



**DEVELOPMENT OF WORKSHEET BASED ON SCIENCE, TECHONOLGY,  
ENGINEERING AND MATHEMATICS (STEM) TO IMPROVE CREATIVE  
THINKING ABILITY ON SUBSTANCE PRESSURE MATERIALS**

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**Abstract**

Student Activity Sheet (LKPD) is an activity sheet containing tasks carried out by students, containing instructions, steps to complete a task in the form of theory or practice. LKPD can be used to improve students' creative thinking skills because the use of LKPD involves activities such as investigation and thinking activities such as analyzing and solving problems. LKPD development aims to determine the validity of LKPD, student responses and the effectiveness of LKPD in improving creative thinking skills. LKPD development using the ADDIE method, data collection techniques in this study were descriptive analysis and N-gain test. The samples in this study were two design expert lecturers, material experts and learning experts, as well as class VIII and 30 class VIII students of junior high school RK Deli Murni Delitua. Based on the validation of design experts, learning experts and media material experts, students' responses are very good and LKPD can improve students' creative thinking skills, which can be seen from the N-gain calculation, which is 0.71 high category.

**Keywords:** LKPD, STEM, Creative Thinking

## Introduction

The digital era of the 21st century, the progress of science and technology (science and technology) is growing and advancing which requires human resources (HR) to synergize and integrate cognitive and skills so that they become humans who can adapt and compete. In fact, Indonesia is a country that has entered the 21st century and still has low quality human resources. Science and technology (science and technology) continues to develop in line with human civilization that continues to develop, so that the field of education also undergoes significant changes. Education is a means or space to develop the personality and potential that exists in students in accordance with the values that apply in social life so that they experience changes for the better (Irawati, 2021). The low level of human resources is influenced by the level of education in Indonesia which is still relatively low. One of the low levels of education in Indonesia is marked by the low creative thinking skills possessed by students in answering problem solving problems, providing ideas for new things and providing new innovations in solving problems. The ability to think creatively in Indonesia is still low, this is confirmed from the results of The Global Creativity Index in 2015, Indonesia is ranked 115 out of 139 countries. In line with this, the results of research conducted by the Program for International Student Assessment (PISA) show that Indonesian students are ranked 74th out of 79 participating countries with a score below the average of 396, while the average score of PISA research results is 489 (OECD, 2018).

Creativity in the 21st century plays an important role in improving the quality of education in all areas of learning including science, technology, engineering and mathematics. One of the important roles of creativity is to provide opportunities for students to think differently. Students are given the opportunity to reason, think and draw conclusions alternatively based on their own observations, data collection, classification, analysis, synthesis and evaluation (Wulandari, 2019). Creative thinking is an important ability that must be possessed by students because by having creative thinking skills students can generate original ideas, new ideas and be able to solve problems innovatively in different ways. Creative thinking ability is the result of

interaction between students, educators and their environment. Creative thinking is the same as expressing new ideas or solving learning problems that are different from others. Based on this understanding, the ideas expressed are based on common sense and logical thinking and do not offend or blame other people's ideas. Indicators in creative thinking can be measured from the level of fluent thinking skills, flexible thinking, original thinking and detailing skills. Physics learning process is not enough to do by conveying information about concepts and principles, but Students must also understand the process of phenomena physics with as much sensing possible (Cerling et al, 2020).

Student Activity Sheet (LKPD) is an activity sheet containing tasks carried out by students, containing instructions, steps to complete a task in the form of theory or practice. LKPD can be used to improve students' creative thinking skills because the use of LKPD involves activities such as investigation and thinking activities such as analyzing and solving problems.

Based on the results of observations made by researchers at the Deli Murni Delitua RK Middle School, it shows that in the learning process the teacher has not implemented the demands of the 2013 curriculum. learning is still teacher-centered and does not emphasize the activeness of students so that it cannot explore students' creative thinking skills. In line with the results of the questionnaire given to students of junior high school RK Deli Murni Delitua, it showed that students' creative thinking levels were still low, this was indicated by 17.1% of students having very low creative thinking levels, 67.1% of students having low creative thinking levels. and 15, Interview data The science teacher at junior high school RK Deli Murni Delitua LKPD used by the teacher in the less varied learning process was only in the form of activity sheets from the package book owned by students accompanied by a varied question bank book and LKPD which contained questions that students had to answer without exploring their abilities. creative thinking of students while the facilities and infrastructure to support learning in schools are sufficient, such as libraries, laboratories and a stable internet network.

The need for LKPD is reinforced by the results of interviews conducted with teachers, it is known that in the learning carried out, teachers have used LKPD but the

LKPD used by teachers has not been able to grow and improve students' creative thinking skills. The LKPD used by the teacher in learning does not contain activities that can make students play an active role in learning and the LKPD used does not meet the requirements of a good LKPD that is in accordance with the requirements for making LKPD. The ability to think creatively is one of the important abilities that must be possessed by students. This is because by having the ability to think creatively, students can provide new original ideas, develop an idea and can solve problems innovatively in various ways and can make decisions on situations related to their environment. This is supported by the results of Mahanal and Zubaedah's research (2017) which states that creative thinking is an important thinking ability and is needed by students to solve problems in the learning process, create new ideas and create new innovations in solving a problem.

Based on the background of these problems, it is necessary to develop LKPD based on Science, Technology, Engineering and Mathematics (STEM) to improve creative thinking skills on substance pressure materials in junior high school. The purpose of this study is to determine the validity of the LKPD developed based on material experts, learning experts and media experts, to determine student responses to the developed LKPD and to determine the effectiveness of the developed LKPD.

### **Research Method**

This study uses the ADDIE development model which was carried out until the Evaluation (Evaluation) (Anwari et al, 2020). The ADDIE model uses five stages of development, namely: (1) Analysis, this step is carried out by researchers to find problems, causes of problems and needs analysis. At the analysis stage, the researcher conducted interviews with educators about the problems experienced by students. (2) Design, the design stage is the design stage of the LKPD that will be developed. At this stage, the researcher designs the LKPD, makes the format and components of the LKPD and the research instrument. (3) development, At this stage, the researcher carries out the process of making the LKPD that has been designed to become a reality. (4) Implementation, implementation is the

product trial stage as a real step to implement the product made. (5) Evaluation, at this evaluation stage is carried out by giving questionnaires to students to determine student responses after using STEM-based LKPD and also giving a final test (posttest) to students to determine students' creative thinking abilities. The population in this study were unimed physics and biology lecturers and all students of class VIII junior high school RK Deli Murni Delitua in the academic year 2021/2022, totaling 4 classes with a total of 4 students.

The samples studied were 2 lecturers of physics and biology, experts on substance pressure, 2 lecturers of unimed science, media experts, 2 science and physics lecturers and unimed physics experts, the selection of lecturer samples used purposive sampling technique. There are 30 students in class VIII-2. The student sampling technique in this study used simple random sampling in a random way. Data collection techniques in this study are interview techniques, questionnaires or questionnaires and test techniques. Data analysis in this research is descriptive analysis and N-gain test.

## **Result and Discussion**

### **Research result**

#### **1. Analysis Stage**

The results of the analysis obtained are the main factors in developing STEM-based LKPD so that the developed LKPD can overcome problems. The needs analysis stage aims to find out how far science learning is carried out by science teachers at RK Deli Murni Delitua Middle School. The situational analysis phase of students aims to determine students' creative thinking abilities. Based on the results of observations and interviews obtained results such as Table.

Table 1. of Results of Needs Analysis in the form of LKPD and Situation Analysis in the form of Low Creative Thinking Ability of Students

No	The results of the analysis of the need for teaching materials in the form of LKPD and situation analysis in the form of the low ability of creative thinking of students
1.	The learning process carried out by science teachers already uses the 2013 curriculum, but when implementing it in learning the student center has not been implemented.
2.	The LKPD used by the teacher only contains cognitive aspects in the form of calculations.
3.	Teachers do not have varied materials.
4.	When given a problem, students find it difficult to find a solution to the problem.

## 2. Stage of Design (Design)

The design stage is the LKPD design stage that will be developed. The design stage starts from determining the components of writing LKPD and the format for writing STEM-based LKPD steps, component indicators in creative thinking and determining the instrument sheet for the assessment of the expert team. LKPD that is developed based on STEM is developed by fulfilling the components of the LKPD. The next activity is to determine the LKPD format to be developed. The final step of writing LKPD is by adjusting the typeface, writing layout, images, spacing and color combinations that make the LKPD look more attractive. LKPD developed using Times New Roman font size 12 and spaced 1.5. The last step in the design stage is to determine the validation sheet for the expert team's assessment that is structured so that the necessary indicators can be included in it, namely the presentation of material, STEM components, language, graphics, and LKPD display. The following is the front cover of the designed LKPD, which can be seen in the picture.



Figure 1. LKPD cover designed

## 3. Development Phase (Development)

The things that are done at the development stage include; (1) Validation by material experts, (2) Validation by Learning experts and (3) Validation by design experts.

### 1. Material Expert Validation

The results of the assessment by material experts can be seen in Figure 1.1. Based on the picture of the material expert's first assessment, the LKPD that has been developed by the researcher is declared valid by the two validators with a presentation of validator 1 of 96.8% and validator 2 of 78.1% for the feasibility of presenting the material. The presentation of validator 1 is 87.5% and validator 2 is 93.75% for the STEM component. The presentation of validator 1 is 100% and validator 2 is 75% for the use of language.

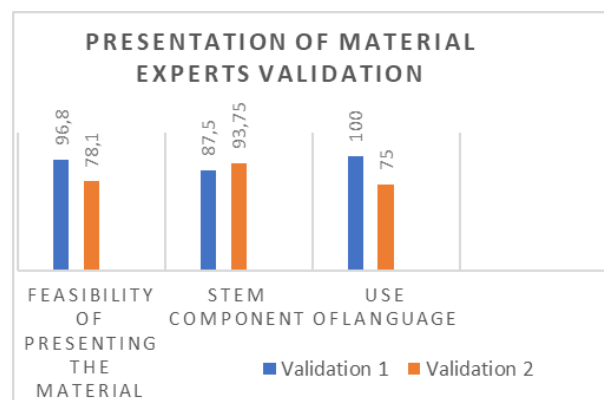


Figure 2. validation results by material experts

### 2. Learning Expert Validation

The assessment by learning experts is carried out to improve the quality of learning

materials from LKPD. The results of the assessment by learning experts can be seen in Figure 3.

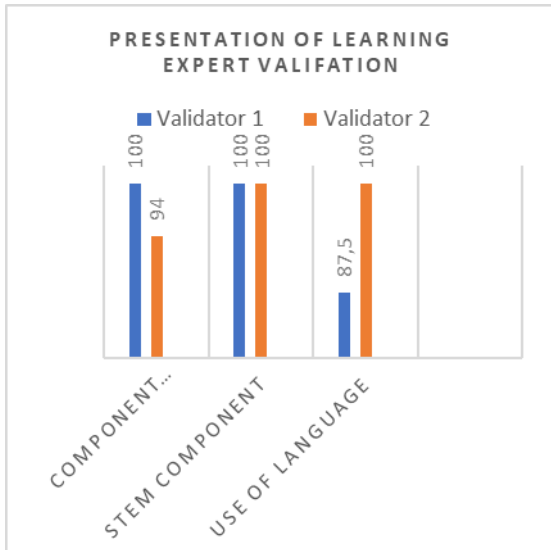


Figure 3. Validation Results of Learning Expert LKPD

### 3. Design Expert Validation

The assessment by the design expert is carried out to improve the quality of the LKPD design to make it look more attractive. The results of the assessment by design experts can be seen in Figure 4 below.

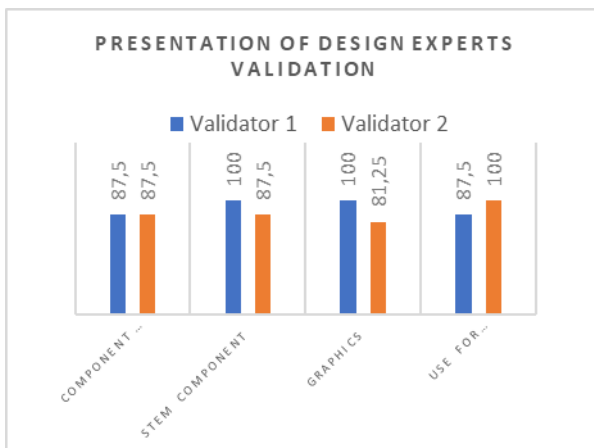


Figure 4. Design Expert Validation Results

Based on Figure 1.3 the results of the design expert's assessment, the LKPD that has been developed by the researcher is declared valid by both validators with a presentation of validator 1 of 87.5% and validator 2 of 87.5% for component presentation. The presentation of validator 1 is 100% and validator 2 is 87.5% for the STEM component. The presentation of validator 1 is 100% and validator 2 is 81.3% for graphics and the presentation of validator 1 is 87.5% and validator 2 is 100% for language use. It can be concluded that the LKPD that has

been developed can be continued at the stage of student trial feasibility.

### 4. Implementation Phase

#### 1. Small Group Student Responses

The results of the responses of small group students are shown in the following figure:

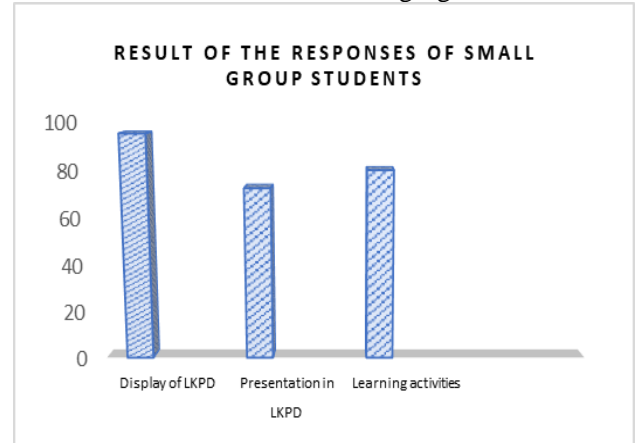


Figure 5. Responses of Small Group Students

Based on Figure 5 the responses of small group students to the developed LKPD obtained the percentage. The data shows that in the LKPD 95%, the presentation in the LKPD is 72.5% and the learning activities are 80%.

### 5. Evaluation Stage

#### 1. Responses of Large Group Students

The results of the responses of large group students are in Figure 6.

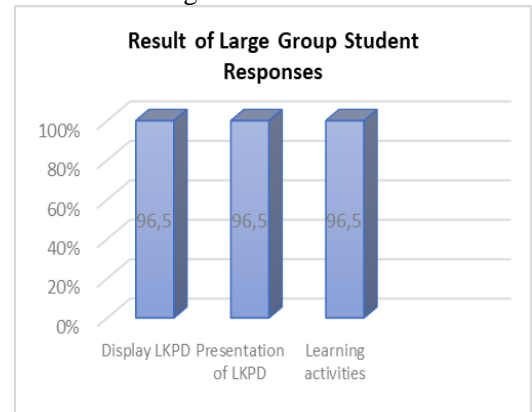


Figure 6. Results of Large Group Student Responses

Based on Figure 1.6 the percentage of large group student responses. The data obtained that the LKPD display is 96.5%, the presentation in the LKPD is 96.5% and learning activities are 96.5% and is declared suitable for use in learning.



2. Assessment of Students' Group Work Skills  
The results of the student group work assessment are shown in the following figure.

Table 2. Assessment of group work skills

No	Evaluation	Value of Group Ability Level					
		1	2	3	4	5	6
1	Preparation phase	9	9	9	9	9	9
2	Production stage	5	4	5	4	5	4
3	Last stage	6	6	6	6	6	6
4	Cooperation stage	5	5	5	5	5	6

Based on table 2. above, it is known that the assessment of the work of groups of students assessed from the preparation stage, production stage, final stage and cooperation stage was obtained that in group 1 with a value of 92.5%, group 2 with a value of 88.8%, group 3 with a score of 92.5%, group 4 with a score of 88.8%, group 5 with a value of 92.5% and group 6 with a value of 92.5%. The scores of all these groups are in the range of A, so it can be concluded that from the preparation stage to the stage of cooperation, each group has carried out well.

### 3. Results of the Pretest and Posttest of Students

The results of data analysis using STEM-based LKPD on substance pressure materials and their application in daily life that have been designed to improve creative thinking skills from large group trials, the average pretest score is 40 and the posttest average score is 83 and the N-Gain score is 0.71 with a high interpretation. The pretest and posttest data on students' creative thinking abilities before and after using the LKPD with the STEM approach on the substance pressure material and its application in everyday life converted into the N-Gain formula can be seen in the table.

Table 3. Pretest and Posttest Data of Students to Improve Creative Thinking Ability

Types of observed data	Pretest results obtained	Posttest results obtained
The highest score	72.5	90
Lowest value	30	60
Number of students who completed ( $\geq 70$ )	2	27
Number of students who have not completed ( $<70$ )	28	3
Average score	40	83

Table 4. N-Gain Score Category

No	N-Gain Index	Interpretation	Frequency	Percentage (%)	Average N-Gain
1	$g > 0.70$	Tall	21	70	0.71
2	$0.3 < g \leq 0,70$	Currently	9	30	
3	$g \leq 0,30$	Low	0	0	
Amount			30	100	

Based on the table, it is found that the N-Gain score of students' creative thinking abilities on the use of STEM-based LKPD is a high interpretation of 70% and a moderate interpretation of 30% with an average N-Gain of 0.71 with a high interpretation.

### Discussion

Results of the discussion of the analysis of the LKPD is that in the learning process in the classroom the teacher has not maximized the use of the LKPD and the LKPD which is applied is simply designed which only contains cognitive questions or work procedures so that they are not able to meet the demands of learning indicators. The LKPD compiled by the teacher has not met the preparation of a good and correct LKPD so that when faced with problems, students find it difficult to find solutions to the problems given.

Addressing this problem must first be linked to the expected needs in the 2013 curriculum demands, where the basic competencies consist of attitudes, knowledge

and skills sourced from core competencies that must be possessed by students to achieve learning success.

In accordance with the opinion (Warsita, 2011) defines that needs analysis is a formal process to determine the gap between the output of the real impact and the desired impact, then places this gap on a priority scale, then chooses the important things to solve the problem. The conclusion of the needs analysis is a method for identifying problems in order to determine the right solution, especially to overcome the LKPD used with low creative thinking skills of students.

The results of the design stage in the form of a STEM-based LKPD are to determine the format of the steps for preparing the LKPD, determine the steps of learning with STEM related to creative thinking indicators, provide a problem to be written down in the LKPD, and determine the validation sheet and rubric for the assessment of the material expert team, learning and design. The purpose of the design stage is that the LKPD that is compiled can be done well sequentially so as to produce a STEM-based LKPD that is worthy of being tested to improve students' creative thinking skills and in the preparation of instrument sheets it is carried out properly according to the indicators selected and reviewed to support the validity of the LKPD.

The results of the discussion at the development stage are compiling STEM-based LKPD learning steps to improve students' creative thinking skills which have been linked to creative thinking indicators and are in accordance with the material pressure of substances and their application in daily life as well as compiling a validation sheet for a team of material experts, learning expert and design expert.

Based on the results of validation by material experts, it was stated that the STEM-based worksheets were "very feasible" with an average percentage of 87.45% on the aspect of content feasibility, an average of 87.5% on the aspect of language use and an average percentage on the aspect of STEM components 80 ,62% with eligible criteria. The feasibility of the content in the LKPD developed is

categorized in the word feasible so that it can be concluded that the material on the LKPD is in accordance with KI and KD in the 2013 curriculum. This is because in the preparation of the LKPD the material refers to learning objectives and indicators that are adjusted to KI and KD. The Ministry of National Education (2004) says that having basic competencies will help students in the learning process and students will also know their abilities after going through the learning process.

The results of the validation by learning experts stated that the STEM-based worksheets were "very feasible" with an average percentage on the content feasibility aspect of 97%, the average percentage on the STEM component aspect of 100% and the average percentage on the language use aspect of 93.75%. In the aspect of feasibility, the content in the LKPD does not yet contain indicators of competency achievement so that it must be corrected and included after the basic competencies. This is because at the time of preparation the LKPD material refers to KI and KD so that the learning indicators are appropriate. All basic activities that must be carried out by students are collected in LKPD to maximize understanding and formation of basic abilities in accordance with the indicators of achievement of their competencies (Aldiyah, 2021).

The results of validation by design experts stated that STEM-based worksheets were "very feasible" with an average percentage of 87.5% on the presentation aspect of components, an average percentage of 93.75% on the STEM component aspect, an average percentage on the graphic aspect of 90, 62%, and the average percentage on the aspect of language use is 93.75%. The results of the revision with the validator are the presentation of the image and the identity of the image as well as the accuracy of providing information so that it must be improved by presenting the image in the right place and improving the accuracy in providing information. LKPD appearance in general is good and creative. According to Umbayati (2016) a good picture in the LKPD is an image that is able to represent the content or message effectively for LKPD users and the clarity of the content and

message of the image as a whole.

The results of the percentage of small group student responses to LKPD obtained data that in the LKPD display 95%, presentation in LKPD 72.5% and 80% learning activities. The presentation in the LKPD only gets a percentage of 72.5% because the available images are not helpful because when the LKPD is given to students it is only in black and white.

Large group trials were carried out on 30 students. The results showed that the percentage of large group student responses to the LKPD showed that in the LKPD it was 96.5%, the presentation in the LKPD was 96.5% and the learning activities were 96.5% with good criteria and could be used. in the learning process. Research conducted by Astuti (2018), in testing the LKPD product can be categorized as feasible and effective if it gets a positive response from students. Assessment of work results is important because it can determine the knowledge and skills of students. In line with that research Arhin (2015) explains that performance appraisal is a type of assessment that requires students to show that they have mastery of certain skills and competencies by carrying out an activity to convey what they are capable of doing. Kunandar (2013) also states that the performance assessment that is carried out specifically is able to determine the ability of students, conceptual understanding, ability to apply knowledge and skills, ability to implement performance, and ability to carry out a process.

The results of students' creative thinking skills and N-Gain scores, the number of students tested was 30 people and obtained an average N-Gain with a high category of 0.71. Based on this statement, it can be concluded that the LKPD tested is suitable for use in the learning process and can improve students' creative thinking skills. This is supported by the Ministry of National Education (2008) which states that learning assessment in the learning system is initially a process that determines and ensures that students have completed or not. The implementation of the 2013 curriculum that is applied can be integrated with an approach such as STEM to support the development of student skills, one of which is creative thinking.

## Conclusion

Based on the results of research and discussion of the development of STEM-based LKPD on the material pressure of substances and its application in everyday life in class VIII previously stated, the following conclusions can be drawn:

1. STEM-based worksheets that were developed using the ADDIE method on substance pressure materials and their application in everyday life were declared valid after being validated by material experts, learning experts and design experts. The level of validity of LKPD obtained results with an average percentage of 85.19%, 96.92% and 91.40%.
2. The STEM-based LKPD that was developed received a suitable response for use in learning by students in small group and large group trials. The results obtained in the small group obtained data with an average percentage of 82.5% and an average percentage of 96.5% for the large group.
3. The STEM-based LKPD developed is effective to improve students' creative thinking skills on substance stress material and its application in life. The results obtained with an average pretest score of 40 and an average posttest score of 83 and an N-Gain score of 0.71 with a high interpretation.

## Reference

- Anwari, T., Ali, S., dan Andi., P. (2020). Pengembangan Media Pembelajaran Berbasis Android pada Pemrograman Dasar Pasca. *Jurnal Penelitian dan Pengembangan Pendidikan*. 4 (1), 123-134.
- Astuti, S., Danial, M., dan Anwar, M., (2018). Pengembangan LKPD Berbasis PBL (Problem Based Learning) Untuk Meningkatkan Keterampilan Berpikir Kritis Peserta Didik Pada Materi Kesetimbangan Kimia. *Chemistry Education Riview. Pendidikan Kimia PPs UNM*, 1 (2) : 90 – 114
- Cerling, P., Syam, M., Junus, M., (2020). Penerapan Model Problem Based Learning (Pbl) Terhadap Hasil Siswa Sman 11 Samarinda. *Indonesian Science*



- Education Research (ISER)*. 2 (1). 1-10.
- Depdiknas. (2004). Panduan Implementasi Pendidikan Karakter di Sekolah. Yogyakarta : Araska.
- Departemen Pendidikan Nasional. (2008). Pengembangan Bahan Ajar dan Media. Jakarta : Departemen Pendidikan Nasional.
- Irawati, E., S. 2021. Literature Studies: Blended Learning Assisted By Edmodo To Increase Student Independence And Learning Outcomes. *Indonesian Science Education Research (ISER)*. 3(2) : 31 - 36
- Kunandar. (2013). Penilaian autentik (hasil belajar peserta didik berdasarkan kurikulum 2013). Jakarta : Raja grafindo persada.
- Mahanal , S., & Zubaidah, S. (2017). Model Pembelajaran ricosre yang berpotensi memberdayakan keterampilan berpikir kreatif. *Jurnal Pendidikan*. 2 (5) : 676-685.
- OECD. (2018). PISA 2018 Combined Executive Summers Volume I, II, and III. Accessed from [https://www.oecd.org/pisa/Combined\\_Executive\\_Summaries\\_PISA\\_2018.pdf](https://www.oecd.org/pisa/Combined_Executive_Summaries_PISA_2018.pdf)
- Umbaryati, U. (2016). Pentingnya LKPD pada pendekatan scientific pembelajaran matematika. In PRISMA, prosiding seminar nasional matematika (pp.217-225).
- Wulandari, AS, Suardana, IN, & Devi, NPL (2019). The Effect of Project-Based Learning Model on Middle School Students' Creativity in Science Learning. *Indonesian Journal of Science Education and Learning (JPPSI)*, 2(1) : 47-58.