JPPIPA 11(3) (2025)

Jurnal Penelitian Pendidikan IPA

Journal of Research in Science Education

http://jppipa.unram.ac.id/index.php/jppipa/index

Development of Happy Notes PERUGI Learning Media (Energy Transformation) Based on Problem Based Learning to Improve Student Learning Outcomes in Natural and Social Science Subjects in Grade IV of Elementary School

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Received: December 18, 2024
Revised: January 27, 2025
Accepted: March 25, 2025
Published: March 31, 2025

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DOI: 10.29303/jppipa.v11i3.10992

Abstract: Research at SD Negeri Wonosari 03 Semarang City identified the problem of limited concrete learning media and low student learning outcomes in Natural and Social Sciences subjects. To overcome this problem, the researcher developed and tested the Happy Notes PERUGI (Perubahan Energi) learning media based on Problem Based Learning. The method used is research and development (R&D) with the Borg and Gall model through 10 stages (research and information collecting, planning, develop preliminary form of product, preliminary field testing, main product revision, main field testing, operational fiel testing, final product revision, dissemination and implemention) as well as data collection through observation, interviews, questionnaires, and documentation. The results of media validation by material and media experts show percentages of 83.3 and 87.5%, which are classified as very feasible. The calculation of N-Gain yields a value of 85.49%, with a high criterion. Thus, this learning media is declared to be very feasible and effective to improve the learning outcomes of grade IV students at SD Negeri Wonosari 03.

Keywords: Happy notes; Media development; Problem based learning; Science; Student learning outcomes

Introduction

Education is the most important thing for everyone, with education can shape a person into character, and have a broad view of the future (Alika & Radia, 2021). Education today needs to prepare qualified students who can go through the science education process so that they have high-level scientific skills, attitudes, and thinking skills (Liliasari in Pratiwi, 2015). In achieving a quality education curriculum, education that is directed and guided by national education goals is needed (Mahya & Setiawan, 2024). Learning outcomes are abilities obtained by students after gaining learning experience from teachers by conducting certain assessments that explain the criteria that have been achieved (Yanti et al., 2023). Learning outcomes are the abilities that students have after receiving their learning experiences (Aristawati et al., 2021).

According to Ertikanto (2018) stated that Natural Sciences (IPA) is a complex science and closely related to daily life. Therefore, learning in schools, including science, is expected to be a means for students not only to be able to master science well but also to be able to apply what they learn at school to the community and utilize the community as a learning resource (Annisa &

How to Cite:
Zahra, R. S. A., & Wulandari, D. (2025). Development of Happy Notes PERUGI Learning Media (Energy Transformation) Based on Problem Based Learning to Improve Student Learning Outcomes in Natural and Social Science Subjects in Grade IV of Elementary School. *Jurnal Penelitian Pendidikan IPA*, *11*(3), 954–969. https://doi.org/10.29303/jppipa.v11i3.10992

Subiantoro, 2022). Science learning content at the elementary level aims to focus on aspects of knowledge competence, scientific skills, and scientific attitudes such as daily behavior in interacting with society and the environment (Sari & Atmojo, 2021). According to Gathong & Chamrat (2019) stating that this is an important goal of science learning, which is to encourage students to learn scientific concepts, understand the essence of science, make connections between evidence to make explanations for various phenomena, and lead to the creation of various impacts on society based on morality. According to Parmiti et al. (2021) stated that science learning in schools today tends to develop the intellectual aspect by relying only on information from textbooks and teachers as the main learning source.

Education is a right for all Indonesian citizens as stated in the 1945 Constitution of the Republic of Indonesia Article 31 Paragraph 1, namely "Every citizen has the right to education". Therefore, education is essential for the development of students' knowledge, abilities and personalities. Dr. Eneng Susilawati, M.Pd. (Head of Program) stated that the success of education lies in the ability of teachers to apply learning approaches and methods. Education in schools to foster a sense of love and concern for the environment for students needs to be prepared by prospective teachers. Teachers have an important role in the learning process to achieve learning objectives and deliver materials that foster curiosity.

According to the opinion of Primi & Wechsler (2018) it is stated that under the demands of the 21st century, teachers need to have the ability to critically solve problems and produce creative solutions. At the same time, they must also have full mastery in science, technology, engineering, and mathematics (Liliawati et al., 2018). Therefore, the teaching and learning process must meet the standard needs of graduates in this century by equipping students with ting-level thinking skillsgi.

One of the efforts made to improve student learning outcomes is to improve the teaching and learning process in schools by designing an interesting and effective learning model (Hilmi & Harjono, 2017). In addition, the development of interesting and fun learning media is also an important factor in increasing student learning motivation. Students tend to participate more and engage in learning if they feel interested and emotionally engaged. In this context, the development of "Happy Notes" learning media is a potential solution. Happy Notes is a learning medium that combines pictures, and descriptions of the images in an interesting way. This learning medium aims to provide a fun learning experience and stimulate students cognitively and emotionally. Learning media is one of the tools that affects the learning process. "Happy Notes" learning media can improve student learning outcomes because first, this learning media is made using thick wood so that it is easy to hold. Second, this media uses laminated Ivory paper so that the paper is not easily damaged and the color does not fade easily. Third, the material is presented in a structured and systematic manner starting from the forms of energy, examples of objects that change energy, and the meaning of the change in energy of these objects so that it can make it easier for students to understand the material gradually. Fourth, the use of text examples that are close to daily life and the environment around students makes learning more contextual, meaningful and easy to understand. Fifth, the availability of a guidebook on how to use the media complete with PBL syntax makes it easier for media users to use it for learning.

According to Ntobuo et al. (2018) stated that to increase students' interest in learning, interesting learning media is needed. The approach to using digital technology as a learning medium has a better and more effective impact compared to other approaches (Adnan et al., 2017). So that through meaningful learning, it makes it easier for students to remember the material given for longer and if given new material will facilitate the next learning process in receiving science material. In line with Siberman's opinion (in Gani et al. 2018) that in each class consisting of 21 students, there are 15 students who can learn effectively when the teacher presents activities that combine the auditory, visual, and kinesthetic senses while the other 6 students only master one learning style which results in difficulty receiving the material well.

The results of observations at SD Negeri Wonosari 03 show several obstacles in the science learning process. One of them is the existence of a student who has difficulty understanding the material delivered by the teacher, so he needs special assistance from the homeroom teacher. In addition, the learning media used is only displayed through the LCD projector, so students cannot understand the changes in energy directly or really. This condition can affect students' understanding of learning materials and have an impact on their learning outcomes. Students need interactive, interesting learning media, there are learning challenges in problem solving and related to daily life and student worksheets are also needed. So that the learning media used is effective and in accordance with the characteristics of students in understanding learning materials because students' reading interest is very low so that students do not understand the material and are confused to contribute to the learning process and students are less active in receiving learning. According to Ayunda et al. (2023),

student worksheets using PBL can improve students' critical thinking skills and self-efficacy. According to Ertikanto (2018) states that learning outcomes obtained through the problem-based learning model are student learning outcomes from the process of understanding and observing the learning activities provided. According to Purnami et al. (2021) stated that in general, critical thinking skills focus on the ability to analyze, synthesize, and evaluate various information to make decisions and actions in order to solve problems. Students' creative thinking skills play an important role in determining the success of student learning (Mumford & McIntosh, 2017; Siburian et al., 2019; Nouri et al., 2019). Creative thinking skills are interrelated with academic skills and the learning environment, such as the applied learning model (Trang & Hansen, 2020). Evendi & Verawati (2021) also found that the implementation of a problem-based learning model showed improvement and encouraged students to participate actively. Nurmahasih & Jumadi (2023) found that there was an increase in student learning outcomes after practicing the PBL model in learning, namely increased learning independence, creative thinking skills, critical thinking skills, argumentation skills, science process skills, and problem-solving skills.

The main purpose of this study is to develop Problem Based Learning-based Happy Notes learning media to facilitate the understanding of the concept of energy change and improve student learning outcomes based on Problem Based Learning in science lessons. This study also aims to analyze the effectiveness of Happy Notes learning media in improving learning outcomes and student engagement. It is hoped that the development of Happy Notes learning media can make a significant contribution in improving student learning outcomes in science lessons. In addition, this research is expected to provide practical information and recommendations for teachers, policy makers, and related parties in the development of innovative and effective learning media in the context of science learning. According to Maryani et al. (2017) stated that at the elementary school level, learning difficulties often arise in both mathematics and memorization subjects. In addition, this research is expected to provide practical information and recommendations for teachers, policy makers, and related parties in the development of innovative and effective learning media in the context of science learning. According to Maryani et al. (2017) stated that at the elementary school level, learning difficulties often arise in both mathematics and memorization subjects.

Based on the results of the pre-research carried out by researchers at SD Negeri Wonosari 03 through observations, teacher interviews, documentation data for grade IV students of SD Negeri Wonosari 03, Academic Year 2023/2024, there are problems in science learning that result in learning outcomes not being achieved. The learning process of teachers often applies learning methods such as lectures, discussions and assignments so that they are less varied. Good learning outcomes obtained by students are certainly inseparable from the teacher's achievement in managing learning in the classroom. Managing learning in the classroom is one of the tasks of professional teachers who are oriented to the needs of students. Good learning outcomes obtained by students are certainly inseparable from the teacher's achievement in managing learning in the classroom. Managing learning in the classroom is one of the tasks of professional teachers who are oriented to the needs of students. Therefore, teachers are expected to be able to plan learning well, leading to the preparation of learning evaluation tools (Tanta et al., 2023).

The research that supports this research is a research conducted by Arifin et al. (2023). Based on the analysis of the data, the assessment of media experts meets the criteria to be used as a learning media for smart wheels, meeting the criteria with the results of validating material experts reaching 100%. The validation results of design experts reached 100%. The results of individual trials reached 100%. The result of the small group trial was 83%. The results of the large group trial reached 94.67%, the results of the t-test analysis with a significance level of 0.05 showed that the p-velocity value of the t-test statistics was 0.00 < 0.05, so it can be concluded that Ho was rejected and Ha was accepted. This shows that there is a significant influence on the average score of the pre-test and post-test. The conclusion is that the smart wheel learning media developed is effective in improving the learning outcomes of students in the 3rd semester at Madrasah Ibtidaiyah Nurul Huda Ngampelsari. Sidoarjo.

From the data of the learning outcomes of grade IV students of SD Negeri Wonosari 03, it can be seen that the learning outcomes of science are quite low. The criteria for achieving Learning Objectives in the fourth-grade science lesson of SDN Wonosari 03 is 75. The number of students in grade IV is 21 students. In Natural and Social Sciences (IPAS), many grade IV students who got an average score in semester 1 above the Learning Goal Achievement Criteria amounted to 8 students (38%) and who got an average score below the Learning Goal Achievement Criteria amounted to 13 students (61%).

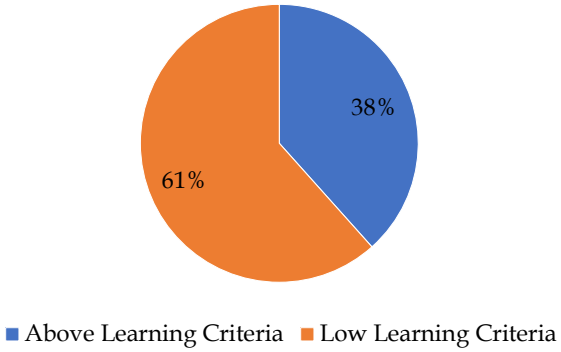


Figure 1. Percentage of completeness of learning outcomes of grade IV students of SD Negeri Wonosari 03

The researcher carried out research at SDN Wonosari 03 by reviewing the results of teacher interviews, observations and data on student learning outcomes. The type of research applied by the researcher is Research and Development (R&D) research to develop Happy Notes learning media based on Problem-based learning to improve student learning outcomes in the subject of Natural Sciences Energy Change Materials Class IV SD Negeri Wonosari 03 Semarang City. Teachers are expected to make the results of this research as one of the references so that science learning activities in elementary schools become more interesting, challenging, motivating, and fun. In addition, the results of this study can support the achievement of basic competencies expected by elementary schools (Jampel et al., 2018). Based on this background, the researcher will conduct a research entitled "Development of Happy Notes PERUGI (Energy Change) Learning Media to Improve Student Learning Outcomes in Natural and Social Science Subjects (IPAS) in Class IV SD Negeri Wonosari 03 Semarang City."

Method

Research and Development (R&D) is a research method used to produce certain products and test the effectiveness of the product. The development and research model used is a modification of the development steps of Sugiyono (2015). In this study, the researcher developed a product in the form of learning media called Happy Notes based on Problem Based Learning, which is designed to improve learning outcomes in grade IV of SD Wonosari 03. The feasibility of this product will be tested through the evaluation of experts, both media experts and material experts. To measure the effectiveness of the product. The researcher will conduct trials using pretest and posttest methods, testing the average difference and analyzing changes in pretest and posttest results.

In the research and development of Happy Notes PERUGI learning media based on Problem Based Learning of energy change materials in grade IV elementary schools, the researcher used the Borg and Gall model in its development using 10 stages in the Borg and Gall model. The following are the 10 stages of borg and gall taken by researchers, namely: potentials and problems, on the potential and problems of the researcher to make observations, interviews and documentation; data collection, at this stage the researcher collects data by analyzing the needs of students and teachers; product design, at this stage the researcher designs the Happy Notes Media Product of Energy Change; design validation, in the design validation assessment is carried out by two experts, namely media experts and material experts; design revision, after receiving suggestions for improvement from the next two experts, Happy Notes Energy Change experienced a revision of the media design of Happy Notes Energy Change; product trials, at this stage the revised Energy Change Happy Notes media is then tested on a small scale; product revision, at this stage the media design that has been tested and then the finished product revision; Usage trials, at this stage the researcher conducts a trial of use which is carried out on a large scale; final product revision; mass products. The following is the procedure for developing Happy Notes PERUGI learning media based on Problem Based Learning.

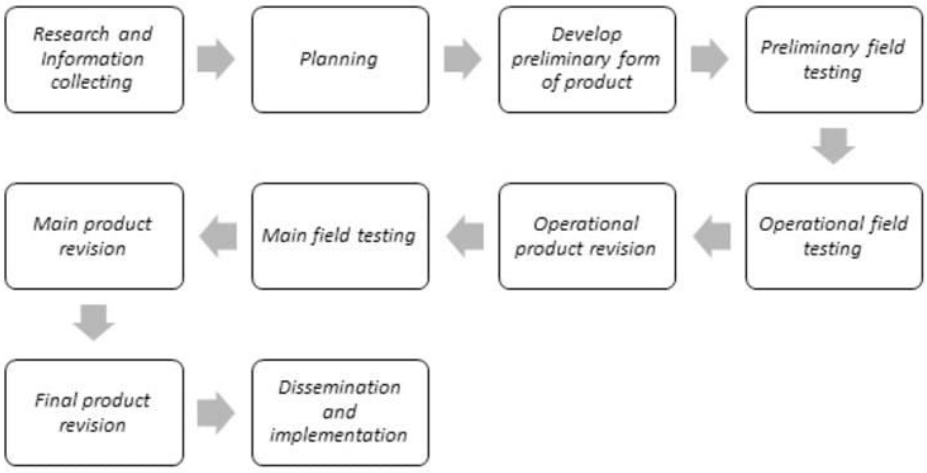


Figure 2. Research prosedure

The following is an explanation of the research procedure in the development of Happy Notes on Energy Change based on Problem Based Learning based on Figure 2, the first potential problem is in the form of observational data, interviews and documentation of student learning outcomes, so that it can identify problems that exist at SD Negeri Wonosari 03 Semarang City. After that, the researcher collects a number of information or data through a questionnaire of the needs of teachers and students. The design of the Happy Notes PERUGI learning media based on Problem Based Learning was developed in the form of a circle with a meter of 19 cm, using bright colors so that it can attract the attention of students. The design of the "Happy Notes" learning media in the form of a circle with bright colors is not only visually appealing, but also supports problem-based learning goals. By creating an inclusive and fun environment, students are expected to be more engaged and motivated in their learning process. This media includes a guidebook on how to use Happy Notes PERUGI based learning media based on Problem Based Learning because it is easier to access or apply by teachers or other media users. The use of varied media is needed in science learning. This is because varied learning media can foster student motivation to learn.

The next stage, namely the validation of media experts and material experts, is carried out by filling out a validation questionnaire to provide assessment or validation using a validation instrument for assessing the feasibility of learning media Happy Notes PERUGI based on Problem Based Learning. Design validation is defined as an activity process that aims to make a rational assessment of how effective the product design is being developed. The assessment is carried out rationally because design validation is obtained based on rational thinking rather than based on facts in the field. Validation of the product design that is being developed is carried out by discussing with experts or experts who have experience in the field to provide an assessment of the product that has been designed by the researcher. Each expert will be asked to give an assessment of the design so that the advantages and disadvantages of the product that has been developed will be known.

After the product is designed, it will be tested through discussions with experts to find out the shortcomings. In addition, design improvements are made to reduce product shortcomings. Researchers will make improvements that allow for the production of high-quality products. The design of the product that has been improved is not directly applied to the student but is converted into a finished product and tested. Product testing can be used to evaluate the effectiveness and usability of learning materials. The researcher will use the Happy Notes PERUGI learning media based on Problem Based Learning to test products in small groups. The purpose of testing products conducted on this small group is to ensure that the product ultimately has better quality.

The types of data used in this research process are quantitative and qualitative data. The data collection techniques used in this study are test and non-test techniques. Non-test techniques were obtained from interviews, observations, questionnaires and documentation. Meanwhile, test techniques are obtained from pretests and posstests. The questionnaire that has been carried out by the validator is then used in the field. The following is a grid table of media experts and subject matter experts.

Table 1. Material expert rating grid

Aspect	Assessment score
Lessons	1.2.3.4.5.6
Linguistic Rules	7.8.9
Contents	10.11.12.13.14.15

Learning Aspects of Learning Media Happy Notes PERUGI Based on Problem Based Learning. This aspect consists of the suitability of CP and indicators, suitability with learning objectives, suitability with the essence of science learning, evaluation/quiz questions in accordance with indicators, completeness of material related to energy changes, suitability of material with student development level. This aspect was obtained by a percentage of 66% which was included in the eligibility criteria.

Aspects of Language Rules in Happy Notes PERUGI Learning Media Based on Problem Based Learning. This aspect consists of the suitability of the language style with the target (audience), language that is easy to understand, and language that is the same age as the rules of the General Guidelines for Indonesian Spelling. This aspect obtained a percentage of 100% which is included in the very feasible criteria.

The content aspect of the material contained in the Happy Notes Learning Media is on Problem Based Learning. This aspect consists of the scope and depth of the material, the material in accordance with the learning indicators, the material facilitates student understanding, the clarity of the material description, the clarity of the material description, the clarity of the examples displayed, the relevance of the material in daily life. This aspect was obtained by a percentage of 91.6% which was included in the very feasible criteria.

Table 2. Media expert rating grid

Aspect	Assesment score
Lessons	1.2.3.4
Eligibility and presentation	5.6.7
Interactivity	8.9.10
Display and media	11.12.13.14.15.16
Linguistic rules	17.18
Media	19.20

Learning Aspects of Learning Media Happy Notes PERUGI Based on Problem Based Learning. This aspect consists of the suitability of the media title with the material, clarity of learning outcomes and learning objectives, the program can simplify the learning process and the suitability of the questions with the material. In this aspect, a percentage of 87.5% was obtained which was included in the very feasible criteria.

Feasibility Aspects of Happy Notes PERUGI Learning Media Based on Problem Based Learning. This aspect consists of the advantages of the media. This aspect was obtained by a percentage of 83.3% which is included in the very feasible criteria. Feasibility Aspects of Interactive Learning Media Happy Notes PERUGI Based on Problem Based Learning. This aspect consists of media feedback, student independence, and instructions for working on the questions. This aspect was obtained by a percentage of 91.6% which was included in the very feasible criteria.

Aspect of the Happy Notes PERUGI Learning Media Display Based on Problem Based Learning. This aspect consists of the suitability of the letters, the clarity of the text, the combination of colors, the clarity of the game, interesting questions and interesting elements. This aspect was obtained by a percentage of 83.3% which is included in the very feasible criteria.

Aspects of the linguistic rules of Happy Notes PERUGI Learning Media Based on Problem Based Learning. This aspect consists of a language that corresponds to the characteristics of the student and the clarity of the language used. This aspect obtained a percentage of 100% which is included in the very feasible criteria. Aspects of Happy Notes PERUGI Learning Media Based on Problem Based Learning. This aspect consists of easy-to-understand media and easy-to-use media. This aspect was obtained by a percentage of 87.5% which was included in the very feasible criteria.

The scale table below is presented by the researcher for the assessment of the validation scale.

Table 3. Validation assessment scale

Criterion	Score
Very good	4
Good	3
Enough	2
Less	1

Table 4. Product eligibility categories validator experts

Percentage (%)	Criterion
82 – 100	High practicability
63 – 81	practicability
44 – 62	Quite practicability
25 – 43	Not practicability

After the product is developed, it is tested for feasibility by media experts and material experts. Next, is to conduct a test question. The test questions were carried out in grade IV of SD Negeri Wonosari 03 Semarang City with a total of 50 questions. From the 50 questions, a validity test was then carried out to determine valid questions for pretest and posttest

questions. The following are the results of the validity test of the trial questions.

Table 5. Results of validity of question trials

Criterion	Question number	Total
Valid	1.2.3.5.7.11.12.17.20.21.24.27.28.29.30.32.33. 34.37.44.50	21
Invalid	4.6.8.9.10.13.14.15.16.18.19.22.23.25.26.31.35. 36.38.39.40.41.42.43.45.46.47.48.49	29

Of the 21 valid questions in Table 5, the researcher used 20 questions for the pretest and postest questions. The data analysis used is the N-Gain test or the average increase test. The N-Gain test was carried out with the aim of comparing the improvement of student learning outcomes from before (pretest) and after (posttest) using the Hapyy Notes PERUGI learning media based on Problem Based Learning. So that the difference in student learning outcomes in the pretest and posttest can be known.

Result and Discussion

Research and Information Collecting

The research is carried out because there are problems that are used as potential through Research and Development (R&D). Based on the results of the study, it was found that several malfunctions of the learning outcomes of grade IV students of SD Negeri Wonosari 03 Semarang City in science subjects were obtained student learning outcomes that had a considerable difference between the highest and lowest scores. The problems that have been mentioned are also supported by data on learning outcomes of grade IV students in the content of IPAS semester 1 of the Light material from 21 students, 8 students (38%) and those who got an average score below the Learning Goal Achievement Criteria amounted to 13 students (61%).

Based on the problems that have been mentioned, the researcher chose to develop Happy Notes PERUGI learning media based on Problem Based Learning as a solution. This is in accordance with the research admitted by Samsidar et al. (2024) in the development of this media is presented online and broadcast on LCD projectors. So this study has no similarities with previous research. In contrast to the media developed by researchers, the research media is real or concrete with material that is packaged in a more structured and more interesting way so that it can improve student learning outcomes.

Planning

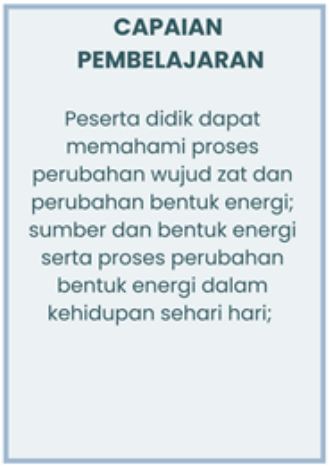
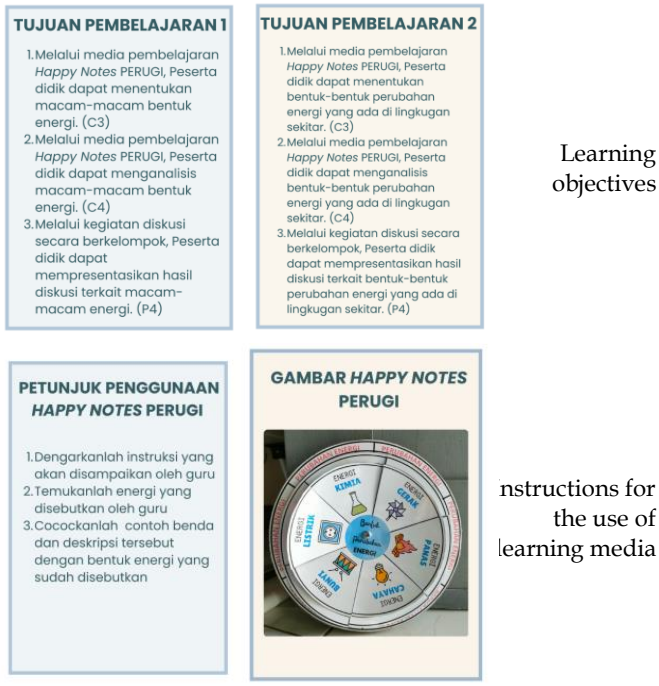
At the data collection stage, the researcher collected various information related to product development, so that the products produced were able to overcome the problems that existed at SD Negeri Wonosari 03 Semarang City according to the needs of teachers and students. Product design is carried out based on the results of the analysis of the questionnaire needs of teachers and students. At this stage, the researcher designed a Happy Notes PERUGI learning media product based on Problem Based Learning that is interesting for grade IV elementary school students. This Happy Notes PERUGI learning media is in concrete form that can be done by students containing a summary of the material equipped with a guidebook on how to use the learning media, learning media must also use short, concise, and clear sentences that are easy for students to understand. The display of Happy Notes PERUGI also needs to be designed as attractive as possible because it will affect the level of students' comprehension. Based on the results of student needs, it is known that some students find it difficult to understand the material of energy change. Students need interesting co-op learning media.

Develop Preliminary Form of Product

Happy Notes, an innovative learning medium, is the center of attention in understanding. This media introduces interesting forms of variation, making the learning process more interactive and enjoyable for students. With the help of Happy Notes, they not only master basic concepts, but can also motivate students to improve learning outcomes in a fun way. This activity proves that creative and fun learning approaches, such as the use of Happy Notes, can improve students' motivation and learning outcomes. Hopefully similar activities can continue to be carried out to create a more inspiring and effective learning atmosphere in the future.

Based on the results of the interview, SD Negeri Wonosari 03 still has limitations in the use of innovative learning media for science subjects. Teachers and students argue that an engaging learning medium can make the learning process more enjoyable. Therefore, the development of Problem Based Learning-based Happy Notes PERUGI media can be a solution to improve quality learning and attract students' interest in learning so that it can improve the learning outcomes of grade IV students.

Table 6. Happy notes learning media design PERUGI based on Problem Based Learning

Picture	Description
	Book cover
	Learning outcomes
	Learning objectives nstructions for the use of learning media

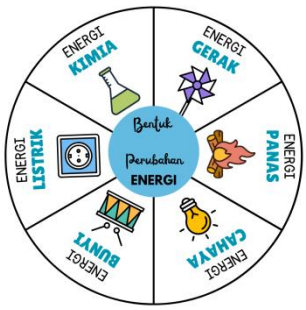


Figure 3. Happy notes PERUGI learning media design based on Problem Based Learning

Validation of the Design of Feasibility of Learning Media Happy Notes PERUGI Problem-Based Learning

The next step is to validate the product design. The researcher followed up on suggestions for improvement from media experts and material experts to optimize the instruction manual for the use of Happy Notes PERUGI learning media. This is so that the process of providing knowledge to students can take place effectively when implemented in the field. In addition, this stage is also important to find out whether the media and learning materials developed are feasible or not to be implemented in learning. Product validation in this study involves two experts, namely media experts and material experts. The following is a recapitulation of the results of the validation of the Happy Notes learning media by media experts and material experts.

Table 7. Recapitulation of media expert assessment results

Aspect	Percentage (%)	Criterion
Lessons	87.5	Highly feasible
Presentation eligibility	83.3	Highly feasible
Presentation eligibility	96.6	Highly feasible
Display and media	83.3	Highly feasible
Linguistic rules	100	Highly feasible
Media	87.5	Highly feasible
Total	87.5	Highly feasible

Table 8. Recapitulation of material expert assessment results

Aspect	Percentage (%)	Criterion
Lessons	79.1	Highly feasible
Linguistic rules	100	Highly feasible
Contents of the material	91.6	Highly feasible
Total	83.3	Highly feasible

Based on Table 7 and 8, 25 the results of the validation questionnaire by media experts, the final results of the Happy Notes Learning Media assessment of Problem Based Learning obtained a total score of 70 out of 80 maximum scores. The percentage obtained is 87.5% with very feasible criteria. Based on the results of the assessment, it can be concluded that the Problem Based Learning Happy Notes PERUGI Learning Media is worthy of being tested in the field with revisions and final results obtained from the assessment by material experts, namely 50 scores out of a maximum of 60 scores. The percentage obtained was 83.3% with very feasible criteria. Through this assessment, it can be concluded that the Happy Notes PERUGI Learning Media Based on Problem Based Learning is worthy of being tested in the field with revisions. Revisions and suggestions for improvement from material experts are used by the researcher to improve the Happy Notes PERUGI Learning Media for Problem-Based Learning so that it is more optimal when used in the learning process.

As the research conducted by Arifin et al. (2023), based on data analysis, media experts assess that they meet the criteria to be used as a smart wheelwheel learning learning media to meet the criteria with the results of validation of material experts reaching 100%. The validation results of design experts reached 100%. Individual test results reach 100%.

The research conducted by Kuntari et al. (2023) show that the results of the assessment from the questionnaire distributed to experts show that linguists scored 73% in the practical category, media experts scored 83% in the very practical category, and material experts scored 62% in the practical category. This means that the media can conclude that the validity of the results of the development of rotary media in Healthy Food Materials in class V elementary school is very valid.

Trial Use

After the Happy Notes PERUGI learning media based on Problem Based Learning, it has been assessed by media experts and material experts and has been revised by researchers. Furthermore, the researcher conducted small-scale product trials. This small-scale trial was carried out at SD Negeri Wonosari 03 Semarang City class IV A with a total of 6 students. The trial of the use of small-scale products aims to determine the effectiveness of Happy Notes PERUGI learning media based on Problem Based Learning before being used in large-scale trials. The results of small-scale trials can be seen through pretest and posttest scores. To see the effectiveness of the use of Happy Notes PERUGI learning media based on Problem Based Learning on a small scale, it can be seen in the following trial table.

Table 9. Pretest and posttest results in small-scale trials

Types of tests	Average	Average difference
Pretest	36.66	58.34
Posttest	95	

Based on the data in Table 9, there is a significant difference between the pretest results with an average score of 36.66 and the posttest which reaches an average of 95. This achievement shows an increase in the completeness of student learning. So that the use of Happy Notes PERUGI learning media can be said to be effective in learning. This study focuses on improving student learning outcomes by using Happy Notes PERUGI Learning Media. The effectiveness of Happy Notes PERUGI learning media based on Problem Based Learning was measured using the N-Gain test, which is a quantitative analysis method to evaluate the improvement of student learning outcomes. In its implementation, the N-Gain test compares the difference between pretest and posttest scores with the difference in the maximum pretest score. Through this method, the level of significance of improving writing skills after the use of Happy Notes PERUGI learning media based on Problem Based Learning can be objectively measured. The analysis of the N-Gain test not only shows the amount of value increase, but also provides measurable information about the success of the Happy Notes PERUGI learning media based on Problem Based Learning for improving students' exposition text writing skills. The researcher conducted the N-Gain test, trying to use small-scale and large-

scale tests. The results of the calculation of the N-Gain test on a small scale are presented in the following table

Table 10. Small-scale N-Gain test results

Average difference	N-Gain	Criterion
58.34	0.9221	High

Based on the data in Table 10, the results of the analysis of the N-Gain test on a small scale show an increase in the learning outcomes of grade IV students of SD Negeri Wonosari 03. The use of Happy Notes PERUGI Problem-Based Learning learning media in 6 students resulted in an N-Gain value of 0.9221 which is included in the high category. During the small-scale trial, the researcher also distributed a response questionnaire to teachers and students regarding the Happy Notes PERUGI learning media based on Problem Based Learning. The assessment instrument consists of 17 questions with an assessment system using a checklist mark (√) on Yes/No that has been provided. The data collected from the survey results was used to evaluate how effective the use of Problem Based Learning-based Happy Notes PERUGI learning media based on the classroom teacher's perspective. The results of the responses of teachers and students consisted of four criteria, namely: 82–100% (very feasible), 63–81 (feasible), 44–62% (quite feasible), and 25–43% (not feasible). The following is a recapitulation of the results of teacher and student responses to a small-scale test on Happy Notes PERUGI learning media based on Problem Based Learning.

Table 11. Results of teacher and student responses to small-scale test on Happy Notes PERUGI Learning Media Based on Problem Based Learning

Respondents	Percentage (%)	Criterion
Teachers	100	Highly feasible
Students	89.21	

Based on the results of the questionnaire of teachers and students' responses to the Happy Notes PERUGI learning media based on Problem Based Learning, it can be concluded that the learning media is suitable for use in learning. This can be proven from the number of scores obtained from the teacher's response questionnaire is 17 with a percentage of 100% and the number of scores obtained from the student response questionnaire is 89.21% with a very feasible category. The increase in learning outcomes is reflected in the success of obtaining qualifications in a subject that depends on several aspects (Sudirman, 2023). The supporting research is research conducted by Aan (2024). It showed that the Penilain in the educators' response obtained an average percentage of 88% with a very feasible category, and the response of students in a small-scale trial at SD N 1 Sidorejo obtained an average percentage of 96% with a very interesting category and a large-scale trial at SD N 3 Tekad obtained an average percentage of 92% with a very interesting category. It can be concluded that the learning media in the form of a rotary wheel that has been developed is suitable for use in the learning process.

Product Revision

After getting a recapitulation of teacher and student responses to problem-based learning-based flipbook teaching materials, the next step is to revise the product according to the results of the response. Despite obtaining perfect results, researchers realized that there were some errors in word writing. Therefore, the writer must correct words that are still written incorrectly in accordance with the General Guidelines for Indonesian Spelling.

Product Trial of the Use of Learning Media Happy Notes PERUGI Based on Problem Based Learning

After the trial in a small group consisting of 6 students in class IV A, then a large group trial was carried out involving 21 students in class IV B. At this stage, students first worked on pretest questions before learning using the Happy Notes PERUGI learning media. Then, at the end of the lesson, students will work on posttest questions to find out the changes after using the Happy Notes PERUGI learning media in learning. The effectiveness of the Happy Notes PERUGI learning media based on Problem Based Learning was measured through a comparison of pretest and posttest scores. The results of the study from a large group trial provided data on the impact of the use of Happy Notes PERUGI learning media based on Problem Based Learning energy change material on the understanding of social studies of grade IV students. The following are the results of a large group trial of class IV B on the Happy Notes P PERUGI learning media based on Problem Based Learning.

Table 12. Pretest and posttest results in large-scale tests

Type of test	Average	Average difference
Pretest	49.52	44.28
Posttest	93.80	

Based on the learning outcomes of grade IV students of SD Negeri Wonosari 03 Seamarang City, the use of Problem Based Learning-based Happy Notes PERUGI learning media showed significant development. At the pretest stage, there were 21 students who had not reached the set standards. However, after the implementation of Happy Notes PERUGI learning media based on Problem Based

Learning in the learning process, the posttest results showed an increase where 21 students managed to achieve completeness. To find out the criteria for increasing the average pretest and posttest, the N-Gain trial was carried out by comparing it with the pretest. The following are the results of the N-Gain test in a large-scale test.

Table 13. Large-scale N-Gain test results

Average difference	N-Gain	Criterion
44.28	0.8550	High

Based on Table 13 data, the results of the analysis of the N-Gain test on a large scale show an increase in the learning outcomes of grade IV students of SD Negeri Wonosari 03. Happy Notes PERUGI Problem-Based Learning learning media produced an N-Gain value of 0.8550 which is included in the high category. This is supported by the average difference between the pretest score (and posttest with a percentage of NGain reaching 85.49%) included in the high criterion. This data shows that the implementation of Problem Based Learning Happy Notes PERUGI learning media has a positive impact on improving student learning outcomes in large-scale tests. Thus, it can be concluded that the use of learning media is effective in supporting the learning process of energy change.

In addition to conducting the N-Gain test, the effectiveness and success of the Happy Notes PERUGI learning media based on Problem Based Learning in supporting the IPAS learning process can also be seen from the results of the feedback from teachers and students of grade IV B at Wonosari 03 Elementary School during the large-scale trial. The following is a recapitulation of the results of the teachers' and students' feedback.

Table 14. Results of teacher and student responses to large-scale test of Happy Notes PERUGI Learning Media Based Problem Based Learning

Respondents	Percentage (%)	Criterion
Teachers	100	Very feasible
Students	94.76	

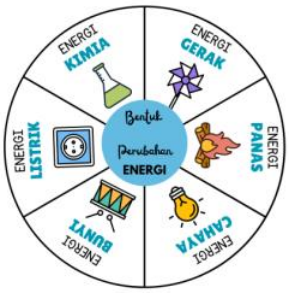
Based on Table 14, it can be concluded that the Happy Notes PERUGI media received a very good response and was suitable for use in learning IPAS energy change material. This result can be proven from the number of scores obtained from the questionnaire is one for each question, so that the score from the teacher is 100% and the score from the student is 94.76% with very feasible criteria.

Another supporting research is a study conducted by Marzuki et al. (2023) with the title The Effect of Rotary Wheel Learning Media on Science Content Learning Motivation in Grade IV Elementary School Students in Takalar Regency based on the results of the calculation of the N-Gain Score Test, showing that the average N-Gain Score for the experimental group was 66.0801% which was included in the Quite Effective category, with a minimum score of 49.12 and a maximum score of 89.13, while the control group showed an average N-Gain Score of 36.5938% with a minimum score of .00 and a maximum score of 66.67. Thus, it can be concluded that the use of rotary wheel media can increase students' learning motivation in science learning in the experimental group, while for the control group that carried out activities without treatment (treatment) was not able to increase student learning motivation.

Design Revision

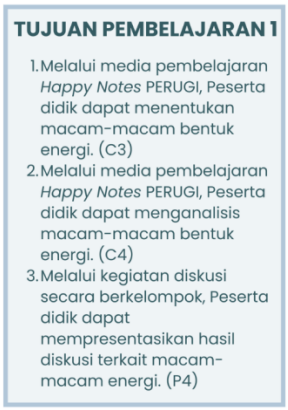
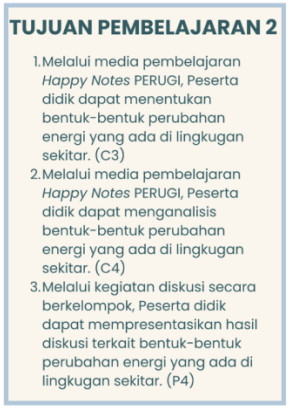
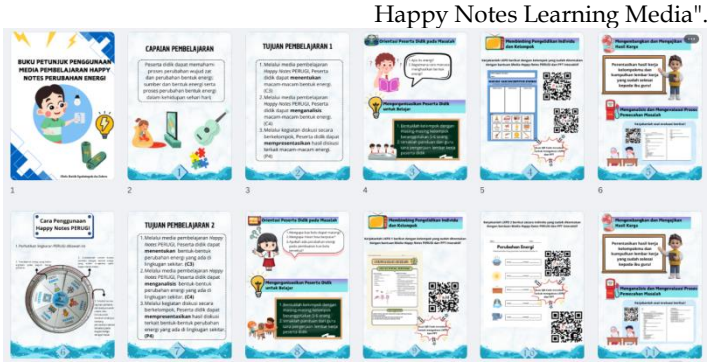
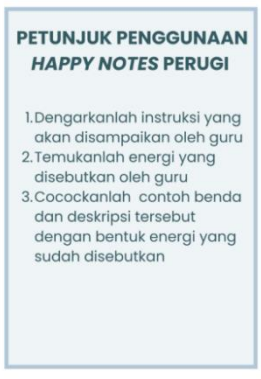
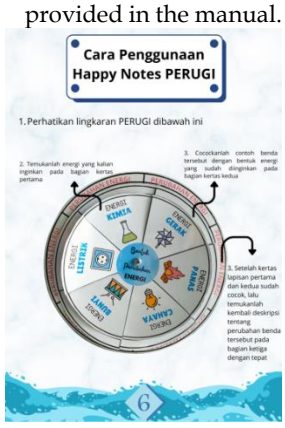
Experts also suggest that effective and fun science learning must be student-centered, namely students play an active role in the learning process (Suhartono, 2019). After receiving assessments from media experts and material experts, the researcher followed up on suggestions for improvement from media experts and material experts to optimize the learning media of Happy Notes PERUGI. This is so that the process of providing knowledge to students can take place effectively when implemented in the field. The following is a table of presentation of suggestions for improvement from media experts and material experts.

Table 15. Guidebook design on how to use Happy Notes PERUGI Learning Media Based on Problem Based Learning

Before repair	After repair
	
In this section, there are no revisions from media experts or material experts because they already contain the material that will be given to students.	
	
Before the fix, there were no keywords "sample picture" and there was no change in the picture of television and microwave.	After the improvement of the image that shows electrical energy looks ambiguous or unclear because the learning media displays images of microwaves and televisions where the image cannot be defined as electrical energy. Therefore, based on the advice of the material expert, the image was changed to Power plant and battery stone, because these two objects can generate electricity.
	
Before the fix, the words were still "... comes from energy... turned into energy..."	After the repair, the words presented looked difficult to understand. From the words "derived from the energy ... turned into energy..." changed to be better understood by students to "transform energy... into energy..."

The researcher followed up on suggestions for improvement from media experts and material experts to optimize the instruction manual for the use of Happy Notes PERUGI learning media. This is so that the process of providing knowledge to students can take place effectively when implemented in the field. The following is a table of presentation of improvement suggestions from subject matter experts.

Table 16. Guidebook design on how to use Happy Notes PERUGI Learning Media Based on Problem Based Learning

Before repair	After repair
	
It is necessary to add elements related to energy in the surrounding environment. This aims to make students interested in reading it.	The change in the title of the book, which was originally titled "Pocket Book on How to Use Energy Change Happy Notes Learning Media" was changed to "Manual for Using Energy Change Happy Notes Learning Media".
 	
Previously, the researcher did not include the PBL syntax in the manual for the use of the Happy Notes learning media PERUGI. The researcher only listed learning objectives 1 and learning objectives 2.	This gets suggestions for improvement from subject matter experts to add PBL syntax to each lesson plan. This is intended so that students and teachers can know the learning flow that has been provided in the manual.
 	
The section is less varied and there are no elements that show the paper parts	In the revised section, the researcher added elements so that it can make it easier for product users.

The Process of Developing Happy Notes PERUGIES Based on Problem Based Learning

This media development research produces a product in the form of Happy Notes PERUGI based on Problem Based Learning in Natural and Social Sciences subjects. This media was developed focusing on grade IV students of SD Negeri Wonosari 03 Semarang City on energy change material. An attractive media design that suits students' learning needs. The first step that must be taken by the researcher is to collect information about the problems that exist in Class IV of SD Negeri Wonosari 03 Semarang City, especially the subject of natural and social education. Data collection was carried out by means of observation, interviews and documentation. Based on the results of the interviews, teachers have not fully used the Problem Based Learning model. During the teaching and learning process, teachers only apply discussion, lecture, and question and answer methods. Science learning by involving students to discover and connect with real life results in a more meaningful learning experience and is stored in students' minds for longer. This has an impact on improving student learning outcomes. This is in line with the research of Herman (2015) who stated that experimental activities can encourage students to discover information about the material taught by guided inquiry guided by then Students can relate the information obtained to life. The experiments are designed to be concrete and easy to find in everyday life so that students understand the material and easily engage in the learning process.

By using the Problem Based Learning model, learning has not gone smoothly because there are still some students who do not pay attention to the material and the learning process is more teacher-centered. In addition, the problems that occur in the learning process, namely the availability of learning media, are also an obstacle for teachers in carrying out teaching and learning activities. Teachers have used learning media in the form of learning videos from YouTube, but the use of learning videos from YouTube makes students unfocused and cool themselves not paying attention to the material shown by the teacher on the projector screen. By using concrete learning media, it can increase students' motivation to learn in participating in learning. In addition, it can make it easier to understand science learning materials. Students of the research class carried out group learning activities which began with problem orientation activities in daily life around the energy material to be studied, followed by formulating problems based on illustrations, compiling provisional conjectures to answer the questions that had been formulated, conducting various variations of experiments with groups to collect data, discussing to determine the correct provisional conjecture based on the data that obtained, and the last step is to draw conclusions.

Conclusion

The results of the research and discussion related to the development of Happy Notes PERUGI learning media based on Problem Based Learning to improve the learning outcomes of fourth grade students of SD Negeri Wonosari 03 were developed through 10 stages, namely the potential and problem stages, data collection, product design, design validation, design revision, product trial, product revision, usage trial, product revision, problem production. The media developed was adjusted based on the questionnaire of the needs of teachers and fourth grade students of SD Negeri Wonosari 03. Happy Notes PERUGI learning media based on Problem Based Learning is equipped with a guidebook on how to use Happy Notes PERUGI based on Problem Based Learning, attractive images and structured material content. The learning media developed by researchers is packaged in the form of concrete media so that it attracts students' attention, makes students more active during learning, and helps students understand the material and improve their cognitive learning outcomes. The feasibility of Happy Notes PERUGI learning media based on Problem Based Learning on the material of energy changes meets the criteria of very feasible based on the results of the assessment of material experts, media experts, teacher response questionnaires and student response questionnaires. The effectiveness of Happy Notes PERUGI learning media based on Problem Based Learning on the material of energy changes is said to be effective based on the results of the pretest and posttest that have been carried out, namely experiencing an increase with the results of the N-Gain calculation meeting high criteria.

Acknowledgments

The researcher expressed his gratitude to the Principal, Teachers and Staff of SD Negeri Wonosari 03 Semarang City who had provided the opportunity during the research to run well. The researcher also expressed his gratitude to the supervisor who had guided the researcher in completing this article.

Author Contributions

The contribution of the author involved in the preparation of scientific articles consists of R.S.A.Z. (Author 1) who acts as a researcher who conducts observations at SD Negeri Wonosari 03 Semarang City which is the object of research and article writing. D.W. (Author 2) as a supervisor who has guided, evaluated, provided input and direction in the preparation of this scientific article.

Funding
This research is a research using personal funds owned by researchers.

Conflicts of Interest
Regarding the publication of this paper, the author states that there is no conflict of interest

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