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# Plantasika e-Module with Problem Based Learning (PBL) Model for Class IV Primary School Students

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## ABSTRACT

This research is motivated by the fact that the use of learning media still needs to be expanded and more varied. This research aims to develop the design, test the feasibility, and test the effectiveness of the Plantasika e-module media using the problem-based learning (PBL) model. This type of research is Research and Development (R&D) with the development of the Borg & Gall model. The data collection techniques used are tests and non-tests, including observation, interviews, questionnaires, and document data. Data analysis techniques include normality tests, homogeneity tests, paired t-tests, and N-gain tests. The Plantasika e-module media received a very suitable category for use as learning media with percentage results of 96.25% from media experts, 95% from material experts, and 90.6% from language experts. The results from the normality test of the pretest and posttest scores were normally distributed, and from the homogeneity test, the pretest and posttest scores were declared homogeneous. The t-test results show that t_count = 13.468 > t_table = 2.073, so there is a significant difference between the pretest and posttest results with the class N-gain test of 0.71 with high criteria. The analysis of indicators of critical thinking skills obtained an average pretest score of 64.57 with a learning completeness of 58.7%. After being treated with the Plantasika e-module media, the average posttest score increased to 89.78, with learning completeness of 86.7 %. The results of the percentage of teacher and student responses to the questionnaire showed a positive response. This concludes this research concludes that the Plantasika e-module media with the problem-based problem-based learning (PBL) model is feasible and effective in improving learning outcomes and critical thinking skills in class IV science course content.

***Keywords:*** Plantasika E-Module, Problem Based Learning, Class IV Elementary School Students

## INTRODUCTION

Education is one of the primary keys to the progress of a nation. Following the educational paradigm in the 21st century, education demands that students develop high-level thinking abilities (Jaenudin et al., 2020). In this modern era, education is critical in ensuring students can learn, innovate, and use technology and information media (Pare & Sihotang, 2023). The rapid progress of technology and science has led to the need for better human resources who can analyze problems and produce practical solutions to solve these problems (Arisoy & Aybek, 2021). This technological progress is also proven by the increasing increase in internet access in the world, based on survey results in January 2021 of a total population of 7.83 billion people, as many as 66.6% or 5.22 billion

people use smartphones, then 59.5% or as many as 4.66 billion use the internet, and as many as 4.20 billion or 53.6% are active social media users (Hartama et al., 2022). However, technological advances that are not balanced with appropriate use in learning can have various consequences that damage morals and culture among students.

In a world that is increasingly connected to technology like today, an effort that educators can take advantage of amidst technological advances is to develop learning media. Media in learning functions as a tool to clarify the message conveyed by the teacher (Winarto et al., 2020). However, the reality in the field is that learning carried out in class has yet to optimize the use of learning media. This can trigger student boredom in receiving the material because learning is only teacher-centered and does not involve students. One step that can be taken to ensure student-centered learning is to implement active learning (Alkasima et al., 2022). This will further develop if teachers can improve learning that involves students exploring the subject matter.

The problem of less-than-optimal use of learning media was also found at SD N 1 Sekaran 01. Data on daily test learning outcomes for the 2023/2024 school year science class IV students at SDN Sekaran 01 had yet to reach the Learning Goal Achievement Criteria (KKTP). Of the 23 class IVA students, 17 (74%) students have not fulfilled the KKTP, and only 6 (26%) students have fulfilled the KKTP. Apart from that, several problems were found, including (1) The use of learning media used by teachers is still limited, lacks variety, and does not yet integrate IT-based media; (2) The learning process is not multi-source because it only comes from student and teacher books; (3) Teachers have not used learning models that can increase student activity in learning; (4) Students' lack of interest in learning, resulting in decreased critical thinking abilities.

Regarding critical thinking skills, most students are still slow to think critically because they are not used to it and are not trained. Critical thinking is a cognitive ability that is very important for individuals to solve problems (Aouaf et al., 2023). Critical thinking is classified as higher-order thinking (HOT) (Sasson et al., 2018). However, many still need to gain low-level thinking skills or what we know as LOTS (low-order thinking skills). This is proven by the results of the questionnaire, which stated that only 5 out of 23 students (21.7%) could answer HOTS questions, while the other 23 students (78.2%) were only at the LOTS stage. Ennis Cit. Costa (1985:24) states that there are five aspects of critical thinking, namely: (1) providing simple explanations (elementary clarification); (2) building basic skills (essential support); (3) concluding (interference); (4) provide further explanation (advanced clarification); (5) organize strategy and tactics (strategy and tactics).

Critical thinking skills at the educational level can be developed by integrating creative and innovative media and learning models (Halik et al., 2022). E-module media with a problem-based learning (PBL) model is one of the media with a problem-based learning approach that can be used as a context for students to learn about critical thinking and problem-solving skills and to gain essential knowledge and concepts from the material. Lessons (Ayunda et al., 2023). Electronic modules (e-modules) are the latest innovation from printed modules so that these electronic modules can be accessed with the help of a computer that has been integrated with software that supports accessing e-modules (Rahayu & Sukardi, 2021).

Based on the problems described, researchers developed the Plantasika e-module with a problem-based learning (PBL) model to improve critical thinking skills and science learning outcomes for fourth-grade elementary school students. In developing the media in this research, the researcher tried to translate the Plantasika media using the Problem Based Learning (PBL) model. The word Plantasika consists of two combined word elements, namely

"Plantae," which comes from Latin and means "plant," and "sika," which comes from Sanskrit and means "critical mind." This term reflects the importance of knowing the parts of the plant body and their functions with critical thinking skills.

The Plantasika E-Module contains material about the structure and function of the main parts of plants and their essential role in plant growth and development. This media is realized in an e-module as a book that can hone fourth-grade elementary school students' critical thinking and problem-solving skills. The products presented in the Plantasika e-module contain several components, including: (1) cover; (2) foreword page and table of contents; (3) learning outcomes and learning objectives page; (4) e-module user instructions page; (5) material description page; (6) evaluation question page; (7) glossary and table of contents pages; (8) profile page; (9) cover. The Plantasika E-Module is supported by evaluation questions with the characteristics of HOTS questions, which are presented as a link so that students can directly connect to the evaluation questions on the Google form, which contains multiple-choice questions. The Plantasika E-Module design was done using the Canva application on the website page, which was then converted into a PDF file and a flipbook using the Heyzine application. The Heyzine application has several features, including video, audio background, links, titles, page effects, logos, and so on.

Other research that supports the development of the Plantasika e-module media with the Problem Learning (PBL) model is research conducted by Made Wisnu P, I Nyoman J, Ketut Pudjawan, in 2020 with the title "Improving Critical Thinking Ability in Biology Through E-Module Based Problem based learning", this research focuses on a combination of the PBL learning model with e-modules which is expected to improve Biology learning outcomes with the ADDIE development model.

Other research was conducted by E. Arruzza, M. Chau, and A. Kilgour in the Radiography Journal in 2023 with the research title "Problem-based learning in medical radiation science education: A scoping review". In this research, it is explained that PBL-based learning positively impacts learning achievement, knowledge acquisition, and students' skills to adapt effectively in managing information and critical thinking skills.

The general problem formulation in this research is as follows: What is the design, feasibility, and effectiveness of the Plantasika e-module design with the Problem Based Learning (PBL) model to improve critical thinking skills and science learning outcomes for fourth-grade elementary school students? This research aims to develop the design and test the feasibility and effectiveness of the Plantasika e-module media with the Problem Based Learning (PBL) model.

## MATERIALS & METHODS

This research is a type of R&D research that aims to develop the Plantasika e-module media with a problem-based learning (PBL) model. This research uses the development model according to Borg and Gall (Sugiyono, 2016), which contains 10 implementation stages, including: (1) potential and problems; (2) data collection; (3) product design; (4) design validation; (5) design revision; (6) product testing (7) product revision; (8) trial use; (9) product revision; (10) mass product manufacturing. However, in this research, the researchers only reached eight development steps, namely trial use, due to the limited time and costs required.

The research was conducted at SDN Sekaran 01, in Gunung Pati District, Semarang City, academic year 2023/2024. The subjects of this research were fourth-grade students at SDN Sekaran 01. Data collection techniques used test and non-test techniques; non-test techniques used interviews, observation, documentation, and questionnaires. Data analysis uses feasibility

tests, validity tests, reliability tests, level of difficulty, and difference power. Then, the pretest and post-test learning results were analyzed using initial data analysis, namely the normality test and homogeneity test, then analyzed using the t-test and N-gain to determine how much the pretest and post-test learning results increased. Meanwhile, the achievement of critical thinking skills is analyzed using 5 indicators including: (1) Providing a simple explanation, (2) Building basic skills, (3) Drawing conclusions, (4) Explanation of follow-up, and (5) Strategy and tactics, and strengthened using the N-Gain test.

## RESULT & DISCUSSION

The results of this research will be presented in the form of: (1) Results of the Plantasika e-module design using the Problem Based Learning (PBL) model; (2) Results of the feasibility of the Plantasika e-module media product with the Problem Based Learning (PBL) model; and (3) Results of the effectiveness of the Plantasika e-module media with the Problem Based Learning (PBL) model.

### Results of Plantasika E-Module Media Design Using Problem Based Learning (PBL) Model

The Plantasika E-Module is learning material for fourth-grade elementary school students, presented as an electronic module (E-module). The word Plantasika consists of two combined word elements, namely "planta," which comes from Latin and means "plant," and "sika," which comes from Sanskrit and means "critical mind." This term reflects the importance of knowing plant body parts' structure and functions with critical thinking skills. Integrating critical thinking in learning can prepare students to assess facts and find relevant explanations (Chusni et al., 2021).

The products presented in the Plantasika e-module contain several components, including (1) cover; (2) foreword page and table of contents; (3) learning outcomes and learning objectives page; (4) e-module user instructions page; (5) material description page; (6) evaluation question page; (7) glossary and table of contents pages; (8) profile page; (9) cover. The Plantasika E-Module is supported by evaluation questions with the characteristics of HOTS questions, which are presented as a link so that students can directly connect to the evaluation questions on the Google form, which contains multiple-choice questions.

The Plantasika E-Module design was done using the Canva application on the website page, which was then converted into a PDF file and a flipbook using the Heyzine application. The Plantasika media focuses on the science and science subject material on the structure and function of plant parts. The results of the Prezi learning media were developed with several pages containing a cover, foreword & table of contents, CP & TP page, e-module usage instructions page, material description page, evaluation question page, glossary & bibliography page, profile page, and closing cover. For more details, below are the results of Plantasika media products.


**Figure 1. Cover**


**Figure 2. Foreword and Table of Contents pages**


**Figure 3. e-module user manual page**


**Figure 4. CP & TP page**


**Figure 5. material description page**


**Figure 6. material description page**


**Figure 7. evaluation questions page**


**Figure 8. glossary page and bibliography**

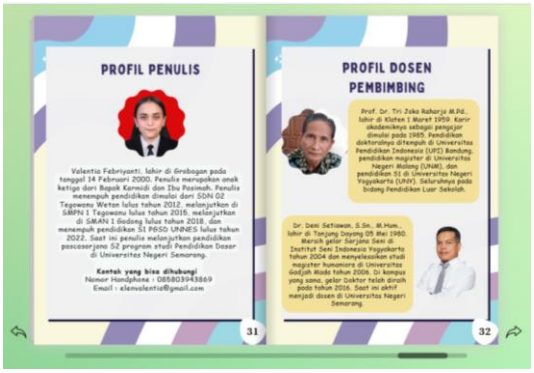


**Figure 9. Profile page**


**Figure 10. Back Cover**

## Feasibility Results of Plantasika E-Module Media Using Problem Based Learning (PBL) Model

The assessment of the suitability of the Plantasika e-module media with the Problem Based Learning (PBL) model was assessed by 3 experts, namely media, material and language experts who are presented in the following table:

**Table 1. Recapitulation of Media Feasibility Validation Results**

| No | Validator | Percentage | Criteria |
|---|---|---|---|
| 1 | Media | 96,25% | Very worthy |
| 2 | Matery | 95% | Very worthy |
| 3 | Language | 90,6% | Very worthy |

Table 1 shows that media validation received a percentage of 96.25% with very appropriate criteria, material validation received a percentage of 95% with very appropriate criteria, and language validation received a percentage of 90.6% with very appropriate criteria. The validation results from media, material, and language experts show that the Plantasika e-module with the Problem-Based Learning (PBL) model is declared very suitable for testing.

## Results of the Effectiveness of Plantasika E-Module Media Using the Problem Based Learning (PBL) ModelLearning Result

Student learning outcomes are used to determine the effectiveness of the Plantasika

e-module media with the problem based learning (PBL) model. Student learning outcomes can be seen from the pretest and posttest scores. The learning results of using the Plantasika e-module with the Problem Based Learning (PBL) model are presented in the following table:

**Table 1. Pretest Posttest Learning Result**

| No | Information | Learning Result | |
|---|---|---|---|
| | | Pretest | Postest |
| 1 | The number of students | 23 | 23 |
| 2 | The highest score | 75 | 100 |
| 3 | Lowest value | 50 | 75 |
| 4 | Complete number of students | 3 | 23 |
| 5 | Mastery learning | 13,04% | 100% |
| 6 | Average | 65 | 90 |

## Normality test

The normality test is used to determine whether the pretest and posttest learning results of class IV at SDN Sekaran 01 are normally distributed. The normality test is calculated using the Kolmogorov-Smirnov test formula with the SPSS version 26 application. The normality test is presented in the following table:

**Table 2. Normality Test**

**Tests of Normality**

| | Kolmogorov-Smirnov[a] | | | Shapiro-Wilk | | |
|---|---|---|---|---|---|---|
| | Statistic | df | Sig. | Statistic | df | Sig. |
| Pre | .176 | 23 | .062 | .927 | 23 | .094 |
| Post | .163 | 23 | .117 | .904 | 23 | .031 |

a. Lilliefors Significance Correction

Based on Table 2, the results of the pretest value normality test using the Kolmogorov-Smirnov test showed that the normality test results of the pretest value are 0.062>0.05, so the data is normally distributed, while the posttest value shows that it is 0.117>0.05 so that the data is normally distributed.

## Homogeneity Test

The homogeneity test is used to see whether the scores from the pretest and posttest come from similar variants or not. The following are the results of the F-Test of Homogeneity of Variances test calculations with SPSS 26 shown in Table 3:

**Table 3. Homogeneity Test**

**Test of Homogeneity of Variances**

Kel_Besar

| Levene Statistic | df1 | df2 | Sig. |
|---|---|---|---|
| .190 | 1 | 44 | .665 |

Based on table 3, a sig value of 0.665 is obtained. If Sig is > 0.05 or greater than 0.05, it is concluded that Ha is rejected and $Ho$ is accepted so that the pretest and posttest data for the large group are declared homogeneous.

## Paired t-Test

In the paired t-test, the researcher used parametric statistical techniques with the help of Microsoft Excel which was used in the t test. If t calculated is greater than t table, then H0 is rejected and Ha is accepted.

**Tabel 4. Uji Paired t-Test**

| t-Test: Paired Two Sample for Means | | |
|---|---|---|
| | Post | Pre |
| Mean | 89,78261 | 64,56522 |
| Variance | 66,99605 | 52,0751 |
| Observations | 23 | 23 |
| Pearson Correlation | 0,325386 | |
| Hypothesized Mean Difference | 0 | |
| df | 22 | |
| t hitung | 13,46819 | |
| P(T<=t) one-tail | 2,1E-12 | |
| t Critical one-tail | 1,717144 | |
| P(T<=t) two-tail | 4,2E-12 | |
| t Critical two-tail | 2,073873 | |

Table 4 shows the results of the t test for two dependent samples in the final large group test. The value obtained was t_count = 13.468 > t_table = 2.073, so H0 was rejected and Ha was accepted. So it can be concluded that there is a significant

difference between the pretest and posttest results.

### N-Gain Test

Gain data is used to determine the increase in students' abilities between before and after treatment. The n-gain test results are presented in the following table:

**Table 5. N-Gain Test Analysis Results**

| Average | | Gain | N-Gain | Criteria |
|---|---|---|---|---|
| ***Pretest*** | ***Postest*** | | | |
| 64,57 | 89,78 | 25,22 | 0,71 | Tinggi |

Based on table 5, it is known that the N-Gain test results obtained a pretest value of 64.57 and the posttest value increased to 89.78, so that in the n-gain test there was an average increase of 0.71 with an average difference of 25. .22 and is included in the high criteria.

### Critical Thinking Skills Analysis

**Table 6. Results of Analysis of Critical Thinking Skills Indicators**

| INDICATOR | *PRETEST* | | *POSTTEST* | |
|---|---|---|---|---|
| | Score | Mastery learning | Score | Mastery learning |
| Provide a simple explanation | 43,913 | 67,6% | 60 | 92,3% |
| Build basic skills | 1,96 | 39,1% | 4,35 | 87,0% |
| Drawing conclusions | 9,13 | 60,9% | 12,39 | 82,6% |
| Follow-up explanation | 3,04 | 60,9% | 4,13 | 82,6% |
| Strategy and tactics | 6,52 | 65,2% | 8,91 | 89,1% |
| Average | 64,57 | 58,7% | 89,78 | 86,7% |

Based on table 6, the following results were obtained: (1) the indicator providing a simple explanation obtained a score of 43.913 with a learning completeness of 67.6%, in the posttest the score increased to 60 with a learning completeness of 92.3%; (2) the indicator for building basic skills obtained a pretest score of 1.96 with learning completeness of 39.1% and the posttest score increased to 4.35 with learning completeness of 87.0%; (3) the indicator for drawing conclusions obtained a pretest score of 9.13 with a learning completeness of 67.6% and the posttest score increased to 12.39 with a learning completeness of 82.6%; (4) the follow-up explanation indicator obtained an average score of 3.04 with learning completeness of 60.9% and the posttest score increased to 4.13 with learning completeness of 82.6%; and (5) the strategy and tactics indicators obtained an average score of 6.52 with a learning completeness of 65.2% and the posttest score increased to 8.91 with a learning completeness of 89.1%. Based on the analysis of the pretest and post-test indicators, there has been an increase in the average score and learning completion for each indicator of critical thinking skills.

## DISCUSSION

Development of the Plantasika e-module media with a problem-based learning model in the science and sciences subject material on plant body parts and their functions for class IV elementary school using Borg and Gall research and development procedures with stages including (1) potential and problems; (2) data collection; (3) product design; (4) design validation; (5) design revision; (6) product testing; (7) product revision; (8) trial use.

The Plantasika e-module was designed using Canva by creating an attractive and colorful template to export the file and then using the Heyzine application. The products presented in the Plantasika e-module contain several components, including (1) cover; (2) foreword page and table of contents; (3) learning outcomes and learning objectives page; (4) e-module user instructions page; (5) material description page; (6) evaluation question page; (7) glossary and table of contents pages; (8) profile page; (9) cover. The Plantasika E-Module is supported by evaluation questions with the characteristics of HOTS questions, which are presented as a link so that students can directly connect to the

evaluation questions on the Google form, which contains multiple-choice questions.

The suitability of the Plantasika e-module media with the Problem-Based Learning (PBL) model was assessed by three experts: media, material, and language. The media feasibility assessment received a percentage of 96.25% with very appropriate criteria, the material feasibility assessment received 95% with very appropriate criteria, and the language feasibility assessment received a percentage of 90.6% with very appropriate criteria. The validation results from media, material, and language experts show that the Plantasika e-module with the Problem-Based Learning (PBL) model is declared very suitable for use.

The effectiveness of the Plantasika e-module media with the problem-based learning (PBL) model can be determined by looking at student learning outcomes, namely the pretest and posttest scores. From the student learning results, the average pretest score was 65, and the posttest average was 90. It was found that there was a difference in the average pretest and posttest scores of 25. The number of students who experienced an increase in learning completeness during the pretest was three (13.04% ), and the number of students who experienced learning completion during the posttest was 23 (100%). Next, the normality of this data will be tested using the Kolmogorov-Smirnov test formula. The pretest value has a sig value of 0.062>0.05, and the posttest value has a sig value of 0.117>0.05, so it is stated that the data is normally distributed, so the following calculation uses parametric statistical techniques—test homogeneity using the F-Test of Homogeneity of Variances test. The homogeneity test results obtained a sig value of 0.665. *Ho* is accepted if Sig > 0.05 or greater than 0.05, then it is concluded that Ha is rejected and *Ho* is accepted so that the large group pretest and posttest data are declared homogeneous. In the next step, after the data was distributed and homogeneous, the researcher tested the difference in pretest and posttest means using the paired t-test. From the calculation results, the value of t_count = 13.468 and t_table = 2.073. So we get t_count = 13.468 > t_table = 2.073, so H0 is rejected, and Ha is accepted, or it can be interpreted that there is a difference in the averages. Next, the researcher calculated the n-gain test with the pretest score, obtaining a result of 64.57, and the posttest score increased to 89.78 so that in the n-gain test, there was an average increase of 0.71 with an average difference of 25.22. and they are included in the high criteria.

The results of the analysis for each critical thinking indicator obtained an average pretest score of 64.57 with learning completeness of 58.7%, and after being treated with the Plantasika e-module media with the problem-based learning (PBL) model, the average posttest score increased to 89.78 with learning completeness 86.7%. Based on the paired t-test and n-gain test and analysis of critical thinking indicators, the Plantasika e-module with the Problem-Based Learning (PBL) model effectively improves student's learning outcomes and critical thinking skills.

Other research that supports this research is research (Ramadanti et al., 2021), conducting research aimed at developing Problem-Based Learning (PBL) based mathematics e-modules. This research uses the ADDIE development model. This research states that the Problem-Based Learning (PBL) mathematics e-module on data presentation material for junior high school students meets the valid, practical, and effective criteria, so it is suitable for mathematics learning.

The research results show that the Plantasika e-module with the Problem-Based Learning (PBL) model effectively improves student learning outcomes and critical thinking skills. This research also indicates that the use of the specially designed Plantasika e-module has a significant impact on improving critical thinking skills. Students involved showed increased analysis, observation, and conclusions, the ability to provide further

explanations, and the ability to organize strategies and tactics.

## CONCLUSION

This research uses the eight stages of Research and Development (RnD) research or development research using the Borg and Gall model. The products presented in the Plantasika e-module contain several components, including (1) Cover; (2) Foreword page and table of contents; (3) Learning outcomes and learning objectives page; (4) Instruction page for using the e-module; (5) Material description page; (6) Evaluation Question Page; (7) Glossary page and table of contents; (8) Profile page; (9) Cover cover. In this study, media validation results were 96.25% with very feasible criteria, material validation with 95% with very feasible criteria, and language validation with 90.6% with very feasible criteria.

The data in this study is normally distributed with a Sig value. pretest and posttest >0.05. From the t-test calculations, the value of t_count = 13.468 and t_table = 2.073. So we get t_count = 13.468 > t_table = 2.073, which means there is a significant difference in averages. Meanwhile, in the n-gain test, the pretest score was 64.57, and the post-test score increased to 89.78, so in the n-gain test, there was an average increase of 0.71 with an average difference of 25.22 and included in the high criteria with an increase in the average pretest and posttest learning outcomes of 25. The analysis results for each critical thinking indicator obtained an average pretest score of 64.57 with a learning completeness of 58.7%. After being given treatment with the media, The Plantasika e-module with the problem-based learning (PBL) model had an average posttest score increasing to 89.78 with learning completeness of 86.7%. Based on the research results, the Plantasika e-module with the Problem-Based Learning (PBL) model effectively improves learning outcomes and critical thinking skills for fourth-grade elementary school students.

***Declaration by Authors***

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