Smart Box Learning Media Based on Problem Based Learning to Improve Science Environmental Learning Outcomes

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Abstract: The problems in this research are teachers' obstacles in creating concrete learning media, the problem-based learning model is less effective, and student learning outcomes are low in Environmental Science subjects. This research aims to: develop a design; test validity; and test the effectiveness of smart box learning media based on Problem Based Learning. The research method is a research and development method with a model developed by Sugiyono. The subjects in the research were media and material expert validators, students, and class V teachers at SD Negeri Wonosari 01. Data collection techniques were observation activities, interviews, document data analysis, questionnaires, validation sheets, and tests. The research results showed that the design of smart box learning media based on Problem Based Learning pays attention to the needs of teachers and students in learning activities; product validity obtained a percentage of 87.5% from media expert validators with very valid criteria and 88.75% from expert validators material with very valid criteria; and product effectiveness using the paired sample t-test, namely the calculated t result is 10.69 and the significance value is 0.00 so that there is a difference in the average pretest and posttest scores. The N-Gain test result was 0.54 with moderate criteria so that there was an increase in the average pretest and posttest scores.

Keywords: Instructional media; Learning outcomes; Problem Based Learning; Smart box

Introduction

Education is a way to develop one's potential. Law Number 20 of 2003 Chapter 1 Article 1 concerning the National Education System states that education is a process carried out by a person deliberately and in a planned manner to obtain personal potential and develop knowledge, skills and attitudes that can benefit personally, society and the nation , and country (Kemendikbud, 2003). Quality education for students to develop their potential is currently regulated in the national education curriculum, namely the independent curriculum. The independent curriculum is in line with Ki Hajar Dewantara's principles which emphasize independent learning so that students can develop independently and creatively to learn new things. Ardianti & Amalia (2022). Based on these opinions, the implementation of the independent curriculum is planned and carried out in accordance with the abilities and characteristics of students so as to create more meaningful learning.

The implementation of learning in the independent curriculum for elementary schools has experienced changes in various aspects, one of which is subjects. Natural Sciences and Social Sciences subjects in the independent curriculum are combined into Natural and Environmental Sciences. The Environmental Science subject combines the study of the science of living and non-living things in the universe and interactions with the study of the science of human existence as social

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creatures with social involvement. Suhelayanti et al. (2023). Environmental Science subjects have a reason for change because students can see everything as a whole, can develop holistic thinking about the natural and social environment, and encourage students to realize the strengthening of the Pancasila student profile (Astuti, 2022).

Environmental Science learning components to support the process of teaching and learning activities between students and teachers, namely learning objectives, learning strategies, learning materials, assessments, learning designs, learning models, learning media, learning environment conditions, and teacher competence (Suhelayanti et al., 2023). Based on these opinions, Environmental Science subjects are an important part for students to understand well by involving understanding and skills about nature and social conditions.

Environmental Science learning activities at elementary school level have not run optimally. Researchers found problems in learning activities at SD Negeri Wonosari 01, Semarang City. Based on the results of pre-research carried out by researchers using data collection methods of observation, interviews and document analysis with the source teacher of class V B, namely Muchamad Nur Sodiq, S.Pd., Gr. several problems were found. Based on observations of learning activities in class on the use of learning media used by teachers, teachers experience problems in creating learning media due to limited time to create learning media. One example of concrete learning media that has been made by teachers in Environmental Science subjects is not optimal, resulting in learning media that is made at best. Based on the results of teacher interviews, it was stated that teachers' limited time when teaching in class and the presence of work at home resulted in limited teacher time in creating learning media.

The results of observations in the Environmental Science learning process also show that the use of the problem-based learning model is less effective because students need a long time to think critically to convey opinions or solutions to problems given by the teacher. The results of the Mid-Semester Summative document analysis in the Environmental Science subject for class V B, totaling 27 students in the odd semester of the 2023/2024 academic year, were determined using the Learning Goal Achievement Criteria. The student learning results show that 6 students were declared to have completed the learning objectives with a percentage of 22% and 78% had not completed the learning objectives. Based on these problems, there needs to be a solution provided to overcome the problem.

Implementing Environmental Science learning in the classroom involves collaboration between teachers and students. Teachers as educators need to increase interactive learning in the classroom. The learning process can be interactive if communication between both parties is smooth and both teachers and students are able to communicate and receive information effectively using learning media. (Wahidin, 2015). Learning media is a tool that can support the teaching and learning process and serves to clarify the material presented so that it is hoped that learning objectives can be achieved better and more precisely (Rahmi et al., 2019).

One of the learning media that can be used in the learning process is concrete learning media. Concrete learning media for students has an impact on curiosity to understand more thoroughly and broadly the various things they obtain (Arsita et al., 2020). The use of concrete learning media provides real experience so as to build more meaningful knowledge (Carlucy et al., 2018). Concrete learning media as media that is real, clear and has a form can focus attention on the media using the five senses (Suarjana et al., 2017). Based on several opinions, the use of concrete learning media can focus students' attention using the five senses to understand more broadly, thereby providing real experience and building more meaningful knowledge.

One concrete learning media that can be used by students is a smart box. Smart box media is a box with a three-dimensional display that contains images and questions from the learning material (Sukaryanti et al., 2023). Smart boxes are media that have been modified by adapting learning materials which have several uses to improve student learning outcomes and make learning activities fun (Fauzi et al., 2022). Smart box media supports student involvement during the learning process in a direct and real way (Zuhroh et al., 2021). The benefits of smart box media in the learning process improve student learning outcomes, foster a pleasant learning environment, increase creativity, and be more focused on learning (Fauzi et al., 2022; Harnanto, 2016). The advantages of smart box media are that it is more visually attractive for students by seeing the display of images and colors, students can easily understand the material, and simplifies the explanation of learning material by the teacher (Sukaryanti et al., 2023). Based on several opinions, the smart box has a box shape with three dimensions as a medium that has been modified to suit the learning material.

The requirements for making smart box learning media can be viewed from educational, technical and aesthetic requirements. The educational requirement is that the smart box media is adjusted to the learning objectives and benchmarks for student development

achievements. The technical requirements are that the smart box media is adjusted to the shape and size, usability, material safety and ease of use. The aesthetic requirements are that the smart box media has a color combination, harmonious size, and the media is easy for students to carry (Nurfadilah et al., 2021).

The criteria for smart box learning media can be reviewed in terms of content quality and objectives, instructional quality, and technical quality. The quality of the content and objectives, namely completeness, interest, interest and suitability of students. Instructional quality is usefulness for students and teachers in the learning process. Technical qualities, namely media appearance, ease of use, and readability (Arsyad, 2017). Based on these opinions, making smart box learning media needs to pay attention to educational requirements, technical requirements, aesthetic requirements, quality of content and objectives, instructional quality, and technical quality.

Developing smart box learning media during the learning process can be done by applying the learning model in the classroom. The learning model is used by teachers in learning activities systematically to facilitate the achievement of learning objectives (Putri et al., 2018). One learning model that can be applied is Problem Based Learning.

The Problem Based Learning model is a learning process that begins with the presentation of problems that are related to students' real lives (Suari, 2018). Problem presentation is presented from unstructured problems because structured problems can reduce students' cognitive involvement. Problems based on factual events can be linked by students to solve problems with joint strategies (Ansarian & Lin, 2018). The syntax of the Problem Based Learning model is orienting students to problems, organizing students to learn, guiding individual and group investigations, developing and presenting work results, and analyzing and evaluating the problem solving process (Ariyana et al., 2018). Based on these opinions, the Problem Based Learning model encourages students to find ways to learn to solve problems they face.

The development of learning media and the application of the Problem Based Learning model during the learning process can have an impact on student learning outcomes. The learning process occurs when students can apply learning media and models well so that learning outcomes can be achieved (Astiti et al., 2021). Learning outcomes are used to assess whether someone has learned or not. These learning outcomes are divided into three domains, namely psychomotor relating to a person's capacity to demonstrate motor skills, cognitive relating to the ability to think, and affective relating to a person's feelings, attitudes and

personality (Parwati et al., 2019). Based on several opinions, learning outcomes are results that are possessed or obtained after going through a learning process to assess knowledge, attitudes and skills.

The focus of this research is based on problems regarding learning media, learning models, and student learning outcomes that are not yet optimal, so a solution is needed to overcome these problems by developing concrete learning media in the form of smart box media by applying the Problem Based Learning model in improving student learning outcomes.

Previous research conducted showed that smart box media obtained media validation test results of 87.7%, one to one test results of 88.7%, small group phase test results of 96.7%, and test questions completed by students of 80.3% (Sukaryanti et al., 2023). Other research findings show that the level of media success can be seen from before media use at 56.77% and after media use at 94.19% with a learning completeness level from media use at 37.42 (Harnanto, 2016).

Other research also shows that the learning outcomes at the first meeting were 61.5 and at the second meeting were 79.2. The results of media experts were 86.3%, material experts were 82.6%, and media acceptance questionnaires from students were 97% (Fais et al., 2019). Based on the results of previous research, the use of smart box learning media can improve student learning outcomes. This research aims to: develop a smart box learning media design based on Problem Based Learning; test the validity of smart box learning media based on Problem Based Learning; and test the effectiveness of smart box learning media based on Problem Based Learning. Therefore, researchers are interested in conducting research with the title "Smart Box Learning Media Based on Problem Based Learning to Improve Environmental Science Learning Outcomes for Class V".

Method

The research method used is the research and development method. The research and development model used is a model developed by Sugiyono with the steps: potential and problems; data collection; product design; design validation; design revision; product trials; product revisions; usage trials; product revisions; and mass production (Sugiyono, 2022).
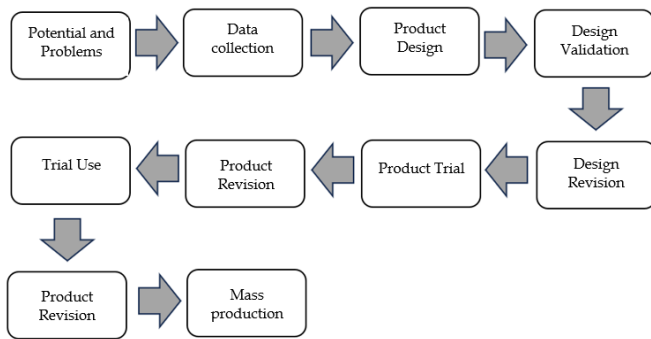
Figure 1. Research and Development Steps

Table 1. Media and Material Expert Validation Result Criteria

Percentage (%)	Criteria
81.26 – 100.00	Very valid
62.51 – 81.25	Fairly valid
43.76 – 62.50	Not valid
25 – 43.75	Invalid

Table 2. Criteria for Teacher and Student Response Results

Percentage (%)	Criteria
76 – 100	Very good
51 – 75	Good
26 – 50	Not good
0 – 50	Very not good

The independent variable used is smart box learning media based on Problem Based Learning. The dependent variable used was the environmental science learning outcomes for class V. The subjects in the research used were class V students at SD Negeri Wonosari 01, class V teachers at SD Negeri Wonosari 01, and media and material expert validators. The data collection technique used is that at the pre-research stage there are observation activities, interviews, teacher and student needs questionnaires, document data analysis, and validation sheets.

The research stage uses data collection techniques using test and non-test techniques. The test technique used is giving pretest questions before using the product and giving posttest questions at the end after using the product. The non-test technique used is giving teacher and student response questionnaires after using the product.

The data analysis used in the research is product data analysis, initial data and final data. The formula used for product data analysis consists of product validity testing and teacher and student responses are presented in formula (1) (Purwanto, 2020). The data results are converted according to the validation criteria of media and material experts and the results of teacher and student responses are presented in Table 1 and Table 2 respectively.

Initial data analysis uses a normality test to determine whether the pretest and posttest data are normally distributed or not. The use of the normality test with SPSS uses Shapiro Wilk because the number of research samples is <50 with reference to a significance value of 0.05 (Quraisy, 2020). The testing criteria for the normality test are based on a significance value < 0.05, so the data is not normally distributed and a significance value > 0.05, then the data is normally distributed (Priyatno, 2018).

$$NP = \frac{R}{SM} \times 100 \tag{1}$$

Final data analysis used a test of differences in the average pretest and posttest of students in paired samples with the same subjects, but who experienced different treatment on normally distributed data. The average difference test uses a paired sample t-test by comparing the calculated t value with the t table and a significance value of 0.05 in data analysis in Microsoft Excel. The testing criteria for the paired sample t-test are based on a significance value < 0.05, then Ho is rejected and Ha is accepted and a significance value > 0.05, then Ho is accepted and Ha is rejected. The testing criteria for the paired sample t-test are based on the calculated t value < t table, then Ho is accepted and Ha is rejected and the calculated t value > t table means Ho is rejected and Ha is accepted (Priyatno, 2018).

Final data analysis used the pretest and posttest average increase test to determine the effectiveness of the product before and after treatment using the N-Gain test with Microsoft Excel. The formula used for the N-Gain test is presented in Formula 2 (Lestari & Yudhanegara, 2015). The results of the data converted according to the N-Gain value criteria are presented in Table 3.

$$N - Gain = \frac{Posttest\ Score - Pretest\ Score}{SMI - Pretest\ Score} \tag{2}$$

Table 3. N-Gain Value Criteria

N-Gain Value	Criteria
N-Gain ≥ 0.70	High
0.30 < N-Gain < 0.70	Medium
N-Gain ≤ 0.30	Low

Result and Discussion

Research and development of smart box learning media based on Problem Based Learning in Environmental Science subjects, material on environmental problems due to natural factors and

human actions, was carried out in class V of SD Negeri Wonosari 01, Semarang City.

Smart Box Learning Media Design Based on Problem Based Learning

The learning media developed by researchers uses a model developed by Sugiyono (2022). The steps used can be explained as follows.

Potential and Problems

Researchers found potential and problems through the pre-research stage by carrying out observation, interviews and data analysis of document data on learning outcomes of class V B students at SD Negeri Wonosari 01. Researchers found problems related to teachers' obstacles in creating concrete learning media due to time constraints, based on learning models The problem is that learning activities are not implemented effectively, and the Mid-Semester Summative Environmental Science learning outcomes for the 2023/2024 academic year of students are low because there are only 6 students who have completed the learning objectives out of 27 students.

The choice of smart box learning media based on Problem Based Learning is in accordance with the potential and problems that occur in class V B of SD Negeri Wonosari 01 because according to Piaget's learning theory, it is explained that the development of students' thinking stages emphasizes concrete thinking to abstract thinking. (Rachmawati & Daryanto, 2015). This research is related to things that happen and are in accordance with the surrounding conditions by using concrete or real objects. The function of learning media is used to describe something concrete into abstract (Ambarwati et al., 2021; Budiyono, 2020; Rahma et al., 2023). Messages or information in smart box learning media based on Problem Based Learning can be understood well by students by providing direct experience.

Edgar Dale's cone of experience also serves as a guide to facilitate students' learning experience (Arsyad, 2017). In this research, knowledge can be gained through direct experience or indirectly through artificial objects. Smart box learning media based on Problem Based Learning as a concrete learning media involves students using the five senses. Based on these potentials and problems, researchers created learning media that are used to teach Environmental Science subjects and help students learn.

Data collection

Researchers collected the latest data collected from research theory, previous research results, and distributed questionnaires regarding teacher and student needs as information in developing products.

Figure 2. Initial Product Design: (a) Landslide Mockup; (b) Pocket Board Games Cause Environmental Problems; (c) Landslide Simulator Experiment; (d) Polluted Water Puzzle Game; (e) Polluted Water Puzzle Game; and (f) Smart Box Learning Media Based on Problem Based Learning

Teacher and student needs questionnaires need to include criteria for selecting learning media. The criteria for selecting learning media must be in accordance with the learning objectives and materials, learning strategies used, characteristics of students, learning media equipment, student needs, costs, quality of media, materials and learning conditions of students (Kisworo, 2017).

Based on the results of the questionnaire on the needs of teachers and students in class V at SD Negeri Wonosari 01, it shows that: (1) students need interesting learning media, (2) the material is presented in smart box learning media based on Problem Based Learning, (3) the material is appropriate to their achievements. learning and learning objectives, (4) the media display is attractive, colorful and bright, (5) the media is easy to use, (6) the language used is easy to understand, and (7) the materials used are easy for students to carry.

Product Design

At this stage the researcher designs the media design based on the results of the teacher and student needs questionnaire analysis. Learning materials are adapted to the development of learning media based on learning outcomes and set learning objectives. The main material used is cardboard. The product design is printed in the form of a poster on A4 paper size (21 cm x 29.7 cm) using ivory paper. The smart box learning media based on Problem Based Learning has five displays, namely (1) landslide model, (2) pocket board game that causes environmental problems, (3) landslide

simulator experiment, (4) polluted water puzzle game, and (5) water pollution experiment. The output of this learning media is in the form of blocks containing pictures, games and experiments related to environmental problems due to natural factors and human actions as shown in Figure 2.

Design Validation

Design validation is carried out by assessing the media design in the form of a discussion. Product validation is carried out by conducting an assessment from a team of experts (media and material expert validators) to assess Problem Based Learning-based smart box learning media. Product validation is carried out by media and material expert validators by assessing the validation sheet to test product validity using a Likert scale with a score of 1 (very bad), score 2 (not good), score 3 (good), and score 4 (Very good). Media and material expert validators give tick marks according to the assessment aspects given. Media and material expert validators provide criticism and suggestions for learning media design.

Design Revision

Researchers received criticism and suggestions from media and material expert validators as input for making design improvements. Criticism and suggestions from material expert validators include adding numbering to each display to make it easier to use smart box learning media based on Problem Based Learning as shown in Figure 3.

| (a) | (b) | (c) | (d) | (e) | (f) |

Figure 3. Product Design Revision: (a) Landslide Mockup; (b) Pocket Board Games Cause Environmental Problems; (c) Landslide Simulator Experiment; (d) Polluted Water Puzzle Game; (e) Polluted Water Puzzle Game; and (f) Smart Box Learning Media Based on Problem Based Learning

Product Trial

In this research, product trials were carried out by selecting 6 students in class V A of SD Negeri Wonosari 01. The sampling technique was purposive sampling by considering certain factors. Product trial activities are carried out with students using the product to find out product deficiencies and filling out teacher and student response questionnaires to the product. Assessment of

teacher and student response questionnaires using the Guttman scale with a score of 1 (yes) and a score of 0 (no). The results of the teacher and student response questionnaire to Problem Based Learning-based smart box learning media are presented in Table 4.

Table 4. Results of Teacher and Student Response Questionnaires for Product Trial

Response	Total Score	Percentage (%)	Criteria
Teacher	10	100	Very good
Learners	60	100	Very good

The total score of the teacher response questionnaire is 10 out of a total score of 10 with a percentage of 100% in very good criteria. The total score on the student response questionnaire is 60 out of a total score of 60 with a percentage of 100% on very good criteria.

Product Revision

Product revision is carried out by making improvements to the product based on the results of product trials. However, from the results of product trials and questionnaires, teacher and student responses to learning media do not need to be revised and can be continued at the next stage, namely trial use.

Trial Use

In this research, a trial of use was carried out by all students in class V B at SD Negeri Wonosari 01, totaling 25 students. The sampling technique is saturated sampling by selecting the entire sample. At this stage, before learning activities, students work on pretest questions first, followed by learning activities using the product, and after learning activities, students work on posttest questions. Teachers and students fill out response questionnaires to learning media.

Product Revision

Product revisions are carried out to make product improvements based on the results of use trials. However, from the results of use trials and questionnaires, teacher and student responses to learning media do not need to be revised.

Mass Production

The final product in this research did not go through the mass production stage due to time constraints and this media was not used by a wider range of educators. Based on the results of the smart box learning media design based on Problem Based Learning, the main material used is cardboard. The product design is printed in the form of a poster on A4 paper size (21 cm x 29.7 cm) using ivory paper. Problem Based Learning-based smart box learning media has five displays, namely (1) landslide model, (2) pocket board game that causes environmental problems, (3) landslide simulator experiment, (4) polluted water puzzle game, and (5) water pollution experiment. The output of this learning media is in the form of blocks containing pictures, games and experiments related to environmental problems due to natural factors and human actions so that it can be used as an Environmental Science learning medium in class V of SD Negeri Wonosari 01, Semarang City.

Data analysis

Validity of Smart Box Learning Media Based on Problem Based Learning. The expert team (media and material expert validators) in this research were lecturers from the Elementary School Teacher Education study program, Faculty of Education and Psychology, Semarang State University, to carry out assessments on the media and material validation sheets. The results of the validity of smart box learning media based on Problem Based Learning are presented in Table 5.

Table 5. Product Validity Results

Expert Validator	Total Score	Percentage (%)	Criteria
Media	70	87.50	Very valid
Material	71	88.75	Very valid

The results of the media expert's assessment were 70 out of a total score of 80 with a percentage of 87.5% in very valid criteria. The results of the material expert assessment were 71 out of a total score of 80 with a percentage of 88.75% in very valid criteria. Criticism and suggestions from the product validity test results include adding numbering to the learning media display to make it easier to use the product. Product validity analysis from the results of media and material expert validator sheets to determine whether the validated product is valid or not (Akbar, 2022; Maduratih & Bakhtiar, 2024; Nurasih et al., 2022).

The assessment indicators on the media validation sheet have shown educational, technical and aesthetic aspects (Nurfadilah et al., 2021). Smart box learning media based on Problem Based Learning is in accordance with learning objectives, material safety, ease of use, and attractive media appearance. The material in this learning media has aspects of content quality and objectives, instructional quality, and technical quality (Arsyad, 2017). Smart box learning media based on Problem Based Learning is in accordance with the completeness of learning materials with learning outcomes and learning objectives, language that is easy to understand, and the quality of material presentation.

Analysis of teacher and student responses is also used as supporting data for product validity testing. The results of the analysis of teacher and student responses in the trial use are presented in Table 6. The results of the teacher's response to the use trial were 10 out of a total score of 10 with a percentage of 100% having very good

criteria. The results of student responses in the usage trial were 242 out of a total score of 250 with a percentage of 96.8% having very good criteria.

Table 6. Results of Questionnaire Responses from Teachers and Students in Usage Trial

Response	Total Score	Percentage (%)	Criteria
Teacher	10	100	Very good
Learners	242	96.8	Very good

Research that supports product validity shows media expert validity test results of 80.56% and material expert validity of 81.25% in the valid category (Sulaedah et al., 2022). Other supporting research shows media expert validation results of 100% and material expert validation of 95.7% in the very good category. The practicality of the media shows results of 100% and the results of student response analysis are 99% (Afiana et al., 2023). Based on the results of product validity analysis from media and material experts, it can be concluded that smart box learning media based on Problem Based Learning, material on environmental problems due to natural factors and human actions in class V in elementary schools, is very valid for use in learning activities.

Effectiveness of Smart Box Learning Media Based on Problem Based Learning

The effectiveness of smart box learning media based on Problem Based Learning was tested using the average difference test and the average increase test. Before carrying out this test, a normality test is carried out. In this study, the Shapiro Wilk test was used because the number of samples was less than 50(Quraisy, 2020). The results of the normality test are presented in Table 7.

Table 7. Normality Test Results for Pretest and Posttest Values

Learning outcome	Statistic	df	Sig.
Pretest	0.95	25	0.26
Posttest	0.92	25	0.06

The results of the normality test on the pretest value using Shapiro Wilk showed a significance value of 0.258 > 0.05 and the posttest value showed a significance value of 0.055 > 0.05. Based on these data, it can be concluded that the pretest and posttest scores have normal distribution data.

Researchers continued to the next stage, namely testing the difference in average pretest and posttest scores. The average difference test uses parametric statistics in the paired sample t-test on normally distributed data. The results of the paired sample t-test are presented in Table 8.

Table 8. Paired Sample T-Test Test Results Pretest and Posttest Values

Parameters	Pretest	Posttest
Mean	50.2	76.2
Variance	369.75	173.5
Observations	25	25
Pearson Correlation	0.780422187	
Hypothesized Mean Difference	0	
df	24	
t Stat	-10.68894387	
P(T<=t) one-tail	6.58657E-11	
t Critical one-tail	1.71088208	
P(T<=t) two-tail	1.31731E-10	
t Critical two-tail	2.063898562	

The results of the calculation of the average difference test in the usage trial show the results of t count > t table (10,689 > 2,060) and a significance value < 0.05 (0,000 < 0.05). Based on the results of the paired sample t-test, it shows the average difference in the pretest and posttest results of students before and after using smart box learning media based on Problem Based Learning.

Researchers continued to the final stage, namely testing the increase in the average pretest and posttest scores. Test the average increase using the N-Gain test. The N-Gain test results are presented in Table 9.

Table 9. N-Gain Test Results Pretest and Posttest Values

Learning outcomes	Number of Students	Average	Score N-Gain	Criteria
Pretest	25	50.2	0.54	Medium
Posttest	25	76.2		

The average increase test results show an N-Gain score of 0.535545 in the medium criteria. Smart box learning media provides opportunities for students to be involved with learning media directly so that it can help students feel the same stimulation and learning goals. (Krismawati et al., 2021). Based on the results of the average increase, the use of smart box learning media based on Problem Based Learning can increase the effectiveness of the learning experience so that it can produce good learning results.

Student learning outcomes in Environmental Science subjects are not only measured by knowledge abilities. However, students' psychomotor abilities can also be observed in the learning process. The psychomotor domain of students in Environmental Science subjects is related to science process skills. Science process skills are a learning process related to nature that involves the process of discovering theories,

principles and concepts (Ismail, 2023). The science process skills of elementary school students are basic science process skills (Sayekti & Kinasih, 2017).

Basic science process skills include observing, measuring, classifying, predicting, inferring, and communicating (Ismail, 2023). Based on the results of observations in the learning process using smart box learning media based on Problem Based Learning, basic science process skills have been carried out by students, namely students observe how landslide models work, cards with pictures of environmental problems, and puzzle pictures of polluted water; students group cards with pictures of environmental problems into pockets that cause environmental problems due to changes in nature or human activity; students carry out landslide and water pollution simulator experiments to predict the impacts; and students communicate the results of the experiment through presentation activities.

Based on the results of the product effectiveness analysis, it can be concluded that the smart box learning media based on Problem Based Learning is effectively used in the learning process to improve learning outcomes in Environmental Science subjects for class V students at SD Negeri Wonosari 01.

Conclusion

Smart box learning media based on Problem Based Learning uses the main material used, namely cardboard. The product design is printed in the form of a poster on A4 paper size (21 cm x 29.7 cm) using ivory paper. The smart box learning media based on Problem Based Learning has five displays, namely landslide model; pocket board game that causes environmental problems; landslide simulator experiment; polluted water puzzle game; and water pollution experiment. The output of this learning media is in the form of blocks containing pictures, games and experiments related to environmental problems due to natural factors and human actions. Smart box learning media based on Problem Based Learning obtained a percentage of 87.5% from media expert validators with very valid criteria and 88.75% from material expert validators with very valid criteria. Smart box learning media based on Problem Based Learning on student learning outcomes shows an average difference using the paired sample t-test on the calculated t result of 10,689 and a significance value of 0,000 so there is a difference between the pretest and posttest scores. The results of the N-Gain test for smart box learning media based on Problem Based Learning were 0.535545 with moderate criteria so that there was an increase in the average pretest and posttest scores. Therefore, smart box learning media based on Problem Based Learning is effective in improving

environmental science learning outcomes for class V at SD Negeri Wonosari 01.

Author Contributions
Maryana as the first author played a role in collecting data, creating smart box learning media based on Problem Based Learning, conducting data analysis, and conducting research at SD Negeri Wonosari 01, Semarang City. Desi Wulandari as the second author played a role in providing input on research results and guiding the research.

Conflicts of Interest
We declare that as the authors of this article we have no interests involved with anyone, either institutions or individuals. We as authors in this article are part of reporting research activities and contributions to science.

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