effectiveness test on the assessment of student attitudes and skills obtained an average score of 87.5% with the criteria of "Very effective." Meanwhile, the assessment test obtained an average score of 88.23% or equivalent to 0.08823. Therefore, the criteria obtained was "Very Effective." Therefore, it can be concluded that the developed learning media, namely digital student worksheet, can be implemented in the classroom.

Table 11. Results of the Effectiveness Test of Attitude and Skills Assessment

No	Aspect	Percentage
1.	Communicative	75%
2.	Creative	75%
3.	Hardworking	100%
4.	Disciplined	100%
5.	Responsible	100%
6.	Curiosity	75%
Mean		87,5%

Table 12. Results of the Assessment Effectiveness Test

No	Student Name	Grade	Description
1	UK 1	80	Passed
2	UK 2	70	Failed
3	UK 3	90	Passed
4	UK 4	70	Failed
5	UK 5	80	Passed
6	UK 6	90	Passed
7	UK 7	90	Passed
8	UK 8	100	Passed
9	UK 9	80	Passed
10	UK 10	90	Passed
11	UK 11	90	Passed
12	UK 12	80	Passed
13	UK 13	100	Passed
14	UK 14	100	Passed
15	UK 15	90	Passed
16	UK 16	100	Passed
17	UK 17	90	Passed

$$VI = \frac{\text{Many student passed}}{\text{Number of students}} \times 100$$

$$VI = \frac{15}{17} \times 100$$

$$VI = 88,23\%$$

e. Evaluation

(Abdillah & Astuti, 2021) The following are some evaluations conducted for each process in the research.

Table 13. Product Development Revisions

Instrument	Before Revision	After Revision
Learning Media Response Questionnaire	The respondent introduction section includes institution and position.	The respondent introduction section was changed to the class and date of the questionnaire.
Assessment Questionnaire for Language Experts, Media Experts, Material Experts	For the assessment scale using Yes/No and conclusions using scales a, b, c, and d	The rating scale was replaced with 1, 2, 3, and 4.
Digital Student Worksheet Learning Media	The initial part of the Digital Student Worksheet only contains the cover, learning objectives, work instructions, and basic competencies.	Initial part Digital Student Worksheet is added to the procedure for using Digital Student Worksheet.

This discussion is structured based on the problem formulation, which covers the validity, practicality, and effectiveness of the Digital Student Worksheet learning media, supported by the Liveworksheet website. Validity indicates that the developed media meet the eligibility criteria as determined by expert assessment and can therefore be used in the learning process. Furthermore, the Digital Student Worksheet is practical, evident in its ease of use by teachers and students during learning activities. Improved student learning outcomes and positive responses to the developed media demonstrate effectiveness. Therefore, the developed Digital Student Worksheet learning media is of adequate quality and can optimally support the learning process. This aligns with research findings showing that the use of technology-based learning media can support the learning process (Sukmawati et al., 2026; Widodo & Astuti, 2026).

The developed digital worksheets were then validated by experts and tested in two stages: a small-scale trial and a large-scale trial. This stage was conducted to determine the media's suitability in terms of validity, practicality, and effectiveness before implementation in the classroom. During the trial phase, teachers guided students in using computers or other available devices to access the digital student worksheets, ensuring a

smooth learning process. Furthermore, during the trial process, several aspects needed to be improved to enhance the quality of the developed media.

Meanwhile, the level of practicality of the media, as indicated by the questionnaire results, showed responses from students and teachers of 80% and 78%, respectively. This data indicates that the developed learning media is easy to use and can help make the learning process more efficient. Therefore, the developed digital student worksheets can be categorized as practical and support student engagement in learning.

The effectiveness test results showed that the student learning completion rate reached 88.23%, indicating that the use of digital student worksheets improves learning outcomes. This is reinforced by the positive student response to the use of media in the learning process. Therefore, the developed digital student worksheets are effective and appropriate for use in teaching and learning activities. This aligns with research findings showing that the use of digital media can improve student learning outcomes (Ismalyanti et al., 2025).

4. Conclusion

The development of digital student worksheets using the LiveWorksheet website for basic statistics for grade VIII is considered valid, practical, and effective. The validity of the media is demonstrated by expert assessments, which fall within the very valid criteria. The media's practicality is evident in its ease of use by teacher and students during the learning process, supported by positive responses. Meanwhile, the media's effectiveness is demonstrated by student learning outcomes, which reached 82.5% and 79.26%, respectively. Therefore, the developed digital student worksheets is suitable for use as a learning medium because it can improve student understanding and engagement in learning.

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