Feasibility of Learning Media to Train Students' Analytical Ability on Factors Affecting Reaction Rate Materials

Kelayakan Perangkat Pembelajaran untuk Melatihkan Kemampuan Analisis Peserta Didik pada Materi Faktor-Faktor yang Mempengaruhi Laju Reaksi

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Abstrak. Tuntutan pendidikan saat ini menjadi tugas bersama untuk meningkatkan kualitas lulusan pendidikan dasar dan menengah dengan membekali dan melatihkan keterampilan Abad 21 sehingga mereka dapat bertahan dan bersaing secara global. Kondisi pandemi COVID-19 yang mengubah pembelajaran menjadi *online* menjadi tantangan untuk tetap memenuhi tuntutan pendidikan. Penelitian ini bertujuan mengetahui kelayakan perangkat pembelajaran ditinjau dari validitas perangkat pembelajaran yang dapat menjadi solusi dan digunakan pada masa pandemi. Penelitian ini menggunakan metode penelitian R&D (*Research and Development*) sampai pada tahap revisi desain. Metode pengumpulan data yang dilakukan adalah telaah dan validasi perangkat pembelajaran. Penilaian yang diperoleh dari tahap validasi kemudian dianalisis menggunakan perhitungan rata-rata dan dikonversi menjadi persentase validasi. Persentase perangkat pembelajaran pada penelitian ini yaitu Silabus pembelajaran 87,5%; RPP 88,8%; LKPD 1 & 2 yaitu 77,7% dan 79,5%; lembar soal *pre-test* dan *post-test* pengetahuan 77,5%; lembar soal *pre-test* dan *post-test* kemampuan analisis 77,5%; dan lembar angket respon peserta didik 78%. Persentase hasil data validasi perangkat pembelajaran diinterpretasikan berdasarkan skala Likert, sehingga perangkat pembelajaran dinyatakan valid karena mendapat persentase hasil validasi ≥ 61%. Kevalidan yang diperoleh menunjukkan kelayakan perangkat pembelajaran, dengan demikian perangkat pembelajaran tersebut dinyatakan layak dan dapat diterapkan dalam pembelajaran *online*.

Kata kunci: *Inkuiri terbimbing, kemampuan analisis, laju reaksi*

Abstract. The demands of education are now a shared task to improve the quality of primary and secondary education graduates by equipping and training 21st Century skills to survive and compete globally. The COVID-19 pandemic condition, which has turned online-based learning, is a challenge to keep up with education demands. This study aims to determine the feasibility of learning media in terms of the validity of the learning media that can be a solution and be used during a pandemic. This study uses the R&D (Research and Development) research method until the design revision stage. The data collection method used was a study and validation of learning media. The assessment obtained from the validation stage is then analysed using the average calculation and converted into a validation percentage. The percentage of learning media in this study were 87.5% learning syllabus; RPP 88.8%; LKPD 1 & 2, namely 77.7% and 79.5%; pre-test and post-test question sheets for knowledge of 77.5%; the pre-test and post-test question sheets for the analytical ability of 77.5%; and the student response questionnaire sheet 78%. The percentage of the data results on the validation of learning media was interpreted based on a Likert scale, results so that the learning media were declared valid because they got a percentage of validation results ≥61%. The validity obtained shows the feasibility of the learning media. Thus the learning media is declared feasible and can be applied in online learning.

Keywords: *Guided inquiry, analytical ability, reaction rates*

1. Introduction

Curriculum 2013 is one of the government's efforts to improve education qualities in Indonesia. In Permendikbud No. 36/2018, Curriculum 2013's learning used a learner-centred pattern, strength active-seeking learning and strength critical learning patterns in which analytical skills are included [1]. Analytical skills integrated with critical thinking are mentioned in Permendikbud No. 20/2016 and have become one of the competency standards for primary and secondary education graduates [2]. Analytical skills are also skills that must be mastered in the 21st century to survive and compete [3]. Analytical skills make students break down a thing or problem into small parts and find out the relationship between these parts [4]. Analytical skills have three components: elemental analysis, relationship analysis, and analysis of organizational principles [5]. The results of the pre-research conducted at SMA Negeri 1 Kraksaan Probolinggo showed that the students' analytical skills in each component was still low, namely 21.11% in the elemental analysis skills category; 39.26% in the relationship analysis skills category; and 27.78% in the category of organizational principles analysis skills, so it is necessary to train analytical skills to students. Analytical skills can be trained by applying a guided inquiry learning model. The guided inquiry learning model can direct students to build their knowledge through scientific activities to become more meaningful and accessible for students to remember because it enters long-term memory [6].

Chemistry is a subject with the characteristics of multiple representation level concepts [7], complex [8], contain quantitative and qualitative variable [9], and is considered difficult by students [10]. The multiple representation consisted of sub-microscopic (abstract), macroscopic, and symbolic material [11]. For example, abstract concept or sub-microscopic level in matter reaction rate, that is the concept of activation energy which we can only do through the occurrence of a reaction that the energy needed by the reactants to react, but we cannot sense the activation energy [12], while for macroscopic material which can be performed by do an experiment such as an experiment on the factors affecting the reaction rate [13], that the speed of reaction can be observed. Besides, chemistry subjects have several levels of representation, based on the pre-research results at SMA Negeri 1 Kraksaan Probolinggo, as many as 96.7% of students think chemistry is a complicated subject, and 56.7% of students choose the rate reaction as material that is considered difficult.

The multiple representation level of chemistry subject have a purpose to practice critical thinking skills of students [14]. The reaction rate in chemistry subject requires students to carry out experiments on the factors affecting reaction rate based on the basic competency in Curriculum 2013. Conducting experiments can be a scientific activity to train students' analytical skills. The learning media are used in the learning activity must also be designed using learning models that conduct an experiment. The learning media that include syllabus, lesson plans (RPP), and student worksheets (LKPD) are designed using guided inquiry model. The guided inquiry model is used for the learning media because it focuses on teacher guidance and in the LKPD, every activity in guided inquiry-based LKPD can practice analytical skills because it adapts to each stage of guided inquiry models, so students will conduct their knowledge about the subjects they are studying during the learning process and be more independent because they already have thinking guidelines.

During the COVID-19 pandemic, it is a challenge to be still able to train analytical skills to students as 21st-century skills that should be mastered by students, even with online learning. The condition showed that teachers need learning media that suitable in pandemic conditions. The learning media developed in this study were adapted to pandemic conditions, which are online-based. Although the learning media are designed according to online learning, but can still be used to train students' analytical skills because the learning media using guided inquiry learning models. This study aims to determine the feasibility of learning media to train students' analytical skills on factors affecting reaction rate materials in terms of the validity of the learning media, so the validity of learning media shows the feasibility of learning media that is to be used in the learning process.

The feasibility of the learning media reported in this study are the learning syllabus, lesson plan (RPP), Student Worksheets (LKPD), pre-test and post-test learning outcomes (knowledge), pre-test and post-test analytical skills, and student response questionnaire sheets. This research was conducted to determine the feasibility of learning media used to train students' analytical skills on the factors affecting reaction rate. The feasibility of learning media is reviewed based on the results of the validation test of learning media.

2. Research Methods and Data Collection Methods

2.1 Research Methods

This research was designed using the R&D (Research and Development) steps method according to Sugiyono as in Figure 1 below:

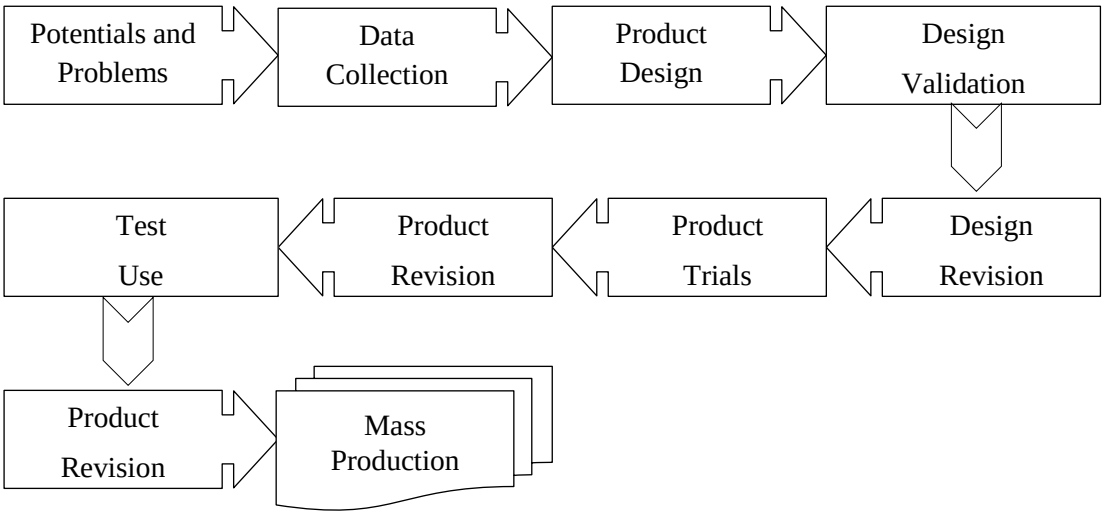


Figure 1. The Research Design according to Sugiyono

[15]

This research was conducted until the fifth stage that is design revision.

2.2 Data Collection Methods

2.2.1 Review of Learning Media

The review stage of the learning media that will be used in the learning activity is carried out by the reviewer to provide suggestions for the media so that it can be refined before being tested on students.

2.2.2 Validation of Learning Media

The learning media's validation stage was carried out to determine the learning media's validity that would be used in the learning activity. The validator carries out this stage by providing an assessment of the learning media. The validator's assessment results will be calculated to determine the percentage of the learning media's validity. The formula used is as follows:

$$Percentage\ of\ Validity = \frac{Assessment\ total\ score}{Total\ score} \times 100\%$$

The criteria for interpreting the value of the percentage validity results can be seen in table 1 below: [16]

Table 1. The Interpreting Criteria of Percentage Validity

Percentage (%)	Level of Validity
81-100	Very Valid
61-80	Valid
41-60	Quite Valid

Percentage (%)	Level of Validity
21-40	Invalid
0-20	Very Invalid

The criterion for interpreting the percentage of validity is used in making decisions on the feasibility of learning media in this study.

3. Results and Discussion

This study developed learning media consisting of a syllabus, RPP, LKPD, pre-test and post-test learning outcomes (knowledge), pre-test and post-test analytical skills, and student response questionnaire sheets. The learning media was developed by adjusting the current pandemic conditions that is online learning. Besides, the media were designed to train students' analytical skills on the factors affecting reaction rates material. The development of this learning media goes through five stages according to the R&D steps [15].

3.1 Potential and Problems Stage

The initial stage is the potential and problems. Online learning has good potential because it has many advantages [17]. Online learning during the pandemic is a challenge for teachers to fulfil the criteria for student-centred learning in the Curriculum 2013 which is the learning activity focus on students [1]. Another challenge is to keep practicing 21st Century skills for students through online learning. The potentials and problems faced have led to developing learning media that are suitable for online learning conditions and can still practice 21st Century skills, one of which is analytical skills. Data from pre-research results at SMAN 1 Kraksaan with low analytical skills test results also supported in the developing learning media.

3.2 Collection Data Stage

The data collection stage was carried out to support the learning media that developed in this study. Data collection was carried out by collecting literature that supports this research, such as looking for relationships between guided inquiry learning models with analytical skills and looking for experimental videos of the factors affecting reaction rate. The guided inquiry learning model has a relationship that can train each component's analytical skills because at each stage of the guided inquiry learning model, there are analytical skills trained, so this learning model is used in the development of learning media and LKPD to train analytical skills. The relationship between the stages of the guided inquiry model and analytical skills is shown in the table 2.

Table 2. The Relationship between Guided Inquiry Learning Model Stages and Analytical Skills

Guided Inquiry Learning Model Stages	Learning Activity	Trained analytical skills
Presents a phenomenon	Formulate problem	Elemental analysis
Formulate hypotheses about phenomena	Make a hypothesis	Relationship analysis
Collect experimental data	Determine the experimental variables and do the experiment	Elemental analysis
Formulate explanations and conclusions	- Analyze experimental data - Summing up the experimental results	- Relationship analysis - Analysis of organizational principles

3.3. Product Design

The product design stage is carried out by the potentials, problems, and data obtained from data collection results based on supporting literature. The product developed is a learning media for the sub material factors affecting the reaction rate. The syllabus and RPP are

designed with attention to the learning model and platform to be used in the learning process that is the guided inquiry model and Google Classroom to facilitate the management of learning activities and assignments.

LKPD are prepared following the guided inquiry learning model and online learning adjustments because students cannot conduct experiments directly in the laboratory, so learning media in the form of experimental videos is used for the factors affecting the reaction rate. The LKPD sections are adjusted to the guided inquiry learning model so that each syntax trains analytical skills. Several analysis questions include elemental analysis skills, relationship analysis, and analysis of organizational principles in each LKPD. The LKPD are made into two, namely LKPD 1, which contains the activity for concentration and surface area factors materials, while LKPD 2 has the activity for temperature and catalyst factors materials.

The pre-test and post-test question sheets for knowledge and analytical skills were used to determine the completeness and improvement of student learning outcomes before and after applying the learning media developed as one of the indicators of the influence of these learning media on students. Student response questionnaire sheets are used to determine the level of practicality of learning media after being applied to learning activities. The designs used in the learning media developed are as follows:

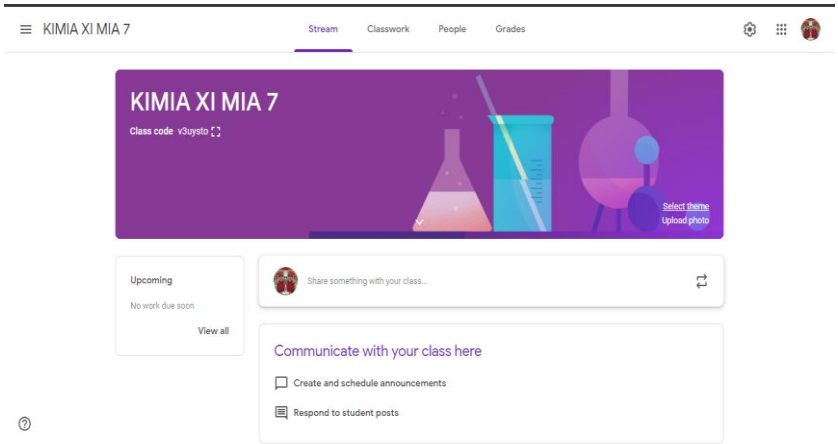


Figure 2. Learning Management System (LMS) used in RPP that is Google Classroom

Figure 3. The LKPD Cover

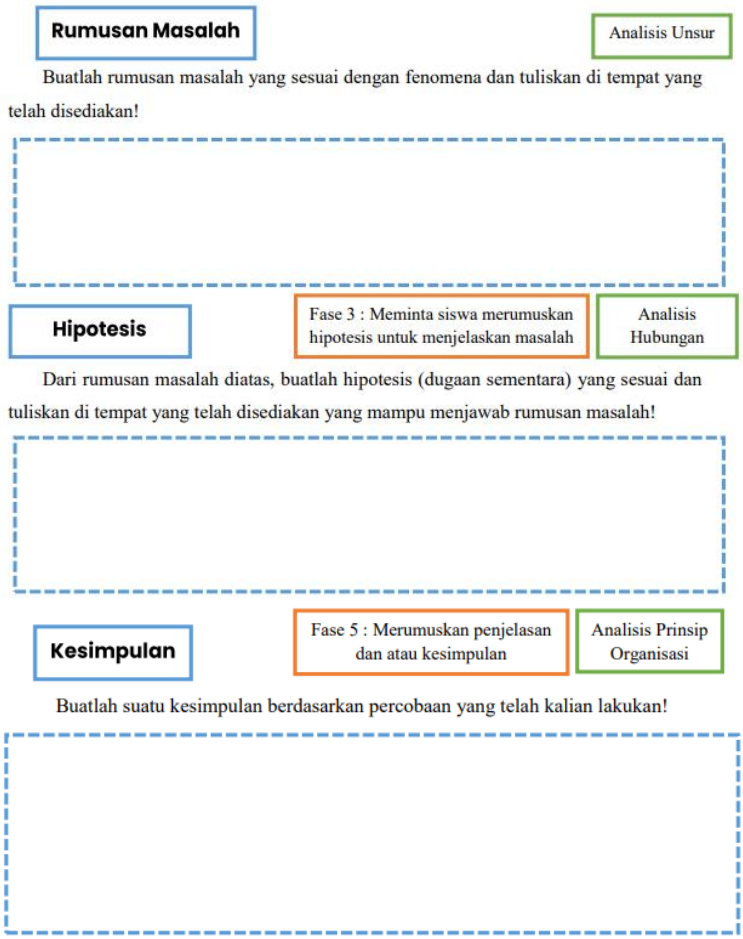


Figure 4. The Analytical Skills are trained according to the LKPD's Stages of Guided Inquiry Learning Model

3.3 Product Validation

The product design compiled is reviewed by reviewer. The review stage is carried out in order to provide input and corrections for learning media. One of the elemental analysis questions and the answer key in LKPD 2 before being reviewed by the reviewer is shown by figure 5:

Jawab:

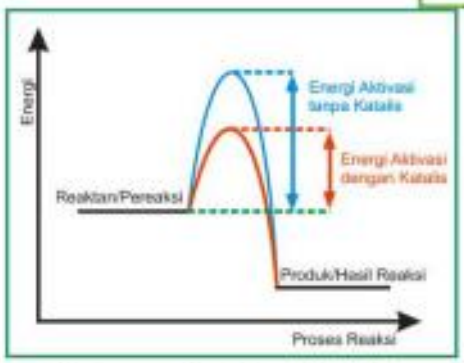
Pada suatu reaksi katalis berfungsi untuk mempercepat reaksi dengan cara mencari jalan lain yang lebih efektif yang ditandai dengan penurunan energi aktivasi. Katalis yang digunakan mempercepat reaksi yang terjadi yang ditandai dengan semakin cepatnya waktu yang dibutuhkan untuk menguraikan H_2O_2 menjadi H_2O dan O_2.

Figure 5. Elemental Analysis Question in LKPD before Review Stage

The result of the revision of input and corrections during the review stage is shown by figure 6, as follows:

4. Perhatikan gambar dibawah ini!

Analisis Unsur



Bagaimana energi aktivasi yang diperlukan suatu reaksi yang tidak ditambah katalis dibandingkan reaksi yang ditambah katalis? Menurut Anda bagaimana pengaruh katalis terhadap energi aktivasi suatu reaksi? Bagaimana pengaruh katalis pada percobaan yang Anda amati?

Jawab:

Pada suatu reaksi yang tidak ditambah katalis memerlukan energi aktivasi yang lebih tinggi dibandingkan dengan reaksi yang ditambah katalis, hal tersebut dapat dilihat pada grafik yang mana grafik biru (tanpa katalis) energi aktivasinya lebih tinggi dibandingkan grafik merah (dengan katalis) energi aktivasinya lebih rendah.

Katalis memiliki pengaruh terhadap energi aktivasi suatu reaksi karena katalis mempercepat reaksi dengan cara mencari jalan lain yang lebih efektif dan membutuhkan energi aktivasi lebih rendah sehingga waktu yang diperlukan untuk bereaksi semakin singkat dan laju reaksi semakin cepat. Pengaruh katalis pada percobaan yang diamati yaitu katalis yang digunakan mempercepat reaksi yang terjadi yang ditandai dengan semakin cepatnya waktu yang dibutuhkan untuk menguraikan H_2O_2 menjadi H_2O dan O_2.

Figure 6. Elemental Analysis Question after the Review Stage

The revised results from the reviewers who have been approved then proceed to the validation stage. The validator validates the learning media. The validation stage needs to be done to determine the validity of learning media for use in learning activity. The validator is given a validation sheet according to the desired assessment criteria, and then the validator assesses according to the validated learning media. The assessments provided by each validator are then added up to find out the value obtained by each media. After that, the percentage of validity is calculated using the formula below:

$$Percentage\ of\ Validity = \frac{Assessment\ total\ score}{Total\ score} \times 100\%$$

The result of calculating the validity percentage of the developed learning media is shown in table 3 below:

Table 3. Validity Percentage of Each Learning media

No.	Learning media	Validity Percentage (%)
1.	Syllabus	87.5
2.	Lesson Plan (RPP)	88.8
3.	Student Worksheet 1	77.7
4.	Student Worksheet 2	77.7
5.	Pre-test and post-test question sheets for learning outcomes	77.5
6.	Pre-test and post-test question sheets for analytical skills	77.5
7.	Student response questionnaire sheets	78

The percentage of validity obtained for each component of the LKPD, which is more detail, is shown in table 4 below:

Table 4. The Assessed LKPD's Components

No.	Assessed Aspect	Validity Percentage of Each Component (%)	
		LKPD 1	LKPD 2
1.	Suitability of LKPD with the 2013 Curriculum	81.25	81.25
2.	Suitability of LKPD with Guided Inquiry Learning Model Components	75	79.25
3.	Suitability of LKPD for Training Analysis Skills:		
	i. Elemental Analysis	75	75
	ii. Relationship Analysis	81.25	81.25
	iii. Analysis of Organizational Principles	75	75

The percentage of validity obtained is then interpreted using a Likert scale as in table 1, with the following results:

3.4.1 Syllabus and Lesson Plan (RPP)

The syllabus and RPP in this study were prepared based on the guided inquiry learning model and online learning conditions using the Google Classroom platform. Based on the data from the syllabus and RPP's validation results, respectively, which were 87.5 and 88.8%. The percentage of these results is included in the very valid category based on the Likert scale in table 1 [16]. The syllabus and RPP are thus declared valid, so the syllabus and RPP are feasible and can be applied in online learning with students.

3.4.2 LKPD 1 and 2

LKPD 1 & 2 in this study follow the learning model used that is the guided inquiry learning model. The percentage of validity obtained by LKPD 1 and 2 are 77.7% and 79.5%, respectively. This percentage is included in the valid category based on a Likert scale [16]. The percentage obtained for each component in LKPD 1 and 2 are 81.25% based on suitability with the 2013 Curriculum, which is categorized very valid. The percentage of 75% for the suitability of LKPD 1 with the guided inquiry learning model and 79.25% for LKPD 2 in the same assessment component. This percentage is included in the valid category based on a Likert scale [16]. The percentage of the suitability component to train analytical skills in each component of the analysis, namely elemental analysis, relationship analysis, and analysis of

organizational principles in LKPD 1 and 2 are 75%; 81.25%; and 75%. This percentage is included in the valid category for the elemental analysis component and organizational principles, while it is very valid for relationship analysis. The decision is made based on a Likert scale [16]. LKPD 1 and 2 are thus declared valid, so the LKPD 1&2 are feasible and can be used in online learning to practice analytical skills on the sub-material factors affecting the reaction rate.

3.4.3 Pre-test and Post-test Question Sheet

There are two kinds of pre-test and post-test question sheets in this study: knowledge and analytical skills. The question sheet is used to determine the initial conditions before the learning media are applied and the final conditions after the learning media are applied so that it can be seen the effect of implementing the learning media contained in this study. The pre-test and post-test question sheets each got the same percentage that is 77.5%. This percentage is included in the valid category according to a Likert scale [16]. The question sheet can be used to measure the improvement in the initial and final conditions of the application of learning media in this study.

3.4.4 Student Response Questionnaire Sheet

Student response questionnaire sheets are used to determine the practicality of learning media, especially LKPD, which assessed by students after being applied to students. The response questionnaire sheet gets a validity percentage of 78% which is included in the valid category according to the Likert scale [16].

The learning media's feasibility in this study in terms of the validity value obtained so that the percentage of validity showed a valid result means that the learning media is declared feasible and can be used in the learning process. Besides, the learning media in this study can be used to look for practicality and effectiveness data to complete the feasibility of the learning media.

3.4 Product Revision

The learning media that became the product in this study was revised twice, namely at the review stage and after the validation stage. The review stage revision is on the learning media' content, while the revision after the validation stage is on the inaccuracy of writing in LKPD.

4. Conclusion

The results of the validation data analysis can be concluded that:

a. The syllabus and RPP got a validity percentage of 87.5% and 88.8%, respectively, so they were declared very valid, so the syllabus and RPP are feasible and could be used in online learning activities.
b. LKPD 1 & 2 got a validity percentages of 77.7% and 79.5%, respectively, so they were declared valid, so LKPD are feasible and could be used in the online learning process. Also, can be used to train students' analytical skills.
c. The pre-test and post-test question sheets, both knowledge and analytical skills, can be used to measure students' initial and final conditions, which become indicators of this learning media's impact after being applied during the learning process. The pre-test and post-test question sheets were declared valid with the acquisition of a validity percentage of 77.5%.
d. Student response questionnaire sheets can be used as a tool to measure the practicality of the media, especially for LKPD after being applied to the learning process because it is declared valid with a validity percentage of 78%.

Acknowledgment

The author would like to thank the completion of writing this scientific article to Allah SWT who has bestowed His blessings, mercy, and gifts so that the author can complete this scientific article's

research and writing. Parents who have given prayer, encouragement, and support in research and writing of this scientific article. The school of SMAN 1 Kraksaan Probolinggo which has been willing to be a place for pre-research data collection.

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