

## ***Development of E-LKPD Based on Constructivism Assisted by Live Worksheets to Improve Mathematical Ability***

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### ***Abstract***

This research and development aims to produce products in the form of e-LKPD based on a constructive approach that is valid, practical and effective in terms of students' mathematical abilities. This type of research refers to RND research and development. The research subjects at the field test stage were students in class VIII of SMP Negeri 1 Bukit Malintang. The design at the field test stage is a one group pretest-posttest design. Research data was obtained through observation, interviews, questionnaires, and tests of understanding mathematical abilities. The results of the e-LKPD validity data analysis obtained an average rating of 3.04. The results of the practicality data analysis obtained an average rating of 3.35. The average gain obtained was 0.62. Based on the results and discussion, it was concluded that the student activity sheets were valid, practical and effective in terms of mathematical abilities.

**Keywords:** *E-LKPD; Live Worksheet; Constructivism; Mathematical Abilities.*

### **Abstrak**

Penelitian dan pengembangan ini bertujuan untuk menghasilkan produk berupa e-LKPD berbasis pendekatan konstruktif yang valid, praktis, dan efektif ditinjau dari kemampuan matematis peserta didik. Jenis penelitian ini mengacu pada penelitian dan pengembangan R N D. Subjek penelitian pada tahap uji lapangan adalah peserta didik kelas VIII SMP Negeri 1 Bukit Malintang. Desain pada tahap uji lapangan adalah one group pretest-posttest design. Data penelitian diperoleh melalui observasi, wawancara, angket, dan tes pemahaman kemampuan matematis. Hasil analisis data kevalidan E-LKPD Berbasis Konstruktivisme Berbantuan Live Worksheet memperoleh rata-rata penilaian 3,35. Hasil analisis data kepraktisan memperoleh rata-rata penilaian 3,04. Hasil rata-rata gain diperoleh 0,62. Berdasar hasil dan pembahasan disimpulkan bahwa lembar kegiatan peserta didik valid, praktis, dan efektif ditinjau dari kemampuan matematis.

**Kata Kunci:** E-LKPD; *Live Worksheet*; Konstruktivisme; Kemampuan Matematis.

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## INTRODUCTION

Education has a very important role in efforts to improve human resources, and education has now entered the technological era. Learning is required to be digital-based and a teacher must be able to innovate in creating multimedia-based teaching materials. Teacher teaching materials can increase the effectiveness of learning and make students more curious. On the other hand, teaching materials can create a learning process that is built by the teacher to develop creative thinking which can improve students' thinking abilities, and can increase the ability to construct new knowledge as an effort to improve good mastery of the lesson material. (Lubis, 2023)

Mathematics is an abstract subject. The term abstract is often used as an adjective which means an idea that is still difficult to understand. We can see the abstractness of mathematics lessons in the material in the form of number symbols, symbols, lines and other terms used . According to the Ministry of National Education, one (Monika Safitri Lubis et al., 2023) of the objectives of learning mathematics is for students to have the ability to understand mathematical concepts, explain the relationship between concepts, and apply concepts or logarithms accurately, efficiently and precisely in communicating ideas with symbols, tables, diagrams or other media. to clarify the problem . Based on this, the aim of learning mathematics at school is not only to get to know the science of arithmetic, but even further, it is hoped that it can form a logical, systematic and critical way of thinking.

Based on the results of observations in Mathematics subjects at SMP Negeri 1 Bukit Malintang, it is known that there are no teaching materials or Student Worksheets (LKPD ) that can facilitate students to develop 21st century skills. Therefore, LKPD is needed, especially electronic LKPD (e-LKPD ) based on Constructivism which can facilitate students to have 21st century skills. With e-LK PD it makes it easier for students to study anywhere and anytime. Based on research results(Maulana & Sopandi, 2022) shows that LKPD worksheets in the field are not fully standardized, do not support certain learning models, and do not train 21st century skills. It is necessary to develop LKPD worksheets according to

standards (meet didactic requirements, construction requirements, and technical requirements, and contain elements including the title , learning guidelines or instructions, learning indicators, supporting information, work steps, and evaluations), which help certain models, and LKPD worksheets must teach 21st century skills in electronic form to be filled out online .

Making lectures more effective can be done through one of the approaches that is suitable to be applied in designing e-LKPD, namely the constructivism approach. A learning approach that emphasizes the formation of students' own knowledge is called constructivism. One of the principles of this approach is the formation of knowledge by students themselves through reasoning, not a knowledge transfer process. The constructivism approach can make it easier for students to understand concepts, students will understand the concept completely from real knowledge to abstract knowledge. This is supported by research (Apriani et al., n.d.) that through a constructive approach assisted by LKPD can improve understanding of mathematical concepts. Apart from that, it is supported by research (Oktaviana et al., 2022a) that media-assisted constructive learning can help students understand material. Thus, it can be concluded that in designing e-LKPD a constructivist approach is needed. Several studies have shown that PD worksheets are based on constructivism, including: 1) showing that LKPD worksheets using constructivist learning are practically used, 2) showing that student worksheets with a constructive approach are very effective, especially in understanding students' mathematical concepts, and 3) showing that Constructivism-based LKPD worksheets have a positive influence on student learning outcomes and creative thinking abilities. This research shows that constructivism-based LKPD worksheets are very practical and effective to use. However, this research has not yet developed a constructivism-based e-LKPD that can improve students' mathematical abilities. Apart from that, researchers also use live worksheets in the learning process. Student Worksheets or abbreviated as LKPD are sheets containing tasks that must be carried out by students in the form of questions or active activities during the learning process (Wahyuni & Kurniawan, 2019). Student worksheets can contain material, summaries and

assignments that students must complete . There are two types of LKPD worksheets (Nurdin, 2019), including: (1) conventional LKM, this LKM which is currently used in universities in general is in the form of a print out in book form; (2) Interactive LKPD, created and executed Applications with the help of computer hardware. This LKPD worksheet can provide feedback for students. In this research, Electronic Student Worksheets or also known as Electronic Student Worksheets (E-LKPD ) are work guide sheets for students containing short descriptions or video reviews of material, practice questions, and active activities during learning using media. electronics (cellphones, smartphones, computers/laptops). This is in accordance with what is being done (Syarifuddin, 2022a), where one way to facilitate students' learning is by modifying previously manual LKPD (Learner Worksheets) into online ones called live worksheets. live worksheet is an application provided free by the Google search engine. This app allows teachers to turn traditional printable worksheets (documents, pdfs, jpgs, or PNGs) into interactive, auto-correcting online exercises. Students can do worksheets online and send their answers to the teacher also online. The advantage of this application is that it is good for students because it is interactive and motivating, for teachers this application saves time and saves paper ([liveworksheet.com/about](http://liveworksheet.com/about)) Teachers can use the worksheets provided by the application or can also make their own according to their needs. If you want to use another teacher's worksheet, just copy the link, then custom link and you can distribute it directly to students. This app has a collection of thousands of interactive worksheets covering many languages and Subjects (Patresia et al., 2020).

If teachers want to create their own worksheets, they must upload a document (doc, pdf, jpg, or png) and it will be converted into an image. then the teacher just needs to draw a box on the worksheet and enter the correct answer. Using worksheets for students is quite easy. Students simply open the worksheet, do the exercise and click "Done". Then they select "Send my answer to the teacher" and enter the teacher's email (or secret key code). Then the teacher will get a notification via email, and the teacher can check.

## RESEARCH METHODS

This type of research is research and development (R & D). The product developed is a student worksheet (E-LKPD) based on a Constructive Approach in terms of mathematical ability .

The research and development procedures in this research are in accordance with the 4D model stages, namely: 1) define; 2) design; 3) develop; 4) dissemination (Handayani & Mandasari, 2018) . The 4D model framework is as in Figure 1. At the define stage, researchers analyze learning problems, student characters, concepts that can be applied, and student assignments based on the results of observations. At the define stage, the researcher designed and created a PD e-LK based on *problem based learning* mathematics subjects according to the findings at the define stage. At the development stage, a *problem based learning* based e-LKPD was produced which was revised based on expert input during validation (expert appraisal). At this stage, the revised *problem-based learning*-based e-LK PD was tested for development (developmental testing) on Class VIII students of SMP Negeri 1 Bukit Malintang.

The population in this study were all students Class VIII SMP Negeri 1 Bukit Malintang. The sample for this research is class students VIII SMP Negeri 1 Bukit Malintang numbering 30 students.

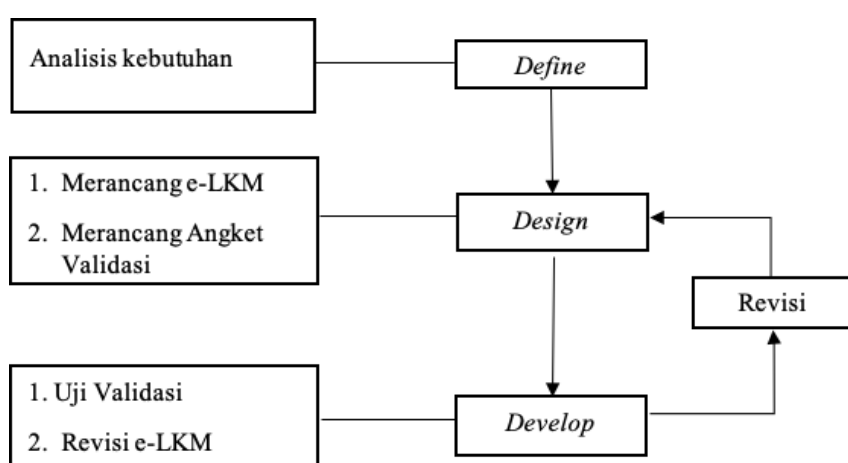


Figure 1. Four D Research and Development Implementation Procedures

Problem Based Learning Based E-LKPD expert validation model involves material experts and language experts from mathematics teachers and mathematics lecturers . This validation test aims to obtain data in the form of assessments, opinions and suggestions regarding: 1) the accuracy, effectiveness and suitability of the material by material experts; and 2) language format by linguists. The data collection instruments used in this research were validation sheets and learning outcomes tests. The validation data collection instrument is the e-LKPD validation sheet which is used to collect data on the results of e-LKPD reviews based on each validator. A validation sheet is given to the validator to give a score by placing a checklist (√) on each aspect assessed on the list provided. The scale used is a Likert scale with the criteria of not good/not suitable (1), not good/not suitable (2), good/suitable (3), and very good/very suitable (4). Data analysis in this research was carried out both qualitatively and quantitatively, namely. Qualitative descriptive data analysis based on input, responses, suggestions and criticism for improvements from validation material experts and language experts. Quantitative data analysis is used to process the data obtained in percentage form and then interpret its validity. The percentage technique is used to present data which is the frequency of test subjects' responses to *problem based learning* based e-LKPD products . This analysis technique is used to process the data obtained through the validation sheet into percentages for each subject. Apart from that, quantitative data analysis uses the N-gain score to determine the effectiveness of implementing e-LKPD based on *problem based learning* . N-gain score is calculated based on students' pretest and posttest results.

## RESULTS AND DISCUSSION

At this stage, a needs and context analysis will be carried out through direct observation of the learning process, interviews with teachers and students, as well as reviewing learning tool documents. The results obtained by the researchers were that in the teaching and learning process, the majority of Mathematics teachers at SMP Negeri 1 Bukit Malintang did not have guides or guidelines for interactive learning activities, only a few printed textbooks or in PDF form

scanned. When learning, most students said that the teaching materials used were books and worksheets. Teachers and students also rarely use interactive learning media in learning, only teachers explain on the blackboard and students work on worksheets. This is also in accordance with the statement of Syarifuddin, Nugroho, et al. (2021) that learning is less effective because teachers have not been able to design interactive teaching materials for mathematics subjects. Therefore, there needs to be teacher readiness in preparing interactive teaching materials for mathematics learning. One alternative to answer the above conditions is to develop interactive learning media in the form of electronic student worksheets or called E-LKPD with the help of a live worksheet web platform tool. (Syarifuddin, 2022). Through E-LKPD with the help of live worksheets, it is hoped that it can help the creative mathematics learning process so that the material presented attracts students so they can focus more and it is easier for students to understand the material presented.

After the needs analysis in the previous stage is known, at this stage the product design is carried out. This product design consists of content design and appearance design. Content design includes a material framework that is appropriate to the learning material Surface Area of Cubes and Cubes. Next, the display design is realized in the form of a flow chart and story board. e-LKPD designs in the form of story boards include cover designs, material pages in the form of material review videos, practice pages, assignments, or interactive quiz pages. The complete E-LKPD development process with the help of a live worksheet can be shown in the following Figure 2.



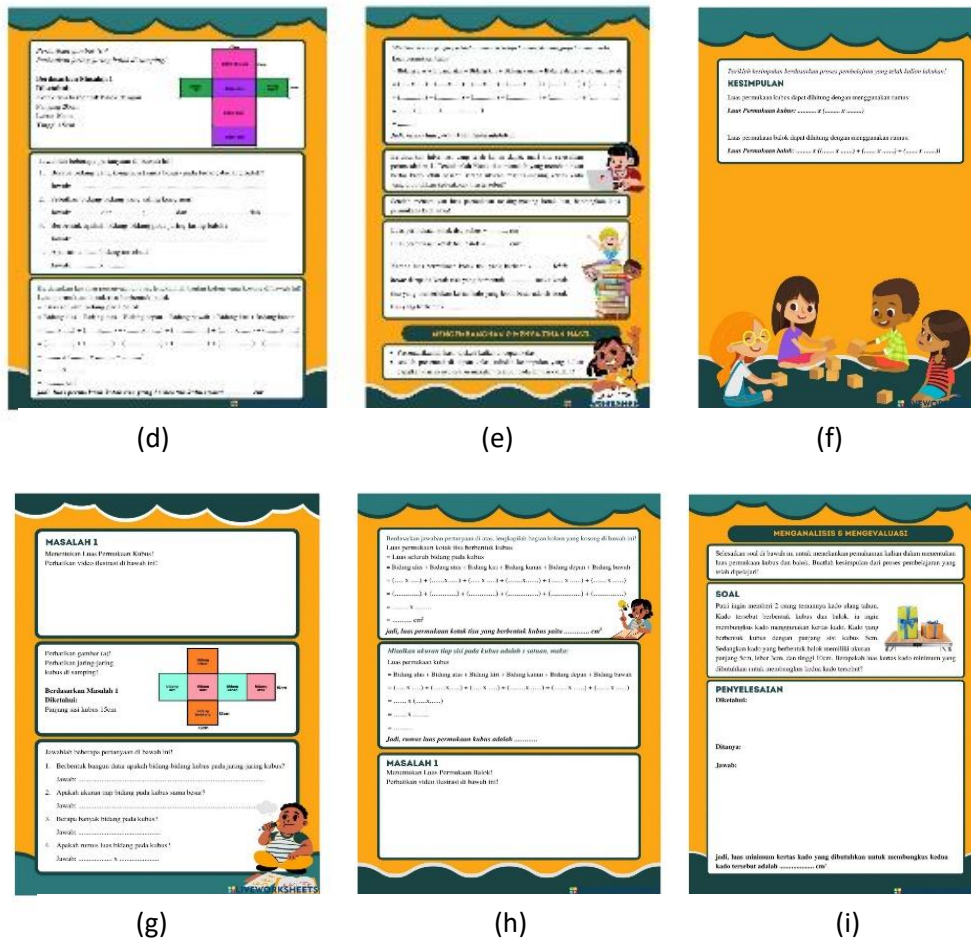


Figure 2. E-LKPD Product Display

The results of the material validation test are based on 3 components, namely appropriateness of content, appropriateness of presentation, learning with a constructive approach to improve students' mathematical abilities . Results are presented in table.

Table 1 . Component Assessment Category Result of Material Expert Validation

No	Component	Average	Assessment Category
1	Content Eligibility	3.7	Very Valid
2	Feasibility of Presentation	3.7	Very Valid
3	Constructive Approach	3.5	Very Valid
4	Average	3.6	Very Valid



The media validation test is based on 2 components, namely graphic suitability and language suitability with a constructive approach to improve students' mathematical abilities . Results are presented in Table 2 . As follows :

**Table 2 . Medical Expert Validation Result Component Assessment Category**

No	Component	Average	Assessment Category
1	Graphic Eligibility	3,4	Very Valid
2	Language Eligibility	3.3	Very Valid
3	Average	3.35	Very Valid

Based on the validation results, the E-LKPD was declared valid. The next stage is field testing, at this stage testing the practicality and effectiveness of E-LKPD in facilitating students' mathematical abilities . This field trial was carried out in class VIII B with a total of 30 students at SMP Negeri 1 Bukit Malintang.

**Table 3 . Practicality Test Results**

No	Component	Average	Assessment Category
1	Appearance	3.06	Very Practical
2	Presentation	3.04	Very Practical
3	Benefit	3.02	Very Practical
4	Average	3.04	Very Practical

To find out data on student learning improvement results when using live worksheets, you can look at the average N-Gain. Normalized score gain (N-Gain) shows the level of effectiveness of treatment rather than score gain or post-test. The use of E-LKPD is said to be able to improve the mathematical abilities of students in at least the medium category. The following is the profile data for evaluating student learning outcomes using E-LKPD as shown in Table 4.

**Table 4. Evaluation Profile of Student Learning Outcomes Using E-LKPD Assisted by Live Worksheet**

No	Statistics	Average Earned Score	Category
1	Pre-test	50.25	Low
2	Posttest	80.25	Tall
3	N-Gain	0.62	Currently _

**Table 5 . Student and Teacher Response Questionnaire Results**

No	Questionnaire Assessment	Grading (%)	Information
1	Student questionnaire	4.53	Very Practical
2	Teacher Questionnaire	4.29	Very Practical
3	Average	4.41	Very Practical

Based on the research data described in the sub-chapter above, a discussion can be carried out regarding the results of product development and students' mathematical abilities in learning. The discussion is as follows: This research is a type of research and development. The result of this research and development is an electronic student activity sheet product based on a constructive approach with material on the surface area of cubes and blocks.

The Student Activity Sheet developed in this research has several background problems. These problems include the non-optimal use of learning resources in schools, the only sources used are textbooks and worksheets. In fact, sometimes textbooks do not meet the needs of individual students, there is a lack of ability and willingness of teachers to develop activity sheets in learning, and the use of activity sheets in learning activities is not yet varied.

Based on validation from several experts, the LKPD based on the Constructive Approach is in the "Very Valid " category. According to experts, the LKPD material is said to be suitable for use with revisions. This is because most of the constructive-based LKPD meets the qualifications of a good LKPD. It can be seen from the suitability of the material with KI, KD, the technique of presenting the material and the involvement of students in the process. Meanwhile, according to media experts, constructive-based LKPD is categorized as "very good". This is because the constructive-based LKPD meets the criteria for appropriateness of content which includes the size of the LKPD, cover design, layout placement, creative and dynamic. In terms of suitability, the language has met the indicators, namely sentence structure, sentence effectiveness, spelling, and use of symbols .

The overall practicality of the LKPD based on the constructive approach developed was in the very good category. The assessment results of student responses received very good criteria because the LKPD was based on a constructive approach in terms of appearance, presentation of material and benefits that met the criteria. According to (Andang et al., 2019) a product has good quality if meet practical criteria. The practical aspect of LKPD can be interpreted as that the LKPD developed can help and make it easier to use (Oktaviana et al., 2022).

Learning using LKPD based on a constructive approach has a positive impact on improving students' mathematical abilities. This can be seen from every learning process carried out. At the first meeting, there was still one group that was not yet active. So the teacher provides assistance. The findings in this research are that social interaction through ZPD will form the scaffolding that students need. Scaffolding is assistance in the early stages of learning which is then gradually reduced (Darwis & Anas, 2015). So that students are better prepared to do their own work (Astuti & Setiawan, 2013). The purpose of scaffolding is to provide clear directions and reduce confusion in children. This is in accordance with Vygotsky's social constructivism theory which explains ZPD and scaffolding .

Overall, students' mathematical abilities are increasingly developing with a constructive approach. LKPD based on a constructive approach is categorized. This is because they are able to construct the concept they are looking for themselves. learning where students think for themselves to construct a certain result expected by the teacher whose implementation is carried out by students based on the instructions given by the teacher. The instructions given by the teacher are questions that guide students to construct .

Apart from that, there is interaction between students. This has a positive impact on students. This is in line with stating that peer social interaction has a positive effect on students' mathematics learning outcomes. It is easier for students to express their ideas by discussing with fellow students, so that each student understands the concepts in the learning process. The research results

show that: (1) the development of E-LK PD assisted by live worksheets consists of several stages, namely the design process (identification of potential and problems, needs analysis and data collection), prototype or development process (E-LKPD) product design which starts with design content and appearance design so that the final E-LKD product is assisted by a live worksheet with cover components, objectives achieved, material content in the form of material review videos, interactive quizzes/assignments/exercises with audio features, multiple choice, drop down, check box, matching with lines, open answers and video material reviews), evaluation or assessment (product validation, revision), product testing; (2) Electronic Student Worksheets (E-LKPD ) assisted by live worksheets produced are very valid and very practical , (3) Online learning using Electronic Student Worksheets (E-LKPD) assisted by live worksheets can increase effectiveness Mathematical abilities with an improvement category are classified as moderate.

## **CONCLUSION**

Based on the results of the development, research and discussion of constructivism-based ELKPD assisted by Live Worksheets in improving students' mathematical abilities in the Surface Area of Cubes and Blocks subjects, it can be concluded that E-LKPD based on constructivism assisted by Live Worksheets in improving students' mathematical abilities in the Surface Area of Cubes and Cubes subjects. The beam achieves the criteria of being very valid, very practical and effective. The suggestions from this research that can provide insight for future readers and researchers include: (1) E-LKPD based on constructivism with the help of Live Worksheets in improving students' mathematical abilities in the Surface Area of Cubes and Beams subjects developed in this research still needs to be refined further. up to the tenth step with scope.

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