Developing Problem-Based Learning Flipbook Media to Enhance Natural Sciences Education in Fifth Grade

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Abstract: The lack of diverse learning media was a factor that impacted student understanding, resulting in low learning outcomes. This study aimed to develop a problem-based learning (PBL) flipbook on environmental damage content as a media for science education in fifth-grade elementary. The research utilized the ADDIE model. The study used two classes: one experimental class with 22 students and one control class with 20 students. Data collection instruments included questionnaires and tests. The results indicated that the PBL flipbook media was highly suitable and effective for supporting science learning in fifth grade. Media experts validated the flipbook and rated it in the qualified category with a score of 93%, meaning that the media emphasizes presentation according to the target; the supporting presentation was interesting; the learning presentation was appropriate; the language used was appropriate; and the cover design and content were interesting. Content experts validated the flipbook and rated it in the very suitable category with a score of 91%, which means that the content was presented following the learning objectives; the content was presented appropriately; there were appropriate presentation supporters; the language used was appropriate and the level of language was appropriate for students; and appropriate learning syntax. The average user response was 91%, meaning that the flipbook content was presented appropriately; the flipbook was easy to use; the language level was appropriate, the flipbook was interesting; the flipbook was useful; and the learning steps were appropriate. The effectiveness of PBL-based flipbooks in improving students' understanding of the content was indicated by the results of the Sig (2-tailed) 0.01 t-test, meaning that there were significant differences in learning outcomes between experimental and control classes after treatment.

Keywords: flipbook; learning media; problem-based learning

Introduction

Natural sciences was one of the subjects that many students complain about and is considered a difficult subject to understand (Rizqi et al., 2023). This was caused by internal and external factors. Internal factors such as interest and motivation, while external factors such as many foreign terms, extensive content, limited learning media, and monotonous learning activities (Efendi & Putri, 2022; Rahmah & Harahap, 2024). The use of appropriate learning media can help students to easily understand the learning content (Arisandhi et al., 2023). Teachers were not only required to be able to teach but also to adapt to technology, such as skillfully facilitating students in learning by using relevant learning media (Kilag et al., 2022; Mursidi et al., 2022). However, in its implementation, the use of technology-based learning media in elementary schools was still not maximized (Arisandhi et al., 2023; Bakhri, 2023; Rahma, Harjono, & Sulistyo, 2023). Research showed that the use of digital learning media could help improve student

learning outcomes (Afifa & Astuti, 2024; Ramadanti & Bektiningsih, 2023).

The results of the Trend in International Mathematics and Science Study (TIMSS) study of fourth grade students in 2015 showed that Indonesia was ranked 44th out of 47 participants. The average score achieved by Indonesian fourth grade students was 397, while the international average score was 500 (Martin et al., 2016). Thus, it was known that the science literacy skills of fourth grade students in Indonesia are categorized at a low level. The results of observations made in the VA class of an elementary school in Ngaliyan Semarang, in the natural sciences learning activities showed that there were several problems that occured. One of the problems was the lack of use of interactive and varied learning media. In the learning process, the media used usually limited to textbooks from the government and teaching module, and sometimes uses sources from the internet. This causes some students to focus easily distracted because students quickly feel bored with books that contain a lot of writing and are less interactive.

The existence of these problems led to a lack of student understanding, which resulted in low student learning outcomes in the natural sciences subject content. Based on the natural sciences learning results in the odd semester of 2023/2024, was known that 9 out of 27 students or 33% of students scored below the learning objective completeness criteria. On the other hand, school facilities were adequate and supported technology based learning such as projectors, computer labs, and wifi networks. However, teachers did not maximized learning by utilizing digital technology in developing media due to limited time and the large workload of teachers. Teachers felt that the learning media currently used, namely textbooks and module, were less effective because the natural sciences subject matter was quite broad and complex, so interactive learning media was needed and could improve student learning outcomes. One of the efforts that could be made to overcome these problems was to use interactive learning media such as flipbooks.

The use of learning media had stimulated students' thoughts, motivation, and interests, so that it can support the achievement of learning objectives (Nurdyansyah, 2019). Various learning resources both conventional (print) and digital (non-print) had been needed to support the learning process (Damasanti & Nuroh, 2023). Flipbook was one of the innovations of books and digital technology (Agustina & Fitrihidajati, 2020). Flipbook included a type of digital-based multimedia that could be accessed through various gadget devices such as cellphones, laptops, and computers (Sumartini, 2022). Flipbook were equipped with a navigation feature so that users could open each page like a printed book. The advantages of flipbooks, besides being able to load text, could also load images, audio, video and links (Aperta & Amini, 2021; Ula et al., 2023). Thus, flipbooks became interactive multimedia that could be utilized in learning activities, thus creating learning that was interesting and not monotonous.

One of the platforms that could be used to create flipbooks was Issuu. Issuu was a digital platform that could convert documents in various formats, such as pdf, word, powerpoint, or others into digital book publications (Ananda et al., 2023). The Issuu platform could be accessed through the website www.issuu.com. In addition to learning media, learning models were also important to consider. Improving student learning outcomes could be achieved with methods, strategies, or learning models and supported by learning media (Hasbulloh et al., 2022). Learning media will provide maximum results if in its application it used a supportive learning model (Endaryati et al., 2023). One of the learning models that could be used was the problem-based learning (PBL) model. PBL was a learning model that used problems as stimuli to increase knowledge, understanding, and encourage students to find solutions to these problems (Ainun & Maryati, 2024; Sofyan et al., 2017).

The use of problem-based learning-based flipbooks as learning media had been widely applied, and has received good responses from students and teachers in various subjects and various levels of education. Previous research revealed that flipbooks based on problem-based learning were feasible and effective in science subjects (Hardiansyah & Mulyadi, 2022; Hasbulloh et al., 2022). Other findings also revealed that PBL-based flipbooks have a significant effect on critical thinking skills (Endaryati et al., 2023; Rohmatin et al., 2022). Likewise, other studies had shown a significant increase in student learning outcomes after using flipbooks (Bunari et al., 2024; Nurhamidah et al., 2023).

A review of previous research demonstrated the feasibility, effectiveness, and significant learning outcome gains associated with flipbook learning media. Based on identified problems and relevant theories, this study purposed the development of PBL-based flipbook as a potential solution. The researchers developed a problem-based learning flipbook to enhance student learning outcomes in the context of environmental damage content for natural sciences lessons. This research offered novelty by focusing on fifth grade at elementary school in Ngaliyan, Semarang. The development process utilized the Issuu platform for the flipbook itself. Additionally, the flipbook integrated explanatory YouTube videos, wordwall-assisted quiz questions, and quizizz-assisted evaluation questions. This research and development project aimed to produce problem-based learning media flipbooks on

environmental damage content, determine the feasibility of problem-based learning media flipbooks on environmental damage content, and determine the effectiveness of problem-based learning media flipbooks on environmental damage content to improve student learning outcomes.

Method

This research employed the type of research and development. The development model used was the ADDIE model which consists of five stages, namely analysis, design, development, implementation, and evaluation (Winaryati et al., 2021). The research scheme was illustrated in Figure 1.
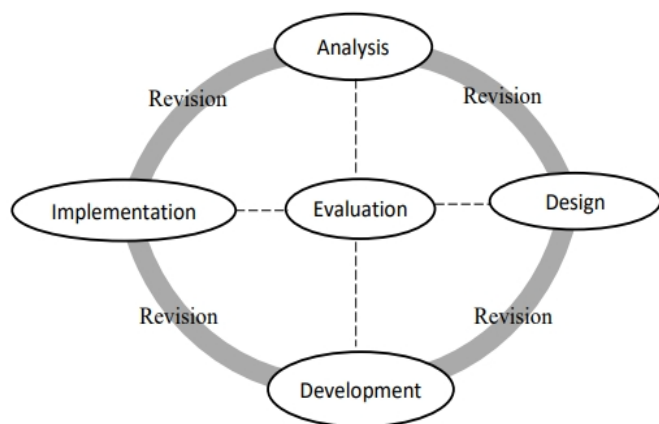

Figure 1. ADDIE model diagram

This research was conducted in the even semester of the 2023/2024 school year in class V of an elementary school at Ngaliyan, Semarang. The subject population in this study consisted of four parallel classes with a total of 110 fifth grade students, and the samples were taken from two classes totaling 42 students. Sampling was done by *purposive sampling* technique, not completely randomized because previously there was already a class division. The research data used came from teachers, students, and expert lecturers. The types of data used are qualitative and quantitative data. Data collection used test and non-test techniques. The test techniques were with pre-test and post-test, while the non-test techniques were with observation, interview, questionnaire, and documentation.

The first stage of the research was analysis, researchers identified problems and analyzed needs based on data obtained through interviews and needs questionnaires. The needs analysis questionnaire used the grids in Table 1.

Second, in the design stage, researchers had designed learning media based on the results of problem identification and the needs analysis questionnaire of teachers and students. Researchers had collected

reference sources of learning contents, illustrative images, and designed the concept of learning media design. The design and illustrative images were created using the Canva application. Furthermore, the design results were converted into flipbooks by uploading on the Issuu platform. The flipbook media development was also equipped with learning videos uploades to the YouTube platform, quizzes made using Wordwall, and evaluations that utilize Quizizz.

Table 1. Teacher and Student Needs Analysis Questionnaire Grid (Milama et al., 2023)

Aspects	Total
Student characteristics in natural sciences learning	5
Availability of learning media	5
Knowledge about flipbook	3
Learning methods and models	4
Flipbook media development based on problem based learning (pbl)	3

Third, during the development stage, the researcher developed the design by combining the drafts that had been made, then the product validation test was conducted by experts to determine the feasibility of the product that has been developed. The expert validation sheet used guidelines that could be seen in Table 2 and Table 3, and employed a 1-5 Likert scale assessment criteria (Sugiyono, 2017) which can be seen in Table 4.

Table 2. Lattice of Content Expert Validation Instrument (Milama et al., 2023)

Aspects	Total
Content eligibility	12
Feasibility of learning presentation	11
Linguistic appropriateness	7
Problem-based learning model	5

Table 3. Media Expert Validation Instrument Grid (Milama et al., 2023)

Aspects	Total
Presentation feasibility	7
Linguistic appropriateness	3
Graphics feasibility	18

Table 4. Validation Assessment Criteria (Milama et al., 2023)

Score	Percentage (%)	Criteria of validity
1	0-20	Revision required
2	21-40	Less
3	41-60	Fair
4	61-80	Valid
5	81-100	Advanced

Fourth, at the implementation stage, researchers conducted a test of flipbook learning media. This test employed a *quasi-experimental pretest-posttest control*

group design method. The experimental class used VA class with 22 students, and the control class used VC class with 20 students. The implementation stages involved administering pretests to both classes, followed by implementing learning with PBL-based flipbook media in the experimental class. The control classes did not use flipbook media. Finally, posttests were administered to both classes. To determine the effectiveness of the media, researchers conducted a quantitative analysis based on the average difference with the independent sample t-test and N-gain test using SPSS version 20. Decision making was based on the guidelines in Table 5 and Table 6.

Table 5. Criteria for Interpretation of Independent Samples T-Test Results (Muhid, 2019)

Results	Interpretation	Conclusion
Significance < 0.05	H0 rejected	There is a significant difference
Significance > 0.05	H0 accepted	There is no significant difference

Table 6. Criteria for Interpretation of N-Gain Results (Supriadi, 2021)

Score	Criteria
N-Gain < 0.3	Low
0.3 ≤ N-Gain < 0.7	Medium
N-Gain ≥ 0.7	High

Fifth, an evaluation had been conducted to evaluate the development that had been carried out and to find out the user's response to the learning media that had been developed. User responses to the media were seen based on teacher and student response questionnaires with the grids in Table 7.

Table 7. Teacher and Student Response Questionnaire Grid (Istiqomah et al., 2022)

Aspects	Total
Ease	2
Freedom	3
Accuracy of content	2
Attractiveness	2
Expediency)	4

Result and Discussion

Result

The results of this development research were learning media in the form of problem-based learning (PBL) based flipbooks on environmental damage content. Research and development was conducted using the ADDIE model with five stages, namely analysis, design, development, implementation, and evaluation. At the analysis stage, researchers conducted teacher interviews and provided a needs questionnaire to collect information data related to problems in learning. Information obtained through interviews shows that there were problems, namely the lack of a variety of learning media to support natural sciences learning, teachers who tended to often use textbooks and worksheets. In addition, there were also students whose scores had not reached the completeness criteria. Furthermore, the results of the teacher and student needs questionnaire show that teachers and students needed innovative learning media to support natural sciences learning. Through the analysis of the results of interviews and questionnaires, information was also obtained on learning outcomes that needed to be developed, student characteristics, and student learning outcomes. Thus, the results of this analysis stage could be used as a reference for designing the products needed in the next stage.

The second stage focused on design. Researchers designed products based on the analysis stage results. Here, researcher determined learning objectives and content adapted to those objectives. Also designed the flipbook media, including layout and color scheme. Canva was used to create a draft layout and write the content. Additionally, the flipbook incorporated YouTube explainer videos, practice quizzes made with Wordwall website, and evaluation questions through Quizizz. The developed learning media included sections for: 1) cover, 2) preface, 3) instructions, 4) PBL information, 5) table of contents, 6) learning objectives, 7) concept map, 8) PBL contents and activities, 9) learning videos, 10) quiz, 11) summary, and 12) evaluation. Finally, the design results were converted into flipbook by uploading them on the Issuu platform (www.issuu.com). This stage produced a draft flipbook media design, which was then assembled the next stage.
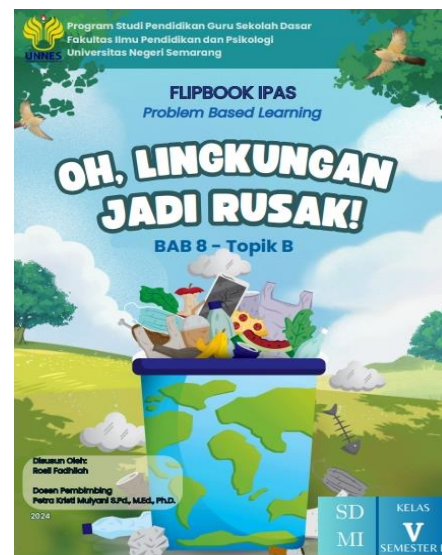

Figure 2. The cover of flipbook media

The third stage was development. The researchers prepared a draft of PBL-based flipbook learning media, which then validated by content and media experts (lecturers) to determine the feasibility. Figure 2 display the final results of the flipbook media development. The results of the assessment from these experts was showed in Tabel 8. These validation results were then used to improve and refine the PBL-based flipbook media draft before the test. The development process cluminated in a final product: a PBL-based flipbook on environmental damage content. This flipbook can be accessed via the link

https://issuu.com/roslifadhilah/docs/rev3_flipbook_ kerusakan_lingkungan_kelas_v.

Table 8. Recapitulation of Content and Media Validation Results

Validation	Score (%)	Criteria
Content	91	Advanced
Media	93	Advanced
Average	92	Advanced

In the implementation stage, a test was conducted using the *quasi experimental pretest-posttest control group design* method. The experimental class consisted of the VA class with 22 students, and the control class consisted VC class with 20 students. The implementation stages involved giving pretests to both classes, implementing learning with PBL-based flipbook media in the experimental classes, while the control classes did not use flipbook media. Finally, posttests were administered to both classes. The results of the pretest and posttest can be seen in Table 9 and Table 10.

Table 9. Experiment Class and Control Class Pre-Test Score Results

Class	Number of students			Pre-Test
		Mean	Min	Max
Experiment	22	61.45	40	84
Control	20	62.80	32	84

Table 10. Experimental and Control Class Post-Test Score Results

Class	Number of students			Post-Test
		Mean	Min	Max
Experiment	22	86.36	72	100
Control	20	77.40	60	96

Next, an independent sample t-test was conducted for the pretest, and a difference test was administered for the posttest. Before administering the posttest difference test, an independent sample t-test was conducted first to determine the initial ability of the control and experimental classes. The results of the independent

sample t-test based on the experimental and control class pretest are shown in Table 11.

Table 11. Pretest Independent Sample T-test of Experimental and Control Classes

Test	Results	Decision
Normality	Experiment = Sig. 0.47	H0 accepted
	Control = Sig. 0.13	
Homogeneity	Sig. 0.35	H0 accepted
Independent	t_{count} = 0.29	H0 accepted
Sample test	df = 40	
	t_{tabel} = 1.68	
	Sig. 0.77	

The results of the normality test conducted in the experimental class obtained a significance of 0.47 and for the control class of 0.13. These results were greater than α (0.05) so that H0 was accepted, and it could be interpreted that both data were normally distributed. Furthermore, the homogeneity test obtained a significance of 0,352 which means it was greater than α (0.05), so H0 was accepted and the data was homogeneous. In the independent samples t-test conducted, t_{count} = 0.29 which was smaller than t_{tabel} = 1.68. The probability value reached a significance of 0.77 which was greater than α (0.05). This shows that there was no significant difference between the experimental class and the control class so it can be said that the classes were balanced or had the same initial ability.

Furthermore, to determine the effectiveness of using PBL-based flipbook learning media in improving student learning outcomes on environmental damage content, an effectiveness test was conducted. Previously, a prerequisite tests were conducted which included normality and homogeneity tests. Details of the prerequisite test results and effectiveness test are shown in Table 12.

Table 12. Prerequisite Tests and Effectiveness Tests

Test	Results	Decision
Normality	Experiment = Sig. 0.24	H0 accepted
	Control = Sig. 0.26	
Homogeneity	Sig. 0.05	H0 accepted
Independent	t_{count} = 2.90	H0 accepted
Sample test	df = 40	
	t_{table} = 1.68	
	Sig. 0.01	
N-Gain	Experiment = 0.68	Medium
	Control = 0.42	Medium

Based on the effectiveness test conducted, it could be seen that the prerequisite test was fulfilled because the data was normally distributed and homogeneous. Furthermore, the independent samples t-test resulted in a t_{count} was greater than t_{tabel}, and the significance value was 0.01 which was less than 0.05. Therefore, it can be

concluded that there was a significant difference between the experimental class and the control class. This was supported by the difference in the average N-Gain results, which showed that the experimental class had an N-Gain was 0.68, while the control class had an N-Gain of 0.4197. The average increase or N-Gain of the two classes fell into the medium category, but there was a difference in N-Gain of 0.26.

The next stage was evaluation, which involved responses and input from students and teachers. The results of the response questionnaire showed that the experimental class teachers and students gave a very good average score of 91%, which could be seen in Table 13.

Table 13. Results of Teacher and Student Responses

Response	Score (%)	Criteria
Teacher	92	Very good
Students	90	Very good
Average	91	Very good

Discussion

The final result of this research and development was a problem-based learning flipbook media on environmental damage content for grade V elementary school. The PBL-based flipbook media developed proved to be very feasible and effective in supporting the learning of natural sciences in grade V elementary school. This flipbook media was developed based on the results of analyzing teacher interviews and student needs in the VA class of an elementary school at Ngaliyan Semarang, which showed that it needed interactive digital learning media to support learning. In learning activities, everything could be used as a medium or intermediary to support the learning process, with a note that the media could facilitate and streamline the learning process (Cahyadi, 2019). Good learning media could present abstract concepts to be easily understood. (Rahayu et al., 2022). The use of learning media could stimulate students' thoughts, motivation, and interest, so that it could support the achievement of learning objectives (Nurdyansyah, 2019). Various learning resources both conventional (print) and digital (non-print) were needed to support the learning process (Damasanti & Nuroh, 2023). After going through the learning process, students got changes that were referred to as learning outcomes, both in terms of knowledge, skills, and attitudes (Rusydi Ananda & Hayati, 2020). One of the factors that influenced learning outcomes was the use of learning media (Astiti et al., 2021).

One of the efforts that could be made to support the achievement of learning objectives and improve learning outcomes was using learning media, as well as utilizing digital technology. In the VA class of an elementary school at Ngaliyan Semarang, it had been shown that students were enthusiastic in participating in learning activities using digital media. When learning activities were supported using digital learning media, learning became more interesting and effective. This was because the teaching media was not only in the form of text and images but also used videos. Therefore, research could be conducted on the development of digital learning media such as PBL-based flipbooks to support natural sciences learning in grade V of an elementary school at Ngaliyan Semarang. Flipbooks are digital media that have been effectively used in learning and can improve student learning outcomes (Arrum & Nurdyansyah, 2023; Wulandari & Nurharini, 2023; Yulianti et al., 2023). Learning media would provide maximum results if in its application it used a supportive learning model (Endaryati et al., 2023). One of them was the problem-based learning (PBL) model, which was a learning model that uses problems as stimuli to increase knowledge, understanding, and encourage students to find solutions to these problems (Sofyan et al., 2017). PBL-based flipbook media was found to be feasible and effective for use in science subjects (Hasbulloh et al., 2022).

The flipbook developed in this study utilized environmental damage content by combining text, images, videos, and quizzes to make it more interesting. Additionally, the learning activities in the flipbook employed a problem-based learning model. The feasibility of the PBL-based flipbook media was determined based on several factors, including the results of expert validation by content and media expert, media trials, and user response results from teacher and students. Based on the validation results from content and media experts, the PBL-based flipbook media developed in this study demonstrated highly feasibility with an average validation value of 92%.

Content expert validation was conducted by assessment several aspects: suitability of content with learning outcomes, accuracy of content, presentation techniques, supporting presentation, presentation of learning, use of language (straightforward, communicative, interactive, in accordance with student development, and in accordance with Indonesian language rules), and the completeness of problem-based learning syntax. Based on the expert assessment, the flipbook media contained content that aligned with the learning outcomes on the theme used in the study. The suitability of the content with learning outcomes, and integration with other aspects of media development indicators, certainly affected the achievement of the learning objectives themselves. Previous research revealed that the suitability of content with learning objectives could facilitate teachers and students in achieving learning objectives (Landina & Agustiana,

2022; Panjaitan et al., 2022; Paramita et al., 2019). Appropriate and well-integrated contents could affect the success of the learning process (Dewi et al., 2022). By achieving the learning objectives, students demonstrated their understanding or competence.

Media expert validated the flipbook based on several aspects: presentation support; presentation techniques; learning presentation; use of communicative language appropriate student development, and in accordance with Indonesian language rules; and cover design and interesting content. The media experts assessment revealed that the PBL-based flipbook effectively utilized presentation support in the form images, videos, and quizzes. The cover and content were also designed attractively to engange students. The existance of presentation supporters and attractive designs in the form of images, videos, and quizzes can attract students' attention in learning. The use of images that are relevant to the content and aligned with the students' characteristics could attract students' attention to learning using flipbook (Yuliawati et al., 2022). Flipbook could contain videos to increase students' mastery of the learning content (Arisandhi et al., 2023; Susiliastini & Sujana, 2022). Utilizing Wordwall-assisted quizzes could also attract students' interest in learning (Khoirurosyadah & Rachmadyanti, 2022; Sutiana et al., 2024). Thus, it can be seen that PBL-based flipbook learning media could increase student interest or motivation to learn. In addition, PBL-based flipbook could encourage interactive learning. The suitability of using language and communicative sentences in flipbook media could make it easier for students to understand the content. This aligns with previous research that revealed that media should be compiled by paying attention to the arrangement of sentences that are easy to understand (Paramita et al., 2019).

The effectiveness of flipbook media was seen from student learning outcomes on the posttest which had increased after using PBL-based flipbook media. The results of the effectiveness test based on the independent samples t-test obtained a Sig value $0.01 < 0.05$, thus indicating a significant difference in posttest results between the experimental and control classes. Reinforced by the N-Gain results in the experimental class of 0.68 which was greater than the control class which was 0.42. The N-Gain results in both classes fell in the medium category, but there was a difference of 0.26. In the experimental class, learning with PBL-based flipbook media was applied. While in the control class, learning was applied without flipbook media. After the test was conducted, posttest results were obtained which showed that the average of the experimental class was higher than the control class. Thus, it can be concluded that PBL-based flipbook media was proven to improve student learning outcomes. The findings of this study

were reinforced by the findings of previous studies which showed a significant increase in student learning outcomes after using flipbooks (Bunari et al., 2024; Nurhamidah et al., 2023). PBL-based flipbooks were found to be feasible and effective for supporting learning and had a significant effect on critical thinking skills (Endaryati et al., 2023; Rohmatin et al., 2022).

The results of student and teacher response questionnaires to the use of PBL-based flipbooks were also very good, with an average of 91%. This meant that they srongly agreed to use learning media in the form of flipbooks, especially for environmental damage content. The assessment of teachers and students was seen from various things: accuracy of content; ease; use of language; attractiveness; usefulness; and accuracy of learning steps. The accuracy of the content, ease of access, and the usefulness of learning media and other indicators were aspects that needed to be considered so that learning media could be appropriate during the learning process.

The implications of this research were that it could add to the variety of available learning media that were feasible and can be used by teachers, students, schools, and parents as learning media both offline and online. Teachers had additional teaching resources, especially on environmental damage content. Teachers could have create flipbook media online through the collaboration of Canva and Issu applications, making them easy and flexible to use. There was a limitation of this study in that the number of research subjects used was only 42 students, with details of 22 students in the experimental class and 20 students in the control class. The results of this study did not represent the effectiveness of flipbooks on improving the learning outcomes of elementary school students at large. In addition, there were obstacles during the research. Namely during the test process in the experimental class, three students were distracted by other applications on their cellphones. When the teacher was careless in supervising students and class control was less controlled, the three students took advantage of the opportunity to open other games on their cellphones even though they had been reminded not to open other applications that were not needed in learning activities. The study be an evaluation content for further research. Suggestions for these limitations were to further optimize class mastery as well as technical constraints such as networks, and expand the research subjects so that the research results could better represent the influence of flipbooks on the learning outcomes of elementary school students.

Conclusion

Based on the results of the data analysis and interpretation, it was concluded that the problem-based learning flipbook media product on environmental damage content was very feasible to use as an alternative learning media and had been effective in improving the learning outcomes of VA class students elementary school at Ngaliyan Semarang. Media experts validated the flipbook and rated it in the qualified category with a score of 93%, meaning that the media emphasizes presentation according to the target; the supporting presentation was interesting; the learning presentation was appropriate; the language used was appropriate; and the cover design and content were interesting. Content experts validated the flipbook and rated it in the very suitable category with a score of 91%, which means that the content was presented following the learning objectives; the content was presented appropriately; there were appropriate presentation supporters; the language used was appropriate and the level of language was appropriate for students; and appropriate learning syntax. The average user response was 91%, meaning that the flipbook content was presented appropriately; the flipbook was easy to use; the language level was appropriate, the flipbook was interesting; the flipbook was useful; and the learning steps were appropriate. The effectiveness of PBL-based flipbooks in improving students' understanding of the content was indicated by the results of the Sig (2-tailed) 0.01 t-test, meaning that there were significant differences in learning outcomes between experimental and control classes after treatment. The findings of this study indicated that problem-based learning-based flipbook media could be a very feasible and effective choice for improving student learning outcomes, especially in natural sciences subjects on environmental damage content. Further research had been done to develop problem-based learning flipbook media that was more in line with the characteristics of students and other topics.

Author Contributions
Rosli Fadhilah contributed to conducting research, developing the product, analyzing data, and writing the article. Petra Kristi Mulyani served as the advisor in the research and writing activities.

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