

# The Effectiveness of Telusur E-Maps-Based PBL in Improving Student Independence and Learning Outcomes in Cell Introduction Material

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## ABSTRACT

The problem encountered in grade 8 students of SMP Negeri 2 Kramat is that they have gadgets with internet quotas that have not been optimally utilized, resulting in unsatisfactory science learning outcomes and a decline in student independence. Based on this problem, the Telusur E-Maps-based problem-based learning instructional material was developed to improve student independence and learning outcomes. This study aims to test its feasibility and effectiveness in improving student independence and learning outcomes in the cell introduction material for grade 8 students. This study used the Research and Development method with a 4D development procedure consisting of four stages: Define, Design, Develop, and Disseminate. The percentage of the effort to increase student independence by using Telusur E-Maps-based problem-based learning instructional materials is 85%. The effectiveness of Telusur E-Maps-based problem-based learning instructional materials in improving the learning outcomes of grade 8 students was proven effective with the paired t-test results showing that there was a difference in the average of the pretest and posttest data, and the n-gain results obtained a score of 0.67 with a medium criterion. The conclusion of this study is that the Telusur E-Maps-based

problem-based learning instructional materials as an effort to improve student independence and learning outcomes in the cell introduction material for grade 8 students can be used and developed for science learning in grade 8. The use of technology can be utilized to help students learn and improve their independence in learning.

**Keywords:** Teaching materials Telusur E-Maps, Problem Based Learning, Independence, Learning Outcomes

## INTRODUCTION

Education is very important for humans in all aspects of their lives. Education is one of the keys to the direction of Human Resources (HR) development, namely building strong, dynamic, productive, skilled HR, mastering science and technology supported by industrial cooperation and global talent. The direction of HR development is one of the seven national development agendas for 2020-2024, namely improving quality and competitive Human Resources. Improving the quality and competitiveness of HR is expected to produce the next generation of the nation who are healthy, intelligent, adaptive, innovative, skilled, and have character (Widyasanti in the Directorate of People's Welfare Statistics: 2023). This is in line with the goals of Indonesian national

education, namely to develop students' potential to become human beings who believe in and fear God Almighty, have noble character, are healthy, knowledgeable, capable, creative, independent, and become democratic and responsible citizens.

In accordance with the Regulation of the Minister of Education, Culture, Research and Technology (Permendikbudristek) Number 12 of 2024, the independent curriculum is officially implemented in all schools in Indonesia at the Early Childhood Education (PAUD), Elementary Education, and Secondary Education levels. This curriculum provides flexibility and focuses on essential materials to develop student competencies as lifelong learners and have the character of a Pancasila student profile. The Pancasila Student Profile expected from this independent curriculum includes faith, devotion to God Almighty and noble character, independence, mutual cooperation, global diversity, critical thinking, and creativity.

Student independence is influenced by student characteristics that can determine learning success. Learning outcomes are something that students achieve or obtain thanks to efforts or thoughts expressed in the form of mastery, knowledge, and basic skills found in various aspects of life so that changes in behavior are seen in individuals (Priansa: 2017). Learning independence will be seen if students experience changes in themselves to carry out learning activities independently and are the result of experience and self-practice without relying on others to master certain materials so that they are able to solve the problems being faced. Learning independence is very necessary for students because it is one of the elements of learning that must be met before students carry out the learning process (Suheni et al., 2023)

There are two factors that influence the student learning process, namely internal factors and external factors. These internal factors include student characteristics, attitudes towards learning, learning motivation, learning concentration,

processing learning materials, exploring learning outcomes, self-confidence, and learning habits. While external factors that influence learning outcomes are teachers, social environment, curriculum, facilities and infrastructure (Aunurrahman, 2022).

According to Jufrida et.al, (2019) showed that the psychological factors of students' science learning outcomes and science literacy are greatly influenced by psychological factors (interest and motivation to learn), family factors (educational background and parental guidance), school factors (teacher teaching methods, facilities and infrastructure, and science learning materials/media), and learning activities outside of school. 21st century education requires students to have several aspects of skills, namely communication skills, critical thinking skills, problem-solving skills, and creative and innovative thinking skills. Problem-solving, creative, and innovative skills have a close relationship with student independence (Bunasri, 2021). These skills can help students become more independent in their learning and in their lives.

The use of teaching materials in the form of interactive mathematics e-modules with a contextual approach is feasible, practical and effective for use in mathematics learning and can increase students' learning completion classically by 73% at SMP Negeri 4 Rawapitu (Fitrio & Merliza, 2023). Interactive teaching materials are used to adapt and facilitate learning in the current digital era. In the current digital era, the use of Information and Communication Technology (ICT) is inseparable from the activities of the entire population, including students in Indonesia. The use of supporting facilities and infrastructure for learning activities such as the internet, cell phones, and computers is a must.

The results of the 2023 National Socio-Economic Survey (Susenas) showed that around 83.41 percent of students aged 5-24 years used cell phones and 19.27 percent used computers. This figure shows that the internet is one of the ICT facilities needed

by students. However, the 2023 Susenas Data still shows that internet use for students aged 5-24 years is still dominated as a means of entertainment reaching 86.65% while internet use for students as a means of online learning has only reached 27.46% (Directorate & Rakyat, 2023).

The use of the internet for learning requires students' awareness and independence wisely. Based on the 2024 education report card data, the student independence score at SMP Negeri 2 Kramat only reached 48.34. This independence indicates the willingness and habit of managing thoughts, feelings, and actions to achieve learning goals in various contexts has decreased by 3.7 from 2023.

The 2024 SMP Negeri 2 Kramat education report card data also shows a decline in the quality of learning by 2.98 from 2023 which had reached 62.54. This decline in the quality of learning shows the level of quality of interaction between teachers, students, and learning materials in the teaching and learning process. This is because learning is still centered on the teacher, so that the interaction between students and teachers, students and students is not optimal. (Susilowati, D., 2023)

The results of observations of problems that occurred at SMP Negeri 2 Kramat class VIII were that students had gadgets equipped with internet quotas, but their use in learning had not been optimized. Internet use for students at home tends to be for playing online games and social media activities. In addition, the average value of student learning outcomes in science subjects, especially the Introduction to Cells material, has only reached 62 while the criteria for achieving science learning objectives for class VIII is 70.

The learning outcomes that have not reached the criteria for achieving learning objectives are due to the gap between students' learning needs and the availability of interactive teaching materials. The teaching materials used in schools are not optimal in facilitating interactivity and flexibility with their users. Interactivity in

learning that has been done in schools has not been implemented by students outside of school. Educators rely heavily on teaching materials, but there are still many

Educators who pay less attention to how students' needs are in developing teaching materials to be more appropriate to the students' environment. Teachers only use existing teaching materials. This is certainly a serious problem, this problem must be solved immediately by overcoming the problem, namely that a teacher in compiling teaching materials should be able to develop their creativity, as well as innovation in attracting students' needs. The use of these teaching materials will have a significant influence on the learning process so that development is needed to support the continuity of learning and selectivity is needed in choosing teaching materials. Teaching materials have a primary role in learning activities.

The teaching materials used must contain material that contains all information, material that is arranged in detail, and shows competencies in its entirety. Teaching materials can be written or unwritten. Telusur E-Maps is one of the interactive teaching materials that includes interactive learning games, teaching materials, learning videos, experiments/practical learning, literacy information and interactive assessments on cell introduction material. Telusur E-Maps can be used appropriately and in a variety of ways, such as to increase motivation and enthusiasm for learning; develop the ability to interact directly with the environment and other learning resources, which allows students or learners to learn independently according to their abilities and interests.

Telusur E-Maps is an interactive teaching material in the form of a module that can be printed or used digitally. This is an interactive teaching material, namely by utilizing the multimedia facilities available on the computer. Telusur E-Maps is called multimedia because it combines several media in the form of text, sound, images, animation, audio, and video with tools and

connections (links). With these multimedia devices, users can surf (search), interact, create and communicate (Kosasih, 2020). In addition, the learning methods used in schools do not involve students enough to think creatively which can increase student independence. Creativity in thinking and student independence can be fulfilled with the Problem Based Learning (PBL) learning model. In Problem Based Learning, students are faced with real problems that they must solve themselves or in groups. This process encourages students to seek information, analyze data, and make decisions independently. Thus, students learn to take responsibility for their own learning, develop time management skills, and improve critical thinking skills. In addition, the Problem Based Learning model also helps students become more confident in taking the initiative and solving problems without relying entirely on teacher guidance. This is very important to prepare them to face challenges in the real world. Based on the background description above, this study will develop interactive teaching materials Telusur E-Maps. Telusur E-Maps is an interactive teaching material on the Introduction to Cell material which contains interactive games, learning videos, 3D images, learning materials and interactive assessments. The use of Telusur E-Maps based on Problem Based Learning is one of the efforts to improve student independence and learning outcomes in the introduction to Cell material for grade VIII odd semester. This problem-based learning provides benefits in developing students' attitudes and skills in making decisions objectively and independently as well as a sense of curiosity that goes further.

## **LITERATURE REVIEW**

Research on the implementation of the Cultural Monument media based on the problem-based learning model in an effort to improve learning outcomes on cultural diversity in Class III students shows a change in the improvement of learning outcomes on cultural diversity material as

seen from the comparison of the average pre test and post test scores with an increase from 64.44 to 77.03 with a difference of 12.59. This study also resulted in an increase in the completion value of 37.04% from the pre test score of 33.33% to 70.37% in the post test so that it can be concluded that the implementation of the cultural monument media and the Problem Based Learning (PBL) model has an effect on learning outcomes and improves student learning outcomes in Pancasila Education subjects, especially cultural diversity material (Pratiwi & Purwati, 2024).

Research on the application of learning with the problem-based learning (PBL) model conducted on class VIII students at SMP Negeri 23 Amnon shows an increase in learning outcomes on the human excretory system in class VIII students. This is shown from the pre-cycle value where the percentage of students who completed was 16%, while in cycle I there were 40% of students who completed, and in cycle II there were 92% of students who completed (Anita & Lessy, 2024).

Research on the application of the problem-based learning model with the help of Cube AR media, a Unit Cube Containing Augmented Reality as an effort to improve the understanding ability of fifth grade students of SD Negeri 02 Gisikdrono in understanding and studying volume material. The results of qualitative descriptive research show an increase in learning outcomes, an increase in the average pretest score which was originally only 63.5 to 77 during the posttest. This shows that the implementation of the "Cube AR" media is effective in improving students' understanding of volume material from the results of the post-test which has mastered volume material with the acquisition of post-test score completion increasing by 85% (Damayanti & Purwati, 2024).

Research on the implementation of problem-based learning (PBL) based on a differentiated approach in an effort to improve learning outcomes for fifth grade

students' food chain material shows that the implementation of the problem-based learning model based on a differentiated approach can improve student learning outcomes. This is evidenced by the average increase percentage of 16.62% and the increasing number of students who achieved the learning objective achievement criteria in the posttest after the implementation of the problem based learning model based on a differentiated approach in science learning in grade V on the food chain material. The implementation of learning with a problem based learning model based on a differentiated approach in the food chain material can improve the learning outcomes of grade V students of SD Negeri Kandangan 04 (Amalia & Purwati, 2024).

Classroom action research on the application of the problem based learning (PBL) learning model to improve science learning outcomes at SMP Negeri 23 Ambon which was motivated by the monotonous use of the lecture method by teachers in learning. The study with 25 grade VIII students as research subjects showed that student learning outcomes on the human excretory system material after the application of the problem based learning model in cycle I, there were 10 students (40%) who completed it while 15 people (60%) did not complete it, in cycle II there were 23 people (92%) who completed it while 2 people (8%) did not complete it. (Anita & Lessy, 2024).

The study entitled Development of Website-Based Interactive Media in Natural and Social Science Subjects for Fourth Grade Students to produce interactive media based on websites in the subject of science for grade IV students. The results of this study indicate the feasibility, validity, practicality, and effectiveness of the use of interactive media based on websites. This study also shows the effectiveness of the use of interactive media based on websites in improving the learning outcomes of grade IV students of SD Negeri Bandarharjo 02, totaling 25 students. The results of the study obtained: (1) the validity of interactive

media based on websites received the criteria of "Very Good" with a score of material experts of 3.85 (very good) and media experts of 3.95 (very good); (2) the practicality of interactive media based on websites received the criteria of "Very Practical" with a student response questionnaire score of 3.72 (very practical); (3) The effectiveness of website-based interactive media from student test results obtained a student completion percentage of 96% and was declared effective for learning (Hermawan et al., 2023)

## METHODS

This study was designed with research and development. Hamzah (2019) stated that research and development is research used to produce products and test their effectiveness. The products developed are not always in the form of hardware (books, modules, classroom learning aids, and laboratories), but can also be in the form of software such as programs for data processing, classroom learning, libraries or laboratories, or learning models, training, guidance, evaluation and others. The product developed in this study is in the form of interactive teaching materials Search E-Maps. The research and development model used is the 4D model (Define, Design, Develop, and Dissemination) developed by Thiagarajan *et al.*

Thiagarajan (in Sugiyono: 2019) describes the define stage as containing activities to determine what products will be developed along with their specifications. This stage is a needs analysis carried out through research and literature studies. Design contains activities to create a design for a product that has been determined. Development contains activities to make a design into a product and test the validity of the product repeatedly until it produces a product with the specified specifications. Dissemination contains activities to disseminate products that have been tested for use by others. These steps are arranged

into a simplified 4D model development chart as follows.

## RESULT

This study aims to develop teaching materials for *Telusur E-Maps* based on problem-based learning in an effort to improve independence and learning outcomes for class VIII students in the introduction to cells material. This study refers to the formulation of the problem, including: the effectiveness of using teaching materials for *Telusur E-Maps* based on problem-based learning in an effort to improve independence in the introduction to cells material for class VIII students, and the effectiveness of using teaching materials for *Telusur E-Maps* based on problem-based learning in an effort to improve learning outcomes for class VIII students in the introduction to cells material. The study was conducted in class VIII of SMP Negeri 2 Kramat in the 2024/2025 academic year.

### Results of the Effectiveness of the *Telusur E-Maps* Learning Material to Improve Student Independence

Measurement of student learning independence includes being responsible, having self-confidence, taking initiative and being creative, not relying on others, being persistent in trying, being able to solve problems on their own, and being firm in making their own decisions, based on a questionnaire that will be answered by students totaling 24 questions as respondents. The questionnaire distributed to students has a score of 1 (Disagree), 2 (Disagree), 3 (Agree), 4 (Strongly Agree). The data obtained is in the form of quantitative data that will be calculated to obtain an average score of the effectiveness of the *Telusur E-Maps* teaching material to improve student independence from the total number of respondents. The results of the learning independence questionnaire from 32 experimental class students can be seen in Table 4.2

**Table 4.2 Effectiveness of the Search *E-Maps* Teaching Material for Improving Student Independence**

No	Indicator	Score obtained
1	Responsible	582
2	Self-confident	539
3	Taking the initiative and being creative	452
4	Not depending on others	446
5	Persistent in trying	238
	Able to solve their own problems	360
Total		2614
Maximum Score		3.072
Result		85
Criteria		Very Effective

The results of the effectiveness test of the *Telusur E-Maps* teaching material for improving student independence from the calculation results carried out using the formula.  $P = \frac{\sum x}{n} \times 100\%$  so that  $P = \frac{2614}{3072} \times 100\% = 85\%$  is obtained with Very Effective qualifications.

### Effectiveness of *Telusur E-Maps* Teaching Materials to Improve Student Learning Outcomes

The effectiveness of *Telusur E-Maps* teaching materials based on problem based learning developed in improving learning outcomes in class VIII students of SMP Negeri 2 Kramat was obtained from a large-scale trial by comparing the pretest results with the posttest results of 32 class VIII students of SMP Negeri 2 Kramat in the 2024/2025 Academic Year in the odd semester. The pretest and posttest results can be seen in Table 4.3.

**Table 4.3 Student Pretest and Posttest Results**

No.	Number of Respondents	Average Pre test	Average Post test
1.	32 Siswa	33,02	78,38

### Normality Test

The normality test was conducted using the Shapiro-Wilk technique. The results of the normality test are based on the results of the pretest and posttest. If sig. (p value)  $\leq 0.05$

(5%) then  $H_a$  is accepted or  $H_0$  fails to be accepted, meaning that the data is not normally distributed. Conversely, if sig. (p value)  $> 0.05$  (5%) then  $H_0$  is accepted or  $H_a$  fails to be accepted, meaning that the data is normally distributed. The proposed hypothesis:

Null hypothesis ( $H_0$ ) : Data is normally distributed

Alternative hypothesis ( $H_a$ ) : Data is not normally distributed

The results of the normality test can be seen in Table 4.4 and Table 4.5.

**Table 4.4 Results of the Normality Test on Students' Pre-Test Scores**

	Kolmogorov-Smirnov <sup>a</sup>			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
Pretest	,123	32	,200*	,976	32	,676

**Table 4.5 Results of Normality Test on Students' Post-Test Scores**

	Kolmogorov-Smirnov <sup>a</sup>			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
Posttest	,136	32	,125	,943	32	,085

Based on the results of the normality test, it is known that the pretest score obtained a Sig. value of  $0.676 > 0.05$ , so the data is normally distributed. Meanwhile, the posttest score obtained a Sig. value of  $0.085 > 0.05$ , so the data is normally distributed. From the analysis of the data, it was found that the pretest and posttest data were normally distributed

### Homogeneity Test

Then a homogeneity test was carried out. The homogeneity test was carried out with the aim of finding out whether the subjects taken came from homogeneous variants or not. The homogeneity test of this research data was tested using the SPSS 23 application with the following test criteria: 1) If the significance is  $< 0.05$ , then the group variants are different; 2) If the significance is  $> 0.05$ , then the group variants are the same. The results of the homogeneity test can be seen in Table 4.6 and Table 4.7.

**Table 4.6 Results of the Homogeneity Test on Students' Pre-Test Values**

Levene Statistic	df1	df2	Sig.
2,995	1	31	,093

**Table 4.7 Results of the Homogeneity Test on Students' Post-Test Values**

Levene Statistic	df1	df2	Sig.
,362	1	31	,552

Based on the results of the homogeneity test, it is known that the pretest value obtained a Sig. value of  $0.093 > 0.05$ , then the group variants are the same. While the posttest value obtained a Sig. value of  $0.552 > 0.05$ , then the group variants are the same. From the data analysis, it was found that the pretest and posttest data were the same group.

### Paired Sample T-test.

After the data is said to be normal and homogeneous, a paired sample t-test is performed. If the Sig. (2-tailed) value is  $< 0.05$ , then  $H_0$  is rejected and  $H_a$  is accepted. Conversely, if the Sig. (2-tailed) value is  $> 0.05$ , then  $H_0$  is accepted and  $H_a$  is rejected. The hypotheses tested are as follows:

$H_0$  = There is no difference in the average between the pretest and posttest.

$H_a$  = There is a difference in the average between the pretest and posttest.

The results of the paired sample t-test can be seen in Table 4.8.

**Table 4.8 Paired Samples t-Test Results**

	Paired Differences					t	df	Sig. (2-tailed)
	Mean	Std. Deviation	Std. Error	95% Confidence Interval of the Difference				
				Lower	Upper			
Pair 1 Pretest - Posttest	-27,242	14,887	2,592	-32,521	-21,964	-10,512	32	,000

The results of the paired t-test show that the Sig value (2-tailed)  $0.000 < 0.05$  means that  $H_0$  is rejected and  $H_a$  is accepted. This indicates that there is a difference in the average of the pretest and posttest data.

### N-gain Test

The n-gain test can be carried out when there is a significant difference between the pretest and posttest results. The n-gain test formula is as follows:

$$\langle g \rangle = \frac{\text{skor posttest} - \text{skor pretest}}{\text{skor idel} - \text{skor pretest}}$$
$$\langle g \rangle = \frac{78,38 - 33,02}{100 - 33,02}$$
$$\langle g \rangle = \frac{45,36}{66,96} = 0,677$$

Based on the calculation results, a score of 0.677 was produced. Then analyzed using Table n-gain criteria, it was found that the increase in student learning outcomes between before and after the use of the Search E-Maps teaching materials based on problem based learning was in the moderate criteria.

The effectiveness of the *Telusur e-Maps* teaching material based on problem based learning developed to improve independence and learning outcomes in the introduction of cells material for grade VIII students is known based on the analysis of test results before and after the use of the *Telusur-Maps* teaching material based on problem based learning in a large-scale trial. The average pre test score was 33.02, with a minimum score of 14 and a maximum of 54. Based on the test instrument grid (attachment), and scoring guidelines (attachment), students also did not understand the questions. Some students also lacked in understanding content knowledge, procedural knowledge, and knowledge so that it can be seen that the learning outcomes of grade VIII students of SMP Negeri 2 Kramat are still lacking. After learning using the developed digital science teaching materials, the average post test score was 78.38 with a minimum score of 68 and a maximum score of 92. The data obtained through the post test of class VIII SMP Negeri 2 Kramat. After obtaining the data, a paired t-test was then carried out which had previously carried out a normality test and a homogeneity test as a

requirement before conducting a paired t-test to determine the difference in the average results of the students' pre test and post test. The results of the normality test showed that the data was normally distributed and the group variants were the same. So a paired t-test can be carried out. Based on the results of the paired t-test, it was found that there was a difference between the results of the students' pre test and post test. In addition to the t-test, an n-gain test was also carried out to determine the criteria for improving student learning outcomes. From the n-gain results, a score of 0,677 was obtained, which stated that the improvement in student learning outcomes was in the medium criteria. Thus, the *Telusur e-Maps* teaching material based on problem based learning is effective for improving student learning outcomes.

### CONCLUSION

*Telusur E-Maps* teaching materials based on problem based learning produced to improve student independence with results obtained of 85%. This states that the *Telusur e-Maps* teaching material based on problem based learning that was developed is effective in improving student independence.

The effectiveness of the *Telusur e-Maps* teaching material based on problem based learning to improve the science literacy training of grade VIII Junior High School students is stated to be effective with the results of the paired t-test which shows that there is a difference in the average of the pre test and post test data, and the n-gain results get a score of 0.67 with moderate criteria.

### Declaration by Authors

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