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Worksheets Electronic Development of STEAM-Based to Improve Students' Creative Thinking Ability

Deden Dicky Dermawan [1]*, Kinanti Andartiani[2]
[1] Universitas Islam 45 Bekasi, Indonesia
[2] Universitas Negeri Semarang, Indonesia

* Corresponding Author. E-mail: dedendickyd@gmail.com
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Abstract

This study aimed to develop a valid, practical, and effective STEAM-based E-LKPD to improve students' creative thinking skills. This study used research and development procedures with reference to the 4D model (Define, Design, Develop, and Disseminate) but this research is only up to the develop stage. The experimental design used is "One Groups Pretest-Posttest Design" with 72 students as research subjects. The research instruments include observation sheets, interview sheets, expert validation test sheets, written tests (pretest and posttest), and questionnaire sheets (questionnaire). The results of the research that have been gained, it is known that the validity of the E-LKPD according to the material expert validator is 91.6 in the very valid category, the media expert validator is 75 in the valid category, and the language expert validator is 85 in the very valid category. The effectiveness of E-LKPD according to the results of the N-Gain test calculation of 0.61 is included in the category of quite effective and showed that there was a significant increase in creative thinking skills before and after using STEAM-based E-LKPD with 91% classical completeness results with complete criteria. The STEAM-based E-LKPD was declared practical according to the results of teacher and student respondents who showed the results of teacher respondents, namely scores of 83 and 80 with very interesting categories and student respondents producing an average score of 81 with very attractive categories. The conclusion of the research is that the development of STEAM-based E-LKPD is suitable for distance learning activities and can improve students' creative thinking skills.

Keywords: *E-LKPD IPA, STEAM, Creative Thinking*

INTRODUCTION

The virus attack that really shook the world, that entered to into Indonesia is Covid-19. Provincial and local governments have formulated policies in the field of Education to temporarily eliminate face-to-face learning at the school and university

level. Elementary schools also use online/distance learning through parental guidance. Through online learning, students can learn by managing time flexibly and can study anytime, anywhere. However, students can use various applications to interact with teachers, such as whatsapp groups, classroom, telephone or live chat, video conferences, or via zoom.

The Student Worksheet is a comprehensive learning tool in the learning process. LKPD needs to be developed because it can help teachers deliver learning materials. Teachers need to develop their own LKPD to activate students' learning abilities, to improve creative thinking skills, and improve learning outcomes (Permendikbud, 2013). This is in accordance with Prastowo (2012: 203) which stated that LKPD can be made by teachers of related subjects, it becomes more interesting and can be adapted to school situations and conditions.

In 21st century education, some people said that everyone should have three skills, there are: (1) life and professional skills, (2) learning and innovation skills, and (3) information media and technology skills. In terms of learning and innovation skills, students must have four abilities, there are: Communication, Collaboration, Critical Thinking, and Creativity (called 4C). The ability to think creatively in the 2013 curriculum is important for 21st century students as a thinking process that produces many possible ideas and broad and diverse ways (Putra et al., 2017). The ability to think creatively can be said to be an important factor in learning objectives because in learning creative thinking can develop the attitudes and abilities of students in dealing with problems in the future (Permatasari. A., 2019).

Based on the results of interviews by researchers with grade 5 elementary school teachers, it was revealed that the LKPD used was still using the printed LKPD provided by the school. Currently in online learning, teachers give assignments via Whatsapp Group which will then be collected within one week. Students will quickly feel bored and less active in the online learning process. It seen in learning outcomes that have not been optimal and have not been trained to develop students' creative thinking processes. It seen in the results of the mid-semester 2 test on themes 6 & 7 of the 2020/2021 academic year, from the number of 5th grade students as many as 80 students, only 42% of students completed the 75th KKM.

One of the comprehensive learning tools in the learning process is the Student Worksheet (Permendikbud, 2013). LKPD needs to be developed because it is able to help teachers deliver the material to be taught through online learning. Teachers need to create their own worksheets that can be taught during a pandemic and can activate students in learning, improve creative thinking skills, and improve learning outcomes. The explanation of the LKPD in the form of definitions, examples, exercises, practice is very easy for the teacher but for students the stages in the LKPD are boring and difficult, thus affecting student learning outcomes (Yenilmez., 2008). Works are being made to overcome the above problems through the development of Electronic Student Worksheets (E-LKPD), because it adapted to the current learning process which is still use online learning processes.

Researchers insert the STEAM approach (Science, Technology, Engineering, Arts, and Mathematics). The application of the model in the LKPD design can provide motivation and arouse the curiosity of students. STEAM is one of the 21st century learning models related to the development of soft skills that link the fields of science (science), technology, engineering, art, and mathematics, then students are given a holistic understanding of the interrelationships of the fields of science through 21st century learning experiences (Hadinugrahaningsih et al. ., 2017). STEM learning also trains students to apply their knowledge in making designs as a form of solving problems related to the environment by utilizing technology (Permanasari, 2016). The learning process in the classroom is a very important part of education. The success of learning cannot be separated from the ability of teachers to develop models, methods, and learning media (Nugraha et al., 2017).

Most LKS contain brief material and questions that must be done by students, although they can support students in learning, they are still not effective, seen from the low level of student activity and students have not shown their creative thinking skills (Putri & Mitarlis, 2015). LKPD generally contains practice questions or reviews of teaching materials for each topic, and contains a summary of the material. LKPD has not guided students to carry out learning activities that can help find their own concepts that are being taught. Teachers have never made their own worksheets to be used in online learning. Therefore, it is necessary to develop an E-LKPD (Electronic Student Worksheet) based on STEAM (Science, Technology, Engineering, Art, and Mathematics)

to improve the creative thinking skills of fifth grade elementary school students in science learning.

METHOD

The method used in this research is research and development method by adopting the Thiagarajan research method. 4D Models development research procedure proposed by Sivasailam Thiagarajan (1974). 4D Models have 4 main stages, defining, designing, developing, and disseminating, but this research only reached the develop stage due to limited research time.

At the definition stage, the researcher used the method of observation, interviews and documentation. Data derived from interviews, adjusted for data from observations and documentation results. Thus, the data obtained will be more accurate (Suryandari et al., 2015).

At the design stage, the researcher designs the contents and appearance of the E-LKPD which will be developed after getting input from the teachers. The E-LKPD that will be developed will include elements of STEAM which aim to broaden their horizons and improve their creative thinking skills. The E-LKPD design has three main parts, namely the introduction/pre-content section, the core/content section, and the closing/post-content section.

At the development stage, it aimed to determine the validity, effectiveness and practicality of STEAM-based E-LKPD. After designing the content and appearance of the E-LKPD, the researchers tested its validity, effectiveness, and practicality by giving the developed E-LKPD to experts.

In the trial phase, researchers conducted a limited test and a broad test to determine the effectiveness of the E-LKPD. Limited testing is carried out after the product has passed the validation stage and is revised according to the suggestions and comments of the expert validators, the product is ready to be tested. This limited trial was conducted on the fifth grade students of SDN 1 Kutoharjo with a total of 36 students. Suggestions and corrections to the results of the limited test are used as improvements to the STEAM-based E-LKPD that will be used in the broad test. Meanwhile, the extensive test uses test techniques (prestest and posttest) and questionnaires to test the practicality of the E-LKPD.

RESULTS AND DISCUSSION

STEAM-Based E-LKPD Validity Analysis

The results obtained in order to analyze the developed E-LKPD in order to test its validity, the researchers justified the E-LKPD developed with material, media, and language experts using the instruments and grids that have been provided. Validation is done by presenting several experienced experts to assess the designed product (Pratiwi, 2016). In addition, the researcher also validates the lesson plans (learning implementation plans) that will be used in the learning process to experts. The results of the justification of E-LKPD with experts are described as follows:

Table 2. STEAM-based E-LKPD Validation Test Results

No	Scoring Aspect	Score	Criteria
1	Material Expert	91,6	Very Valid
2	Media Expert	75	Valid
3	Language Expert	85	Very Valid
4	Lesson Plan Expert	82	Valid

Based on table 2, it can be seen that the results of the validity of the E-LKPD get results with valid and very valid categories. This proved that the validity test in each indicator of the assessment aspect has a good average of criteria. The results of the validation by material experts with a very valid category, which means that the E-LKPD can be tested in learning at school. The results of the validation by media experts and RPP as a whole get a valid category. The validation test is used as an effort to make teaching materials before they are used into good and relevant teaching materials (Sistyarini & Nurtjahyani, 2017).

E-LKPD in this study is considered valid if the score from the validator or experts is in the appropriate or very decent category and gets a positive response from teachers and students. This research is supported by research (Septiani, et al., 2013), obtained a score of 96.87% with a very feasible category on the feasibility of the material. The material presented is in accordance with the level of thinking of elementary school children and the exercises in the student worksheets play a role in measuring the results of learning activities. It is the same with research (Ardan, 2016), that in its development research, products such as Lesson plans (RPP), tenth grade textbooks with indigenous Timorese for teachers and students. Student Worksheets (LKS), learning media after being validated and tested turned out to be valid and practical.

Improvement of Creative Thinking Ability

The increase in students' creative thinking skills can be obtained from the pretest and posttest scores. The increase is calculated using the N-Gain formula. The results of the calculation of the increase in students are presented in table 3 below:

Table 3. Test Result *N-Gain*

Average *Pretest*	Average *Posttest*	N-Gain	Criteria
63	85	0,61	Medium

The results of the study analysis showed a significant increase between the results of the pretest and posttest. This is proved by the results of the N-Gain test which reached 0.6 with moderate criteria. The increase in pretest and posttest results showed that learning activities using STEAM-based E-LKPD can improve students' abilities (Febrianti, et al., 2016). This learning process shows that the abilities possessed by students are increasing.

Learning in class is declared successful if 75% of the number of students in the class have achieved classical completeness. The results of classical completeness are presented in table 4 below:

Table 4. Classical Completeness Results

Number of completed students	Number of total students	Complete Percentage (%)	Criteria
42	46	91%	Complete

Based on table 4, the results of classical completeness after the posttest reached the criteria for completion. The classical mastery of students' learning provides information that students' understanding in general, relating to single substance and mixed substance material presented in STEAM-based E-LKPD, is very good. This showed that the developed E-LKPD can be understood by students well so as to improve creative thinking skills. The results of the study analysis showed a significant increase between the results of the pretest and posttest. This is evidenced by the results of the N-Gain test for creative thinking which reached 0.61 with moderate criteria and the N-Gain test results for creative thinking reached 0.68 with moderate criteria.

Based on the explanation above, it can be interpreted that STEAM-based E-LKPD can increase creative thinking skills. In accordance with the results of the research,

STEAM-based E-LKPD is effective for improving creative thinking skills in the aspects of fluency, flexibility, originality, and elaboration.

STEAM-Based E-LKPD Practical Analysis

The results obtained in order to analyze the developed E-LKPD in order to test its practicality, the researchers gave a questionnaire to teachers and students of class V which aimed to find out the percentage of teacher and student interest in the developed E-LKPD. The questionnaire given to the teacher is called LARG (Teacher Response Questionnaire Sheet) and the questionnaire given to students is named LARPD (Student Response Questionnaire Sheet).

Table 5. Results of Teacher Respondents

No	Name	Score	Score	Category
1	Teacher 1	53	83	Very interesting
2	Teacher 2	51	80	Very interesting

Table 6. Student respondent results

Result	Score	Score	Criteria
Average	49	81	Very interesting
Minimum	26	43	Interesting enough
Maximum	59	98	Very interesting

The results of the teacher's response as a whole get very interesting criteria, meaning that the teacher gives a very positive response to the developed E-LKPD. The material presented in teaching materials and pictures that are relevant in everyday life make it easier for students to understand the material and can help teachers in the teaching and learning process to achieve learning goals (Nurrita, 2019). The use of simple language and the presentation of attractive pictures can lead students to understand the description of the material (Setyowati, et al., 2013).

The results of student responses as a whole get very interesting criteria, meaning that students give a positive response to STEAM-based E-LKPD. With an average score of 49 which was then analyzed with a maximum score of 59, the result obtained was a score of 98 which was included in the very interesting category, meant that students gave a positive response to the STEAM-based E-LKPD for single substance and mixed substances. Teaching materials can be said good if they get a positive response from students regarding the attractiveness aspect, the extent to which it can help students, and how easy it is for students to understand (Febrianti, et al., 2016).

Responses from students with learning using the developed E-LKPD can provide a new learning experience with E-LKPD using STEAM-based learning. This is because students are rarely involved in science learning which is more active for students. E-LKPD received positive responses from students, so that the developed E-LKPD could be used in large-scale trials.

This research is supported by research (Fitriani, et al., 2016). about the development of problem-based LKPD to improve students' understanding of concepts and learning activities on the solution and buffer material, that the results of teacher and student responses to the development of this LKPD were 89.28% and 77.14% gave a positive response. Research (Payudi et al., 2017) on LKPD development is assisted by photoelectric effect interactive multimedia to build science process skills, that student learning outcomes worksheets have an attractiveness level with an average score of 3.27 or 81.74% in the attractive category . Research (Ratnawati, 2021) on improving learning achievement in online learning of electric motor installation using interactive LKPD, stated that the practicality of use for daily tests resulted in 87.5% stating that it could be understood and practical if used by students.

CONCLUSION

STEAM-based E-LKPD is declared valid with validity according to material expert validators of 91.6 with very valid categories, media expert validators of 75 in valid categories, language expert validators of 85 with very valid categories. STEAM-based E-LKPD is declared effective according to the results of the N-Gain calculation which shows that the N-Gain score of 0.61 is included in the quite effective category. Shows that there is a significant increase in creative thinking skills before and after using STEAM-based E-LKPD with 91% classical completeness results with complete criteria. STEAM-based E-LKPD was declared practical according to the results of teacher and student respondents which showed that teacher respondents scored 83 and 80 in the very attractive category and student respondents produced an average score of 81 in the very attractive category.

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