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Development of LKPD on Fraction Material: Open-Ended Approach At State Elementary School 6 Susoh

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ABSTRACT

The purpose of the study was to produce student worksheets (LKPD) on fraction material based on open-ended learning. This type is included in development research using the ADDIE model, consisting of the stages of analysis, design, development, implementation, and evaluation. The subjects used were grade VI students of SD Negeri 6 Susoh, Southwest Aceh Regency, 2024-2025 academic year. The results of expert validation of LKPD based on open-ended is included in the valid category with an average score of 3.9 (good). Based on the results of the trial on students, the answers obtained with an average percentage of 93.18% with a good classification. This shows that students find it easier to understand fraction material if the LKPD is designed with an open-ended approach. The results of the development of LKPD based on open-ended are useful for learning in class 6 of SD Negeri 6 Susoh, Aceh Barat Daya Regency, as evidenced by the achievement of a learning completion rate of 72.73%.

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1. Introduction

Education is the foundation and goal of a country's progress and has a significant impact on its development, so education is an important field for the future of a country. Education also encourages and influences the progress of a country's development process in all fields (Suncaka, 2023). The national education system must always be developed according to needs. The educational process that is carried out can develop self-potential so as to improve

human resources to be better, improving good human resources is a benchmark for the success of education.

The purpose of education is one of the efforts to improve the quality of human life. The process of implementing education cannot be separated from the teaching staff who carry out their responsibilities in each school. The learning process carried out in schools has a positive impact on student development in understanding each subject taught. One of the subjects that is considered very important in education is mathematics. Mathematics as a science that can hone critical, systematic, logical, and creative thinking, and is a discipline that plays an important role in the development of science and technology (Rahmawati & Wulandari, 2020).

The foundation of contemporary science and technology is mathematics, a universal science that advances human analysis and thought. In addition to being the foundation for the growth of other sciences such as computers, engineering, economics, and so on, studying mathematics can help build critical thinking skills. Thus, one of the main disciplines in schools is mathematics.

Learning mathematics is very important because it shapes attitudes and serves as a guide for the thinking process. Therefore, one of the responsibilities of teachers is to help students learn mathematics effectively and creatively. Many students still consider mathematics a challenging topic because of its abstract nature, which causes their lack of mastery of the subject. Low learning achievement, results that are not commensurate with effort, and delays in completing assignments are some signs of learning problems in students (Suncaka, 2023).

In addition, many students have difficulty with this subject because the teaching strategies or methods used are not appropriate, making mathematics a less interesting and challenging subject for students. Learning resources that encourage active learning are needed for the learning process. Student worksheets are one type of learning resource (Supriatna et al., 2022).

One of the learning tools that can be created by teachers to support learning activities is LKPD. This tool is a worksheet completed by students containing theoretical or practical instructions and steps to complete a task. LKPD is one of the effective learning alternatives for students, because LKPD can help them deepen their understanding of the concepts learned through structured and systematic learning activities. Teachers can use LKPD as an additional learning tool to increase student involvement and activity in the teaching and learning process. With an open-ended approach that allows students to think freely and actively is needed in the application of LKPD so that its effectiveness increases. (Yase et al., 2020).

Based on the results of observations at SD Negeri 6 Susoh, Aceh Barat Daya Regency regarding mathematics learning on fraction material, it shows that students still experience problems on how to read or analyze the images presented, teachers at the school have not designed LKPD based on open ended to solve every problem given by the teacher. The

teacher only displays examples of LKPD from the internet, then the teacher only refers to the textbooks that have been provided at school. This is what makes the learning system implemented ineffective, children only follow the teacher's directions without being trained to think more creatively and innovatively and are unable to solve problems independently. In addition, teachers are still focused on using conventional methods such as lectures and questions and answers and do not use a learning approach that can make students think more openly and dare to appear.

In the learning process carried out in schools, teachers must allow students to think creatively and build their own knowledge. Students must be given the freedom to express their opinions and teachers are tasked with providing an atmosphere that supports the learning construction process. Students can be guided to develop important values in their lives by actively participating in their education. Interactive elements, such as the exchange of ideas between students and lecturers or between students themselves, are essential for a successful learning process because they make learning more fun, less challenging, and allow students to grow in creativity and independence (Nareswari et al., 2021).

Compiling LKPD based on open problems or LKPD based on open problems is the answer to various problems that have emerged in this sector today. Because LKPD is open, questions will arise that require various solutions or approaches to these problems (Pokhrel, 2024)

Students have the freedom to develop their ideas when using open-ended LKPD , allowing them to expand their intellectual capacity while dealing with problems in the LKPD presented by the teacher. Such circumstances will encourage the growth of students' innovative thinking in learning. Students are encouraged to investigate potential solutions to the math problems they work on when presented with an open-ended approach, students also have the knowledge needed to handle math problems according to the concept of the approach used (Nareswari et al., 2021).

The research conducted by Agus (2023) obtained the results that the research obtained were (1) LKPD has characteristics in accordance with the concept of the open-ended approach , (2) LKPD has obtained a valid assessment, (3) LKPD has obtained a practical assessment, and (4) LKPD is effective in improving student skills. The use of open-ended based LPKD makes it easier for students to solve all teacher problems when open-question based LPKD is used. Students are then given the opportunity to use their best judgment when determining solutions by considering various points of view and the reversal of those points of view.

Then the research conducted by Wikari Hulu (2024) the results of the study showed that the practicality test reached 89.87% that the open-ended LKPD used could be implemented in real mathematics learning. The percentage of students who completed the learning achievement based on the practicality test data was 87%. This shows that the flat shape material developed through LKPD has a high level of effectiveness. Through the development of open-ended LKPD, students will actively participate and be able to communicate the results of their thinking. Thus, students will have more opportunities to

utilize their mathematical knowledge and abilities to the maximum. Therefore, it is hoped that the development of open-ended LKPD can be used in mathematics learning on fraction material.

2. Theoretical Basis

Development of LKPD

According to the big Indonesian dictionary, development means the process, method, act of developing. Development is an effort to improve technical, theoretical, conceptual, and moral abilities according to needs through education and training. Thus, this development is a series of procedures used to create a new product or improve an existing product according to demands (Pokhrel, 2024).

The preparation of this LKPD is expected to improve students' abilities in carrying out learning activities. The development of LKPD based on open-ended which is prepared in accordance with the syllabus is synchronized with the basic competencies in the applied curriculum. The development of LKPD is adjusted to the concept of an open-ended approach with the aim that students can solve problems in various effective ways. (Rahmawati & Wulandari, 2020).

The development of LKPD developed using an open-ended approach aims to enable students to solve problems or provide answers to the LKPD given in various ways and not focused on just one, meaning that students can provide answers to the LKPD with more than one answer. LKPD consists of 6 main elements which include: (a) title (adjusted to the concept of the material); (b) Learning instructions (instructions must be arranged according to the learning steps so that they are more focused and students can easily understand), (c) basic competencies or main materials (adjusted to the use of the learning curriculum), (d) additional data, (e) tasks or steps in the work, and (f) evaluation (Praswanto, 2014).

Open Ended Approach

Open-ended approach is an alternative learning approach that can develop students' creativity and activity. The open-ended approach gives students the opportunity to learn how to identify, recognize, and solve problems by utilizing various approaches by posing challenges with various methods or correct solutions (Chandra et al., 2021). Open-ended learning usually begins by giving students challenges. These are open-ended questions that give students the opportunity to use their imagination and give them space to be creative (Situmorang, 2023).

Open-ended approach has the principle that the process, results, and ways of getting answers are all open. This approach can be used in the form of questions whose purpose is to produce many correct answers or ways of solving. Questions with an open-ended system can also be interpreted as open questions that ask students to provide answers with more than one word (Chandra et al., 2021).

Fraction Material

One of the basic mathematics subjects studied by elementary school students is fractions. The concept and application of basic arithmetic (operations), especially addition, subtraction, multiplication, and division, for ordinary fractions, decimals, and percentages, are the main focus of the discussion of this fraction material. All of these skills must be mastered thoroughly so that the results obtained are in accordance with the concepts taught (Ritawati et al., 2024).

Fractions are numbers that can be expressed as a / b where a, b are integers and b≠0. The number a is called the numerator and the number b is called the denominator. The basic concept of fraction operations is to simplify the numerator and denominator with the same number of things to make figures that are initially intimidating to look at more interesting.

Fraction material is part of all rational numbers that are not integers, or part of rational numbers. James W. Heddens, John F. Le Blanc, Brueckner, Post, Van de Wall, Negoro and Harahap in their definitions indicate that fractions are the same as rational numbers. Bartle and Underhill in their definitions indicate that rational numbers are part of fractions (Saharuddin, 2021).

In elementary school, students are taught fractions which are parts of rational numbers that can be expressed as p/q, where p and q are integers and q is not equal to zero. Fractions can be symbolically represented as one of the following types:

a. Ordinary fractions
   Fractions whose numerator and denominator are smaller than the denominator are called improper fractions.
b. Simplifying fractions
   If there are no more common factors between the numerator and denominator of a fraction, then the fraction is called a simple fraction. The process of simplifying a fraction involves dividing the denominator and numerator by their greatest common factor.
c. Fractions of equal value
   Equivalent fractions are fractions that have the same value. The steps to determine equivalent fractions can be done as follows:
   1. Multiply the numerator and denominator by the same number
   2. Divide the numerator and denominator by the same number
d. Ordering fractions
   The following requirements must be met to order fractions:
   1. The denominators of the fractions must be the same
   2. Fractions can be arranged in ascending or descending order, which is generally referred to as the order from smallest to largest or vice versa.
e. Mixed Fractions
   A fraction that contains both a whole number and a fraction is called a mixed fraction.
f. Decimal fractions

Decimal fractions are fractions symbolized by a comma and have denominators of 10, 100, 1000, and so on.

g. Percentage (per hundred)
   A fraction whose denominator is 100 is called a percentage fraction.
h. Fraction per mil (thousandth)
   Permil fraction is a type of fraction whose denominator is 1000 (Ritawati et al., 2024)

3. Research Methods

The research conducted is a type of development research with the ADDIE model, consisting of (*analysis, design, development, implementation, evaluation*). Rachmad (Orin, Husnul, 2021) explains that in developing LKPD if learning meets the three requirements of validity, practicality, and efficacy, then the learning is considered high quality. The steps for development research are as follows:

a. Analysi*s*
   Stages implemented include needs assessment, material analysis, curriculum and student characteristics analysis, all needs will be prepared so that the implementation process becomes more effective.
b. Design
   Design stage is carried out to design LKPD which includes teaching materials, student worksheets, and learning test questions on fraction material. This *design stage* also pays attention to the level of color selection and the appearance of LKPD based on *open-ended* so that students become interested and enthusiastic about learning.
c. Development
   The development of LKPD based on *open-ended* is based on validation by design, language and material experts, this development process is really considered in order to obtain quality LKPD development.
d. Implementation
   The implementation stage was tested on 22 students in grade 6 of SD Negeri 6 Susoh.
e. Evaluation
   Conducting analysis and correction of errors that occur during the validation stage by the validator. The evaluation process is carried out from the development stage of LKPD based on *open ended* to the effectiveness stage in the use of LKPD and then also looking at the response and completeness of student learning.

The subjects in this study were 6th grade students of SD Negeri 6 Susoh, Southwest Aceh Regency. The data collection technique was using an instrument used to assess the validity of the design, material and language validation sheets. This validation sheet was checked by *a team of experts* , namely 2 expert lecturers (design, language and material experts) and 2 mathematics subject teachers, this validation sheet determines whether the *open-ended LKPD* is effective and practical to use in the learning process.

The practicality assessment instrument is in the form of a student response questionnaire. Meanwhile, the learning outcome test is a tool used to measure success. In the form of test questions prepared to measure student learning outcomes. Test questions through the development of *open-ended LKPD* are provided to observe the final results of student learning.

The data analysis techniques in this study are divided into several stages, namely:

a. Validity analysis stage
   Validity analysis is done by finding the average of the validation sheet based on the predetermined assessment categories. Validity assessment classification guidelines are presented in the following table:

Table 1. Guidelines for assessing the validity of LKPD

Score Interval	**Criteria**
$\bar{x}$>3.20	Good
2.4 < $\bar{x}$≤ 3.20	Pretty good
1.6 < $\bar{x}$≤ 2.4	Not good
$\bar{x}$≤ 1	Not good

Rachmad (Orin, Husnul, 2021)

The development of LKPD in learning is considered valid if the average value of each validity assessment meets the specified requirements. The appointed team must update the LKPD based on *open-ended* and It is not recommended to have *a value* below the set value.

b. Stages of analysis of the practicality of LKPD
   The assessment criteria for student responses in the learning process can be seen in the following table:

Table 2. Student response assessment categories

Value Range (%)	**Student Response Categories**
25-50	Not good
51-75	Pretty good
76-100	Good

Rachmad (Orin, Husnul, 2021)

The development of LKPD based on *open ended* is said to be practical if the student's response is in good criteria. The student's response greatly determines whether the development of LKPD based on *open ended* can be used or not.

c. Stages of Effectiveness Analysis
   Analysis of the effectiveness of LKPD based on *open ended* which is implemented using the results of student learning tests with KKM criteria (75). Guidelines for the Effectiveness of Learning Results can be seen in Table 3.

Table 3. Guidelines for the effectiveness of learning outcomes

(%) Engagement	Practicality
$0 \leq p < 21$	Very low
$41 < p < 56$	Low
$56 \leq p < 66$	Enough
$66 \leq p < 80$	Tall
$80 \leq p < 100$	Very high

Rachmad (Orin, Husnul, 2021)

LKPD with an *open-ended approach* to fraction material is said to be effective if the percentage of student learning outcomes at least reaches high criteria (Rochmad, 2012).

4. Results and Discussion

The learning process with the development of LKPD based on *open-ended* on fraction material is expected to improve student learning outcomes to be better. The preparation of all LKPD is also revised according to direction and input and is also inseparable from the implementation of the learning curriculum. The steps for developing LKPD are as follows:

a. Analysis

This phase is used to examine students' needs and problems, including curriculum, content (materials), and student attitudes.

1. Analysis of needs and problems
   The stages of student needs analysis are used to identify the skills or competencies that students must have in order to improve their learning outcomes, especially in fraction material.
   a) Students experience problems regarding how to read or analyze the images presented in the fraction material.
   b) Teachers at the school have not designed *open-ended LKPD* to solve every problem given by the teacher.
2. Curriculum Analysis
   Curriculum analysis is used to modify Core Competencies (KI) and Basic Competencies (KD) related to the preparation of LKPD as a basis for preparing indicators and learning objectives to be achieved. The following is a description of the findings of the curriculum analysis:
   a) The curriculum used is the independent curriculum but it is not in accordance with the implementation guidelines.
   b) The curriculum follows the provisions of the education department
3. Material Analysis
   To determine the learning procedures that are usually used when providing fraction material, material analysis is needed. Based on the findings of the material analysis, it can be explained as follows:

a) Difficulty reading and understanding images in fraction material
b) Although some students still need additional instruction, the students' overall understanding of the fraction material is good.
c) Comparing fractional numbers is an idea that students must learn in order to understand fraction material more completely.

4. Analysis of Student Characteristics

The learning process carried out is not only focused on discussing the material, but the teacher also tries to create certain methods or techniques so that students can more easily understand what is being conveyed by trying to find simpler and more interesting references. In the learning process, it is seen that students are active in learning. However, very few students want to ask questions. The interaction between students and teachers during the learning process is lacking, only teachers have the authority to interact with students. This means that learning needs to be carried out more openly and can arouse students' interest in learning to be better.

b. Design (Planning)

The LKPD design stage is carried out with the following steps:

1. LKPD Draft

The design of LKPD on fraction material is arranged based on *open ended,* LKPD is designed with 5 stages. In the first stage, the purpose of using LKPD is described, the second stage is instructions for use, then the third stage is information about learning, then the fourth stage is completing the tasks (activities) given and finally solving each problem presented in LKPD.

2. Fill in the LKPD

The LKPD developed consists of:

a) Cover
b) The cover is designed starting with writing the title and student identity, then it is also decorated with images that can attract students' desire to learn.
c) Describe the purpose of using LKPD
d) Learning activities

c. Development

1. Validation Test Analysis

After the validation data from the four expert teams were tabulated into a table, the average score for each validator was determined. The validation procedure was completed once and then modified based on the validator's recommendations. Table 5 shows the results of the validation tabulation by the linguists, Table 6 shows the validation of the materials, and Table 7 shows the validation by the design experts.

Table 4. Language Expert Validation Analysis

No	Assessment Indicators	Validation 1	Validation 2	Total
1	Validator 1	2.7	3.8	3.3
2	Validator 2	2.3	4	3.2
Average		2.5	3.9	3.3
Assessment criteria		Pretty good	Good	Good

Table 5. Material Expert Validation Analysis

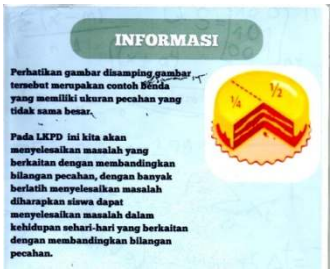
No	Assessment Indicators	Validation 1	Validation 2	Total
1	Validator 1	2.5	3.9	3.2
2	Validator 2	2.8	4	3.4
Average		2.7	4	3.3
Assessment criteria		Pretty good	Good	Good

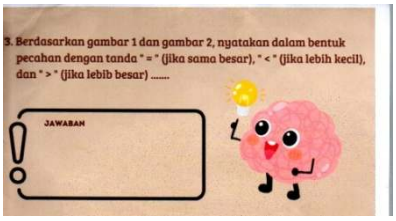
Table 6. Expert Design Validation Data Analysis

No	Assessment Indicators	Validation 1	Validation 2	Total
1	Validator 1	2.8	3.7	3.3
2	Validator 2	4	4	4
Average		3.4	3.9	3.7
Assessment criteria		Good	Good	Good

According to tables 5, 6, and 7, it can be said that LKPD is included in the feasible category at the trial stage. However, it can be seen in table 5 that there are several parts that need to be changed according to the validator's recommendations.

Table 7. Results of LKPD Revision at Validation Stage

Initial Design	Revision Results
The information presented in the LKPD is unclear and less interesting 	The information presented has been corrected according to the validator's instructions. 

In activity 1, the questions presented were not yet *open-ended.*   	In problem 2, the questions have been adjusted according to the validator's directions  
In activity 1 the materials and tools needed for learning activities are not detailed.  	In problem 2, the use of tools and materials for learning activities has been detailed according to student needs. 

2. Readability Test Analysis

   This stage aims to identify deficiencies and errors in the preparation of the LKPD produced, including typos, word changes, and errors in the use of letters. Before entering the field test stage (analysis stage), the LKPD that has been made is corrected using the results of the readability test. The LKPD given to students is in the good category. Based on the results of the analysis of student assessments of the LKPD in the readability test. For example, the words used in the LKPD do not raise questions, and the information and images presented are interesting and easy for students to understand.

d. Implementation

The LKPD that has been validated by the validator is then used in the learning process in the classroom, and this step is carried out in a trial at school. A total of 22 students of grade VI of SD Negeri 6 Susoh participated in the trial of the development of LKPD based on *open*

ended . The LKPD that was tested focused on fraction material. This trial was carried out for two meetings, to determine the learning outcomes of students after the entire series of learning was carried out, the implementation stage aims to observe the learning process using LKPD based on *open ended* , student responses to learning using LKPD *based on open ended*, and the test given at the end of learning.

e. Evaluation (Evaluation)

1. Practicality test analysis
   To assess the quality of the development of *open-ended LPKD* designed by utilizing student responses after implementing learning with LKPD, a practicality analysis was carried out.

   Assessment through student responses aims to assess the effectiveness of learning devices in terms of ease and helpfulness. The results of the student response survey can be seen in Table 8.

Table 8. Results of Student Response Questionnaire

Responded Aspects	**Percentage (%)**	**Category**
Assessment of LKPD based on *open ended*	95.45	Good
Assessment of LKPD used in learning	90.90	Good
Total	**93.18%**	**Good**

Based on table 9 above, 93.18% of students responded well to the implementation of learning, which shows that the level of student learning is very good by using the *open-ended LKPD* that has been developed. This shows that the learning LKPD that has been designed can be used effectively.

2. Effectiveness Analysis
   Open-ended LKPD based on student learning outcome tests, this effectiveness analysis is carried out to determine how effective the learning process is. Student learning outcome tests are taken from the final exam held after the completion of the subject. Table 9 shows the findings of the exam achieved.

Table 9. Student test results at the trial stage

Description	**Learning Outcome Test**	
	Amount	**Percentage**
Students who have completed	**16**	**72.73**
incomplete students	6	27.27

Based on the data in table 10, as many as 72.73% of students completed the learning outcome test after following the learning process, and the results of student learning

completion were obtained based on the established KKM. The designed learning LKPD is effective because all effectiveness criteria have been met.

Through the ADDIE stages (*Analysis, Design, Development, Implementation, and Evaluation*), a process is carried out to create and produce *open-ended LKPD* on valid, useful, and efficient fraction material. This development process aims at a learning LKPD, namely a new product that has been validated, tested for efficacy, and is practical. The following are some research results:

a) Validity of LKPD

In compiling LKPD, there are two important factors that must be considered, namely validation of materials and advantages of LKPD after being tested. The steps for assessing LKPD in student learning activities are validation by language, content (material), and *design experts* . This activity aims to review the development of LKPD, provide input for improvement. The validation process is an effort in ratification and consideration of experts, which is carried out through group discussions. The process of validating LKPD takes place 2 times with each expert (2 people from lecturers and 2 people from practitioners/teachers).

From the results of the expert discussions, several directions were obtained to improve the LKPD that will be used. The process of validating the *open-ended LKPD* was carried out twice with the aim of making the LKPD that will be used more effective, both in terms of language, material and design. The validation of the LKPD carried out aims to test the suitability of the *open-ended LKPD* on the fraction material taught in schools. The results of the language and material validation obtained an average of 3.5 (good).

Open-ended based LKPD is said to be valid if the average score of each validity assessment meets the minimum criteria of good. So it can be concluded based on the results of the analysis of this validation sheet that the *open-ended based LKPD* on the fraction material falls into the valid category, with an overall average of 3.4 (good).

b) Practicality of LKPD

Based on student responses that showed an average percentage of 93.18% with a very good classification, 22 students of grade 6 of SD Negeri 6 Susoh were able to apply LKPD learning well. This shows that LKPD based on open fractions helps and makes it easier for students to understand the material being taught. Assessment of student answers was carried out directly to students who participated in the learning, while the questionnaire answers were obtained from the results of the LKPD trial conducted on grade 6 students.

Then the observation results given by *the observer* obtained an average percentage of 88.46% with a practical category carried out by colleagues. This shows the implementation of LKPD that has been established in the educational

process practically. Based on research conducted by Maulidya Rahmi (2023) that the *open-ended* LKPD developed meets the criteria of valid, practical and effective for use in the learning process in the classroom.

c) Effectiveness of LKPD

Based on student learning outcomes, out of 22 students who participated in the learning, 16 students completed (72.73%), while 6 students did not complete (23.27%). The students' learning completion was achieved because the students completed the learning with a score above 72.73%.

The reported research results show that open LKPD on the main material of fractions has a positive effect on student learning outcomes and the presence of LKPD in the learning process will motivate students to study the material.

5. Conclusion

Based on the results of the study, it can be said that the development of open-ended based LKPD on fraction material is included in the valid category with an average score of 3.9 (Good), practical with an average percentage of 93.18% (Good), and useful for classroom learning. Considering that 6th grade students of SD Negeri 6 Susoh were the subjects of this research trial, it is suggested that this research can be conducted in other schools so that many students and teachers are interested in learning mathematics with a new atmosphere and can easily understand the material by developing open-ended based LKPD.

6. Suggestion

Based on the conclusions from the research results that have been carried out, the author provides suggestions to certain parties who are interested in the results of this research, namely:

a. Practical advice
   1. Schools are expected to be able to implement a quality learning system and be able to improve students' understanding in mastering learning.
   2. Teachers are expected to continue to develop learning systems so that the learning process can take place effectively and students can more easily understand the material presented.
   3. Students are expected to pay attention and follow the entire learning system so that there are no mistakes in understanding the material being taught.

b. Academic advice

   It is hoped that academic institutions in higher education will continue to improve the education system so that they can produce quality and good teachers, and can improve the education system in Indonesia.

c. Relevance of suggestions to research results

It is hoped that this research can provide benefits, especially to the author himself, then to the school, teachers and students as well as future researchers, as a reference in developing future research systems.

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