



DEVELOPMENT OF STEM-BASED LKPD ON THE THEME OF MY HOUSE'S ELECTRIC CIRCUITS TO IMPROVE EXPLANATION, INFERENCE AND EVALUATION SKILLS

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Abstract

One comprehensive and integrative learning approach is the STEM approach. This approach can improve students' explanatory, inference, and evaluation skills by combining the four disciplines: science, technology, engineering, and mathematics. Implementing STEM in teaching and learning activities can use teaching materials, including LKPD. This study aims to produce a valid, practical, and effective STEM-based LKPD product to improve students' explanatory, inference, and evaluation skills. The method used in this study is the research and development method. A validity test has been carried out consisting of a product validity test that is declared valid and suitable for use with a percentage of 80.9%. The effectiveness test is carried out with n-gain and effect size tests. Each obtained a result of 0.68 with the medium category and 2.7 with the high category. Practicality tests conducted by teachers obtained an average result of 83% and students of 87%. So, STEM-based LKPD can effectively improve students' explanatory, inference, and evaluation skills.

Keywords: LKPD, STEM approach, explanation, inference, evaluation

PENDAHULUAN

Unit education in the 21st century is expected to produce source Power quality human beings who have skills and are Ready to compete (Mushthofa *et al.*, 2021). Skills trained during the learning process demand that students become intelligent and skilled people (Akmala *et al.*, 2019). Explaining, inference and evaluation are part of HOTs (*High Order Thinking Skills*) (Agustine & Nawawi, 2020). Skills This is One helpful unit- for life because skills can be used in the future. Skills explanation helps students grow their reasoning (Agnafia, 2019); skills inference practices students estimate solutions and interesting conclusions to problems (Marisda *et al.*, 2022); and skills evaluation is used to think reflective. The third Skill belongs to attitude-critical students.

Attitude is critical for students because problem life is far more complicated, complex, and heavy, so a needed attitude is critical in solving problems (Mushthofa *et al.*, 2021). The same thing was also said by Setyawati *et al.* (2020) that an attitude critically acknowledged can support success in Work or life in the current era or the future. As reported by Mushthofa *et al.* (2021), students with an attitude of good criticism will

quickly encounter various material difficulties. That proves that skills are critical for any student who can develop them through the learning process (Cahyono, 2017).

A possible learning process to hone attitude critical students can be applied through comprehensive learning (Santoso & Mosik, 2019) and integrative (Shabila *et al.*, 2020). One of the natures of learning, comprehensive and integrative, is the STEM approach. *Science, Technology, Engineering, and Mathematics* (STEM) is a natural approach-comprehensive and integrates four disciplines of knowledge. STEM approach applied in learning, according to Novidya & Kustijono (2019), can hone Skills in explanation, inference, and evaluation of students. That matter is proven by its existence of a combination of fourth discipline knowledge that provides an opportunity for students to identify and analyze arguments, solve a problem, evaluate, and investigate something matter (Davidi *et al.*, 2016) as well as interesting A conclusion (Mushthofa *et al.*, 2021) so it can be concluded that fourth aspects of STEM can hone Skills explanation, inference, and evaluation.

Application STEM approach is used To find his thoughts Alone (Santoso & Mosik, 2019) and grow thinking Logically in solving problems (Novidya & Kustijono, 2019). In order to increase skills in explanation, inference, and evaluation, students, through the teacher's STEM approach, will use various types of assistance with teaching materials during the learning process. One of them that took place is LKPD. STEM-based LKPD has influenced to aspect cognitive and affective students (Santoso & Mosik, 2019) and encouraged students to build a scientific attitude in thinking critically, thinking deeply To finish problems, and understanding draft science as well as relationships in life every day (Simatupang *et al.*, 2019).

Based on the observations made during the internship at SMPIT Ihsanul Magelang City, Fikri obtained that device eye learning-science lessons used in a way that generally already refers to the 2013 curriculum. Teaching materials used: No varied and not yet stimulating Skills explanation, inference, and evaluation. That matter impacts the value test daily. Many students get the KKM mark limit; some are even under KKM. According to research, learning outcomes and skills explanation, inference, and evaluation own positive and significant relationship (Mutmainnah *et al.* , 2021; Rasyidi, 2020); if Skills explanation, inference, and evaluation increase, then learning outcomes also increase. So, students' explanation, inference, and evaluation skills at SMPIT Ihsanul Magelang City Fikri must still be at their maximum.

See the problem with that goal from the study. That is, to produce valid, knowledgeable, SSTEM-based LKPD effectiveness and know the practicality of STEM-based LKPD.

METHOD

The research method used is method study development (*Research and Development/ RnD*). Research and development This was developed by applying the ADDIE model. According to Sugiyono (2015), the development model consists of five stages which include (1) *Analysis* (analysis), (2) *Design* (design), (3) *Development* (development), (4) *Implementation* (implementation), and (5) *Evaluation* (evaluation).

The research sample was class IX D, with 26 students as respondents in testing the effectiveness of STEM-based LKPD. Sampling used a purposive sampling technique. The techniques and instruments in this research include LKPD validity instruments, skills test instruments explanation, inference, and evaluation, as well as practical instruments.

An expert validator carries out the validity of the LKPD; then the results are validated, calculated and analyzed using a scale according to the criteria eligibility in the following table

Table 1. Criteria Validity of LKPD

Criteria	Percentage
Very Valid or can be used without revision	$85.01\% \leq P \leq 100\%$
Valid or usable with minor revision	$70.01\% \leq P \leq 85\%$
Invalid or requires major revisions and is recommended not to be used	$50.01\% \leq P \leq 70\%$
Invalid or may not be used	$1\% \leq P \leq 50\%$

Source : (Akbar, 2013)

The test instrument is in the form of essay questions totalling six questions For test Skills explanation, inference, and evaluation. A validator tested the validity of these questions, and the reliability test was tested on 20 students. Statistical testing to calculate question items *The pretest* and *posttest* are the prerequisite tests (normality test and homogeneity test), T-test, N-Gain test, and Effect Size test.

A normality test is used to know the distribution of research data, including whether it is normally distributed. The normality test uses *Shapiro-Wilk* with the help of SPSS 25.0. The level significance used _ is $\alpha = 0.05$. The results show $\alpha = 0.100$ for pretest data and $\alpha = 0.066$ for posttest data. So, it can be concluded that the data distributed is normal. Then, test homogeneity calculated using Microsoft Excel 2016 obtained an F-calculated value = 2.81 and an F- table value = 4.23 so that F- calculated \leq F- table with $\alpha = 0.05$. So, the data is homogeneous. The T-test was conducted using a paired sample t-test assisted by SPSS 25.0. The results of the sig value were obtained based on the paired sample t-test with a significant value of $\alpha = 0.05$. (2- tailed) of $0.000 < 0.05$. That is, H_0 is rejected, and H_a is accepted. The N-Gain test is useful for enhancing Skills, explanation, inference, and evaluation. The results of the N-Gain values are classified into the following criteria.

Table 2. N-Gain Category

Criteria	Scores/Results
$Ng \geq 0.7$	Tall
$0.7 > Ng \geq 0.3$	Currently
$Ng < 0.3$	Low

Source : (Hake, 2019)

The Effect Size test aims to determine the effectiveness scale of STEM-based LKPD Skills explanation, inference, and evaluation of students. Based on the calculation results of the effect size, it can be determined according to the criteria below.

Table 3. Effect Size Criteria

Effect Size	Criteria
$D < 0.2$	Low
$0.2 < d < 0.8$	Currently
$D > 0.8$	Tall

Source : (Yuberti & Saregar, 2017)

The practicality test of STEM-based LKPD was carried out to determine the response of teachers and students to the practicality of the product. After the data was analyzed using the Likert scale method, results showed the LKPD category. These categories can be explained in the following table.

Table 4. Categories Practicality of LKPD

Group	Percentage
Very Practical	80% - 100%
Practical	60% - 79%
Quite Practical	40% - 59%
Less Practical	20% - 39%
Practical	0%-19%

Source : Riduwan (2007)

RESULTS AND DISCUSSION

The feasibility of STEM-based LKPD is obtained based on a validity test carried out by validators with three assessment aspects: content, presentation, and linguistics. Table 5 below shows the results of the validator assessment.

Table 5. Validator Assessment Results

Assessment aspect	Σ Average	Percentage (%)	Category
Content Aspect	4.10	82%	Valid
Presentation Aspects	3.71	74%	Valid
Linguistic Aspect	4.40	88%	Valid
The sum of all scores	4.04	80.9%	Valid

Based on Table 5, STEM-based LKPD in the linguistic aspect has the highest percentage with 88%, followed by the content aspect with 82%, and 74% for the presentation aspect. The results of the two validators' overall assessment of STEM-based LKPD obtained an average of 4.04, equivalent to a feasibility percentage of 80.9%, so it is included in the valid category or can be used with little effort revision.

The presentation aspect obtained a percentage of 74% with a valid category. Aspect presentation obtains a percentage of 74% with valid category. Aspect presentation covers completeness of LKPD, consistency and clarity proportional LKPD, consistency of layout, and attractiveness LKPD display. The content aspect has a percentage of 82% with a valid category. Aspect fills own percentage of 82% with valid category. According to Fitriyah and Wardana (2019), aspect fill must be based on the competencies in the applicable curriculum. Thus, aspect _ content contained in this STEM-based LKPD is by KI and KD in the curriculum; the material presented according to purpose learning, the material presented leads to STEM aspects. It supports the enhancement of Skills explanation, inference, and evaluation of students. The validity category with the highest percentage, namely the linguistic aspect, is 88%. That can be achieved because the preparation of STEM-based LKPD considers PUEBI. Besides that, the language used is communicative, straightforward, and effective so that Easy LKPD can be formed and understood by students. According to research, Fitriyah and Wardana (2019) stated that an LKPD must use communicative sentences and PUEBI to make it easier for the reader. Pangesti *et al.* (2017) explain that teaching materials or LKPD must cover clarity and accuracy of information, readability, and suitability of the use of language by the rule.

The STEM-based LKPD, the final product, was tested on students in class IX D SMP Ihsanul Fikri to determine its effectiveness and practicality. Test instruments used in improving skills skills Student explanations, inferences and evaluations have gone through the validity and reliability stages. The validity results were obtained at 80% in the valid category, and the reliability results were obtained at 0.808 in the high-reliability category. Enhancement Skills explanation, inference, and evaluation students can know by the N-Gain test and the *effect size test*. The N-Gain test results produce a value of .68 with medium criteria, and *the effect size* results show an ark of 2.7 according to the tall criteria. Therefore, STEM-based LKPD is stated to effectively increase Skills in explanation, inference, and evaluation. Besides That, Novidya and Kustijono (2019) state that the STEM approach applied to learning can hone Skills in the explanation, inference, and evaluation of students. The difference in critical thinking skills can be seen in the average pretest and posttest scores in the following figure.

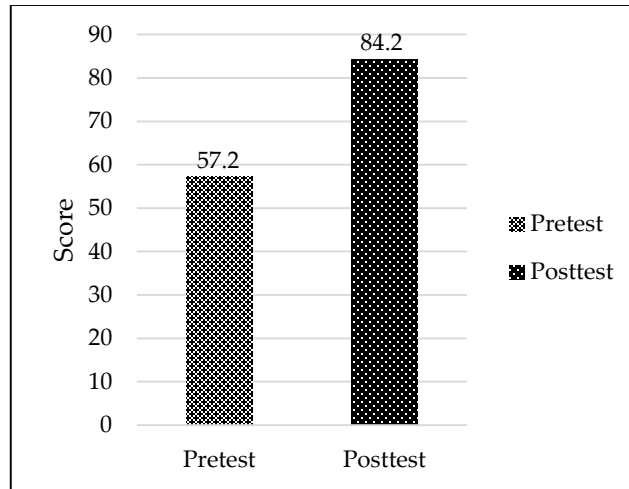


Figure 1. Average pretest and posttest score

Enhancement Skills explanation, inference, and evaluation can be seen in Figure 2 below.

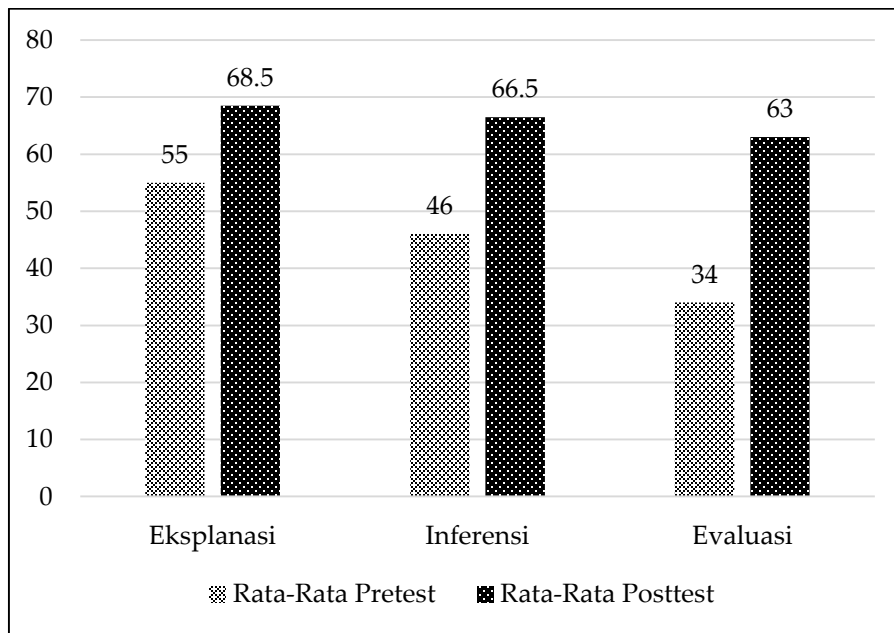


Figure 2. Average Skills explanation, inference, and evaluation Student

Developed LKPD that has STEM integrated. The integration aspects of STEM allow students to connect the fourth discipline of science, that is, science, technology, engineering, and mathematics, in activities learning (Ananda & Salamah, 2021). That is what can be done: train students To analyze or express new ideas in a way that is logical, systematic, and critical (Choiriah, 2019). Therefore, the learning that takes place can also grow proficiency in scientific students (Agustina *et al.*, 2020).

Each aspect of STEM can train Skills in explanation, inference, and evaluation. This matter signifies that STEM is One unity that is mutually intact _ and correlated and can train Skills in explanation, inference, and evaluation students. This LKPD can

practice Skills in explanation, inference, and evaluation students because students are invited to think critically and involve cognitive processes in analyzing or evaluating something matter. Besides that, STEM learning trains students To finish problems and improve their understanding of the concept (Zulfawati & Mayasari, 2021).

Filling out the results of the teacher and student practicality test questionnaire towards STEM based on LKPD aims to know the extent to which teachers and students respond to implementing the LKPD (Agnezi, 2019). Figure 3 results from a teacher and student practicality test questionnaire towards STEM-based LKPD.

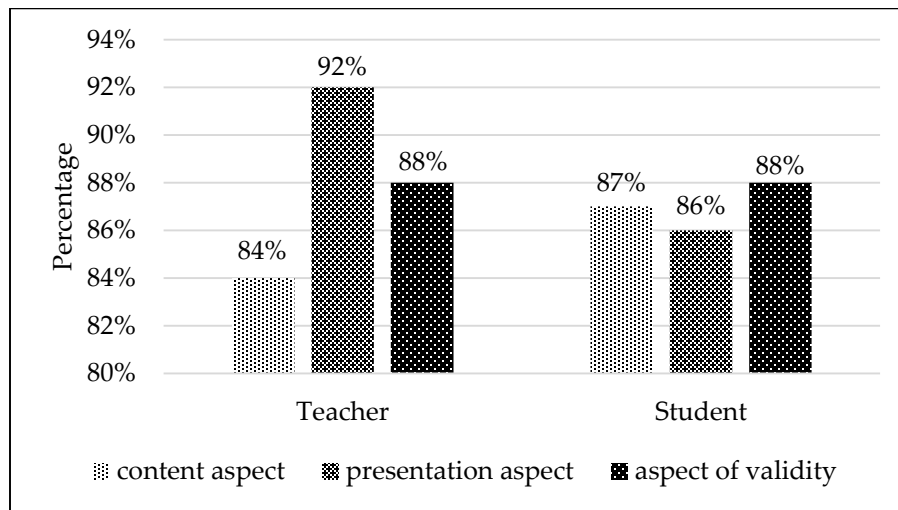


Figure 3. Teacher and student practicality test results

Based on Figure 3, the STEM-based LKPD has developed and fulfils efficient criteria so students can easily use it. According to Agnezi (2019), Practicality That Alone shows the ease of implementation, use, and carrying out process activity in developed products.

Aspect fill obtained 84% by teachers and 87% by students in the convenient category. In terms of this, a picture fills every LKPD and already leads to STEM aspects. Using LKPD makes students actively learn, and materials are served coherently and transparently.

The teacher's aspect presentation obtains a percentage of 92% and 86% by students in the convenient category. In terms of this, the whole thing contents of the LKPD are good illustrations, pictures, and tables arranged clearly. In terms of appearance, it served a pretty design, the colours were attractive, and the size letter selection was a straightforward read. Organized presentations must be consistent and to the needs of the material (Ariq & Fitrihidajati, 2021).

Then, aspects language obtain a percentage of 88% by teachers and students in the convenient category. The language used is easily understandable, simple, and PUEBI-compliant. Besides that, interactive and communicative use of language makes

it easier for students to understand the contents of the LKPD so that students do not need Lots to ask teachers (Simatupang *et al.*, 2019).

CONCLUSION

Based on the results of research and discussion, the LKPD is STEM-based on the theme of my house's electrical circuit can improve skills explanations, inferences and evaluations were declared valid or suitable for use with an average percentage of 80.9%. Furthermore, STEM-based LKPD was declared effective in improving skills explanation, inference, and evaluation based on the N-Gain calculation results of 0.68 with the medium category and the effect size results of 2.7 with the high criteria. STEM-based LKPD was stated to be very practical based on the average practicality test results for teachers of 83% and students of 87%.

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