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Development of Interactive Flipbook-Based E-Books Through Problem Based Learning Models to Improve Science Learning Outcomes in Elementary Schools

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Abstract: This R&D research refers to the Borg and Gall model which aims to develop and test the feasibility and effectiveness of an E-Book in the form of an interactive flipbook based on Problem Based Learning. The population in the study consisted of 5 small-scale test subjects from class VB and 20 large-scale test subjects from class VA. Data collection techniques use test and non-test techniques in the form of observation, questionnaires, interviews and document data. Validation results by material and media experts show that the product meets the very valid criteria with percentages of 90.23% and 92.17%. Based on the test results, it is known that the product developed is effective in improving student learning outcomes as shown by the average increase of 53 to 81 and the N-Gain test results obtained a gain value of 0.61 (medium). Based on the results of the questionnaire, the responses distributed were very positive from teachers and students. From these results, it is concluded that the E-Book in the form of an interactive flipbook based on PBL is effective for improving science and science learning outcomes and is suitable for use in the learning of class V students at SDN 2 Banjaran.

Keywords: E-Book; Flipbook; IPAS learning outcomes; Problem based learning model

Introduction

In life, education is a basic need that takes place continuously as a step to build humans (Akareem &; Hossain, 2016). A quality education system is essential in building an intelligent and ethical generation (Sihaloho et al., 2023). Without education, humans will have difficulty preparing themselves to face significant changes in the times (Destiniar, 2018). A good education system is built from several functionally interrelated components including educators or teachers, students, educational institutions, educational goals, community and religious leaders, parents, and educational content (Koerniantono, 2019). One of the subjects in the independent curriculum that has an important contribution in developing student competence is a combination of science and social studies subjects which become Natural and Social Sciences (IPAS) (Amali et al., 2019). IPAS learning emphasizes the importance of student development in solving problems and finding their own understanding so as to develop students' concepts and knowledge (Sugih et al., 2023).

In facing current developments, it is necessary to update the implementation of science and science learning, especially at the elementary school level, so that it can keep up with the demands of the times. Teachers have an important impact because it will affect the thinking process of students along with the times (Nieto-Márquez et al., 2020). Teachers are also encouraged to be able to develop learning components such as teaching materials that are more flexible and practical in today's digital age (Paramitha et al., 2023). Digitization around the world has a major impact on learning aspects throughout the world (Subari et al., 2022). This change is followed by advances in science and technology (IPTEK) which demands digital transformation of developments through technology (R. Saputra et al., 2023). The application of digital learning

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in education poses challenges especially for developing countries to improve human capital and infrastructure (Aditya, 2021).

Science learning supported by the use of technology will make learning more effective than conventional learning. The use of diverse technology in learning will make students feel easier and more enthusiastic in understanding and exploring the concept of the material because they feel interested when learning it (Anggraeny et al., 2020; Singh, 2016). The use of digital devices by children is increasing as the 21st century advances (López-Escribano et al., 2021). The rise of digital learning and the rise of affordable devices provide convenience for the younger generation who are accustomed to using digital devices (Lilian, 2021).

To support the technology-based learning process, it is necessary to improve the quality of the use of digital teaching materials, one of which is by creating an Electronic Book or E-Book (Humairah, 2022). This is because adequate teaching materials will be able to complete, maintain, and enrich the learning process (Santoso et al., 2018). E-Books can make it easier for students to learn independently so that students can learn according to their abilities and can meet the competencies that students must master (Dirgatama et al., 2017). The use of interactive flipbooks can be arranged according to the sequence of procedures in the Problem Based Learning learning model. This learning model meets the requirements to be implemented along with the demands of the times in implementing the independent curriculum. Students will be directed through flipbooks to exchange information and solve problems so that students' critical thinking skills automatically improve (Yuristia et al., 2022).

The implementation of learning cannot be separated from the use of teaching material components (Komalasari et al., 2019). Teaching materials are content that must be mastered by students through learning activities by being developed and modified according to the needs of learning activities to support the quality of learning (T. Wulandari et al., 2018). Teaching materials created according to the needs and characteristics of students and teachers and in accordance with the curriculum will increase interactive communication in learning (Cynthia et al., 2023). One of the teaching materials that can be developed is non-printed teaching materials or electronic teaching materials. Electronic books can be used as learning tools that are arranged for learning activities inside and outside the classroom with digital displays so as to make the learning process more interactive and fun (Yulaika et al., 2020). E-Book has a systematic form of presentation, both from the use of language and the breadth of the scope of the material discussed.

Using E-Books will make it easier for students to browse and read each material, reduce paper usage, and load multimedia content so that learning can be more interesting (Yulia Aftiani et al., 2021). Unlike printed textbooks, the E-Book will display images, audio, animation, and video so that it will create a learning experience that gets more information (Aziz et al., 2019). E-Books offer various benefits and are considered more attractive to the younger generation than paper books (Merga, 2015). According to Mifsud et al. (2021) A well-designed digital book will have higher benefits than a printed book.

One type of electronic book that can be used as a teaching material that is more innovative and more flexible is flipbook. Digital flipbooks are teaching materials that can be used in the science and science learning process in elementary schools (Setianingrum et al., 2022). Flipbook will display classic animations that look as if they were composed of sheets of paper like stacks of books (Humairah, 2022). Flipbooks can increase students' enthusiasm and desire to learn because they are designed creatively and innovatively so that they will have a positive impact on student learning outcomes (Hardiansyah & Mulyadi, 2022). Interactive flipbooks will facilitate students and teachers in learning and teaching activities so that they can achieve the set goals (Lestari & Nur, 2023).

The use of flipbooks as teaching materials is one form of innovation to encourage the learning process to be interactive (Paradise et al., 2023). Another advantage of flipbooks is that students or teachers can access through smartphones or laptops widely unlimited space and time (Brenda et al., 2023). The development of e-books in the form of flipbooks must be effective, valid and practical in order to become quality digital open materials as learning resources in schools (Nurmasyitah et al., 2022). The development of flipbooks supports in learning because it is not only written, but also included with action, video and audio, thus enabling immersive and non-monotonous teaching materials (Erna et al., 2021).

This excellence is a smart innovation to create learning with a new and interesting atmosphere and interactive so as to improve student learning outcomes (Mukarromah et al., 2021). IPAS learning supported by technology, including the use of visuals in flipbooks, is one of the alternative solutions to support learning in the technological era (Lakapu et al., 2023). Flipbooks have the potential to improve students' reading skills which will have an impact on students' final grades. Making interactive flipbooks into teaching materials is done by using appropriate applications for developing digital teaching materials such as Microsoft Word, Canva, and Heyzine Flipbook Website.

There are various factors that affect the completeness or absence of student learning outcomes, one of which is the selection of learning models (Suratno et al., 2023). In order for learning to be maximized, teachers not only integrate interactive flipbooks, but teachers need to choose learning models that attract students' learning interests (Kristiana et al., 2022). The learning model used must also have an influence in activating student participation during learning (Yunitasari & Hardini, 2021). One of them is by using a learning model that requires students to find concepts from the inquiry process that are able to stimulate students' higher-order thinking when facing situations that are oriented to a real problem or known as the Problem Based Learning (PBL) model (Wajdi et al., 2022).

Problem-based learning (PBL) has been widely adopted in various educational fields and contexts to encourage critical thinking and problem-solving in authentic learning situations (Yew & Goh, 2016). Problem Based Learning can maximize students' ability to learn according to the curriculum because it will be implemented based on real and comprehensive problems (Hosniyah et al., 2023). The Problem Based Learning model has syntax or steps that must be carried out sequentially in learning, including: orientation or introduction of students to problems; organizing students to learn; guiding individual and group investigations; develop and present the work; analyze and evaluate the problem-solving process (Vera & Astuti, 2019).

The Problem Based Learning model is an innovative model to invite students to actively solve problems through the scientific process (Kristi & Andriani, 2023). However, the implementation of this model requires a lot of time and requires teacher competence that is able to encourage student performance in groups so that each member interacts with each other. Selection of open materials and inappropriate learning models will have an impact on students' passivity in learning because they are boring and less motivating (Damayanti & Yohandri, 2022). Because meaningful learning will have an influence on improving student learning outcomes.

But in fact, based on the results of pre-research conducted by researchers through interviews, observations, and documentation, there are several problems that occur in science learning at SD Negeri 2 Banjaran. The first problem is that student learning outcomes in science subjects have not been optimal. This can be seen from the formative test scores in each scope of material in science subjects that have not reached the predetermined KKTP score, which is 75. This problem is due to the limited time given during learning, so that the delivery of material is not optimal. So that it is necessary to transform the implementation of education with learning activities that are not limited in space and time (Kholid, 2020). Student learning outcomes are closely related to the abilities of teachers. Teachers with good competence will make the quality of education and graduates of an education become quality (Mukhtar et al., 2020). Teachers must innovate learning so that the quality of education in schools can improve (Saputra et al., 2019). For more data on formative test results for science subjects, please see diagram 1.

Based on data obtained by researchers in the pre-research process by documenting the learning outcomes of class V students, the following results were obtained: first, the learning outcomes of class V students in science subjects were still low; secondly, in the Odd Mid-Semester Summative Score (STS) for science subjects in class V, there are 20 students, of which 12 students (60%) have not completed the KKTP and 8 students (40%) have completed the KKTP; third, in the formative assessment of Science and Technology Scope 1 Material "Seeing because of Light, Hearing because of Sound" students got an average score of 70, Scope 2 Material "Harmony in Ecosystems" students got an average score of 71, Class 3 Student Scope Material "Magnets, Electricity and Technology for Life" received an average score of 70. The following is a diagram of the science learning results for class V of SD Negeri 2 Banjaran for the 2023/2024 learning year:

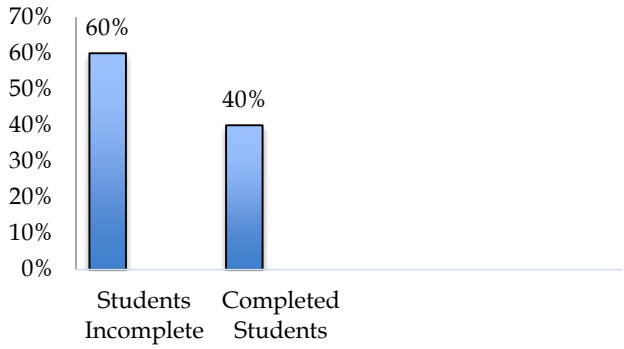

Figure 1. Diagram of the results of learning completeness of students in Class V science subjects SD Negeri 2 Banjaran

The learning resources used by class V at SD Negeri 2 Banjaran are still limited. The teacher said that when the learning process was only sourced from the teacher's companion book and students at school without any other supporting learning resources. Learning resources that are less attractive and not in accordance with student needs cause low levels of student participation in teaching and learning activities which have an impact on low student learning outcomes. Even though quality learning resources can be used to support and facilitate the learning process (Anwar & Wibawa, 2019). Another problem is also the use of teaching materials contained

in teacher and student companion books, the content of science lessons has not been varied, so it does not attract students to be active in learning. Class teachers use more of the help of image media in books, such as in learning science material on the properties of light. Even though elementary school students' reading books should present a lot of text, images, and colors as well as videos to increase student attractiveness so that it can stimulate students' reading desire in learning (Gogahu & Prasetyo, 2020).

Researchers also found problems in the selection of learning models used, which are still teacher-centered or Teacher-Centered Learning (TCL). Teachers still seem dominant in delivering material during the learning process in class so that interaction with students is less than optimal. The learning paradigm should be changed from teacher-centered to student-centered so that problems in learning can be resolved (Permatasari et al., 2019). So, it is necessary to use an interactive and innovative learning model so that students are more active in learning.

There are several studies that have been conducted before that have succeeded in proving that digital teaching materials or e-books in the form of flipbooks can increase student interest and learning outcomes. Such research conducted by Rusdiana et al. (2022) proves that interactive E-Book media has effectiveness in encouraging the improvement of student learning outcomes in grade V elementary school in science learning which is characterized by increasing student independence and student interest in the learning process. Similar research concluded that the attractive E-Book developed was effective with an increase of 92.59% accompanied by providing motivation for students to learn more enthusiastically so that student learning outcomes could increase (Lieung et al., 2021).

Research according to Aswirna et al. (2020) said that the discovery learning-based E-Book can be used effectively and practically in physics learning in class X MAN 2 Padang by obtaining an average score of 80.89% on science literacy skills. In line with the results of research by Katarina (2023) that there are differences in student learning interest between before and after using digital flipbook media based on the Project Based Learning (PjBL) learning model. The use of E-Books in the form of E-Fip PDF based on Problem Posing assisted by scamper creative ideas at SMA Negeri 1 Nanga reached an effectiveness rate of 82.75% with very effective criteria (Rino et al., 2022).

Based on the problems found and information from previous research, the solution that can be done to overcome these problems is for researchers to carry out research and development of digital teaching material products in the form of E-Books in the form of interactive flipbooks using the Learning Learning Model (PBL) which has never been done before. Research like this needs to be carried out because the product being developed will be used by SDN 2 Banjaran students, especially class V, as a learning resource to support science learning. Apart from that, the discoveries obtained from the development of electronic book products which are packaged in e-book form in the form of interactive flipbooks will reduce students' difficulties in acquiring science knowledge specifically on the water cycle material. Because teaching material products packaged in the form of e-books in the form of interactive flipbooks can attract students' attention so that they can increase students' interest in studying science. Science is a subject that has a wide range of material so students need teaching materials that summarize the material in one idea in the form of an interactive flipbook so that students will learn more easily and independently. The findings can also be used by teachers as a basis for creating quality digital teaching materials.

E-Books in the form of interactive flipbooks will be compiled based on the Problem Based Learning (PBL) model to help students develop their thinking, problem solving, and intellectual skills independently (Sari et al., 2021). Therefore, the purpose of this study is to develop and validate E-Book products in the form of interactive flipbooks, and test or prove the effectiveness of interactive flipbook e-book products based on problem-based learning (PBL) learning models to improve science learning outcomes in elementary schools.

Method

The type of research used is Research and Development or R&D, namely: develop products in the form of digital teaching materials, e-books in the form of interactive flipbooks based on the Problem Based Learning (PBL) learning model for grade V students of SD Negeri 2 Banjaran. According to Sugiyono (Sari & Queen, 2021) Research and Development is a method used in research to validate, develop a product or perfect an existing product, or that can be accounted for. The model used in this study is 8 steps out of the 10 steps of the Borg and Gall development model. This is in accordance with opinion Wulandari et al. (2023) that development research using the Borg and Gall development model at the undergraduate education level can be carried out in several stages.

The steps of development research according to Sugiyono (2019) can be seen in Figure 1. According to Sugiyono (2019) potential means everything that has added value if utilized. Meanwhile, problems have the meaning of the difference between the results that occur and what was expected. A problem can be overcome by conducting research and development so that an

integrated and effective solution can be found to overcome the existing problem. After knowing the latest and factual potential and problems, information collection and literature review are then carried out as a basis for making plans to create products that are expected to overcome the problems. To create new and quality products, product design is needed so that deficiencies in the teaching materials can be identified.

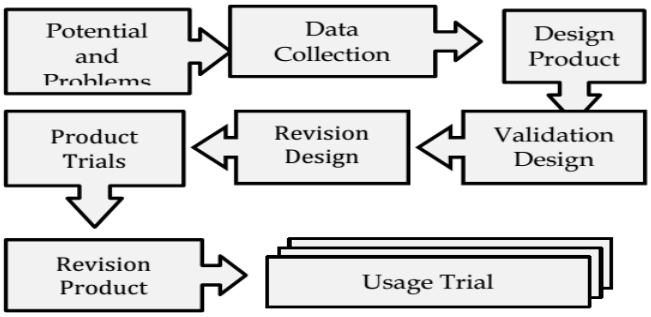

Figure 2. Research and development (R&D) model modified from Borg and Gall

Design validation has the meaning of an activity process that aims to provide a rational assessment of how effective the product design being developed is. The assessment was carried out rationally because design validation was obtained based on rational thinking and not based on facts in the field. Validation of the design of the product being developed is carried out by discussing with experts or experts who already 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 provide an assessment of the design so that the advantages and disadvantages of the product that has been developed will be known.

After designing the product to be made, the product will then be validated through discussions with experts so that the shortcomings of the product will be known. Next, design improvements are made to reduce product deficiencies. Researchers will be tasked with making improvements that will create quality products. Product designs that have been made cannot be given directly to students, but must be made first, a finished product, and tested. Product trials can be carried out by conducting product trials, namely to determine the level of effectiveness and practicality of digital teaching materials. In small-scale or limited product trials, researchers will experiment with using an E-Book in the form of an interactive flipbook. Testing on this small-scale group aims to find out that the product turns out to have better quality from the improvement process. Furthermore, after the product trial was declared successful and there were not too many improvements, the product created in the form of an E-Book in the form of an interactive flipbook could be applied in broader conditions and scope.

The type of data used in this research process is quantitative data and qualitative data. The data collection techniques used in this research are non-test techniques and technical tests. Non-test techniques are obtained from interviews, observations, questionnaires and document data. Meanwhile, test techniques are obtained from the results of pretest and posttest work by students (Princess & Slamet, 2021). In this interactive flipbook-shaped E-Book development research, the questionnaire used aims to obtain development needs analysis data. Questionnaires are also given to validators to test and obtain data whether it is feasible or needs to be revised again. In addition, questionnaires are also given to educators and students as users of the developed flipbook-shaped E-Book. The data collection instrument used is the item of the E-Book feasibility test questionnaire in the form of an interactive flipbook. The instrument grid in this study can be seen in Table 1, Table 2, Table 3, and Table 4.

Table 1. Feasibility Assessment Instrument Grid by Material Experts

Aspects	Item Number
Content eligibility	1, 2, 3, 4, 5, 6, 7, 8, 9, 10
Language eligibility	8, 9, 10
Eligibility of presentation	11, 12, 13, 14
Suitability of images to material	15, 16, 17, 18

Table 2. Grid of Feasibility Assessment Instruments by Media Experts

Aspects	Item Number
Content aspect	1, 2, 3, 4, 5
Language aspect	6, 7, 8
Presentation aspect	9, 10, 11, 12, 13, 14
Aspects of Use	15, 16

Table 3. Teacher Response Instrument Grid

Aspects	Question Number
Technical quality and presentation of the material	1, 3, 4, 5
Presentation of material	2, 6, 8, 9, 11, 12, 7, 10
Language and readability of the material	13, 14, 15

Field trial subjects totaled 5 students taken in class 5B while operational trial subjects amounted to 20 students of grade 5A SD Negeri 2 Banjaran. The data analysis of the validation results of media experts and material experts by finding the average score of the assessment from validators with the following equation 1 (Kamaladini et al., 2021).

$$NP = \frac{R}{SM} \times 100\% \quad (1)$$

Scoring in validation uses the criteria presented according to Sugiyono in Table 4 (Borg, 2024).

Table 4. Expert Validation Rating Scale

Alternative Answers		Score
Excellent	(SB)	4
Good	(B)	3
Enough	(C)	2
Less	(K)	1

A media can be declared feasible or valid for use in the learning process if it has the "Good" criteria, while the score conversion can refer to the assessment score criteria in Table 5 next (Sari & Queen, 2021).

Table 5. Product Eligibility Categories

Percentage (%)	Criterion
76 - 100	Very worth it
51 - 75	Proper
26 - 50	Pretty decent
0 - 25	Less decent

The results of the teacher and student response questionnaire are responses to users E-Book in the form of an interactive flipbook, in this study were teachers and students of grade V SD 2 Banjaran. The data analysis used is the N-Gain test. The N-Gain test is conducted with the aim of comparing the improvement of student learning outcomes from before (pretest) and after (posttest) using E-Book in the form of an interactive flipbook So that the difference in student learning outcomes in the pretest and posttest can be known (Fidarti & Nurharini, 2023). In the variable of learning outcomes, the magnitude of the increase in student learning outcomes can be measured using the Gain value equation proposed by Kamaladini et al. (2021) as equation 2.

$$N\text{ - }Gain = \frac{\text{Score Posttest} - \text{Score Pretest}}{\text{Score Ideal} - \text{Score Pretest}} \quad (2)$$

Then the N-gain obtained is converted to the gain criterion of knight (Kamaladini et al., 2021) in the table 6.

Table 6. Gain Criteria of the Knight

N-Gain Value	Criterion
N-gain ≥ 0.70	Very worth it
0.30 < N-gain < 0.70	Proper
N-gain ≤ 0.30	Pretty decent

Result and Discussion

E-Book Development Process in the Form of an Interactive Flipbook Based on a Problem Based Learning (PBL) Model

This research is development research that aims to produce products. The result of this study is a E-Book in the form of an interactive flipbook based on the Problem Based Learning (PBL) learning model for SD/MI class V. This digital teaching material will support and make it easier for students to better understand the learning material taught by the teacher precisely on the water cycle material. In line with the statement (Mahendri et al., 2023) that the use of flipbook-based E-Books will make learning more innovative, creative, and informative because in it there are images, text, and videos so that students find it easy to carry out the learning process. The development used is R&D (Research and Development) using this development research model adapted from the development of Borg and Gall which is limited to several stages adapted to the needs of researchers, namely potential and problems; data collection; product design; design validation; design revision; product trials; product revision; and trial use.

Potential and Problems

Research departs from the existence of problems that are utilized into potential through Researvh and Development (R&D). Based on the results of the pre-study, several problems were found from the factors of teachers, students, and learning resources. Odd Mid-Semester Summative (STS) Score for the science subject for class V students which has a total of 20 students, of which 12 people (60%) have not completed the KKTP and 8 people (40%) have completed the KKTP. Though good student learning outcomes will be the basis in determining the results of student change, both from increasing knowledge, skills, and attitudes (Riwahyudin, 2015). The use of learning resources in grade V SD Negeri 2 Banjaran is still limited and less varied, only using teacher and student companion books at school without any other supporting learning resources. According to Hamid et al. (2021) Teaching materials that are practical and not monotonous will increase students' attractiveness to learn. The learning model used by teachers is still teacher-centered or Teacher-Centered Learning (TCL). This will make students become less active, dare not express their opinions and feelings, have a low mentality, and are not critical (Firmansyah & Jiwandono, 2022).

Data Collection

The collection of various data and information is carried out by researchers, namely by using questionnaires that spread the needs of teachers and students to the desired learning resources. Based on the results of data collection, it is known that those used in the learning process contain material whose content is not extensive. The teaching materials available in schools are not sufficient for material needs. Teachers need additional learning device innovations to increase

students' insight into the water cycle material. The development of teaching materials using technology is expected to help students understand the material taught. The integration of technology requires teachers in 21st century education to replace the implementation of traditional learning with more modern learning tools (Sari & Atmojo, 2021).

Teachers need teaching material products that are in accordance with learning outcomes and learning objectives so that the learning process can be more meaningful to students. Teaching materials will be equipped with text, images, videos, E-LKPD through liveworksheets, and evaluation questions through multiple-choice quizizz. The use of interactive teaching materials will be able to create quality learning and be able to meet the needs of students with their learning characteristics. The sizes and fonts used in the text of digital teaching materials are made clear so that they are easy to read and understand by students. According to Permatasari1 et al. (2019) the selection of cover design, suitability of images and illustrations, as well as attractive font types and sizes will reflect the quality of the teaching materials.

Product Design

In the second stage, researchers design digital teaching material products to be developed. In this case, the resulting product is an E-Book in the form of an interactive flipbook based on the Problem Based Learning (PBL) learning model which can be used as interactive teaching materials. The teaching materials developed can be used independently by students and can be accessed online and offline using mobile phones or laptops. Product design is designed with learning outcomes and learning objectives in mind. E-Books in the form of flipbooks are arranged with components consisting of writing, video, audio, and images according to student characteristics. E-Books in the form of flipbooks are created by collecting materials and starting to create designs through Microsoft Word and Canva. The results of the material and design that have been prepared will be inserted on the heyzine platform for the addition of audio, images, and video. The final product will be stored on the web and can be shared with students in the form of a link, so it requires an internet network to use it. E-Book design in the form of a flipbook consists of.

Create a Book Cover and Frame Design

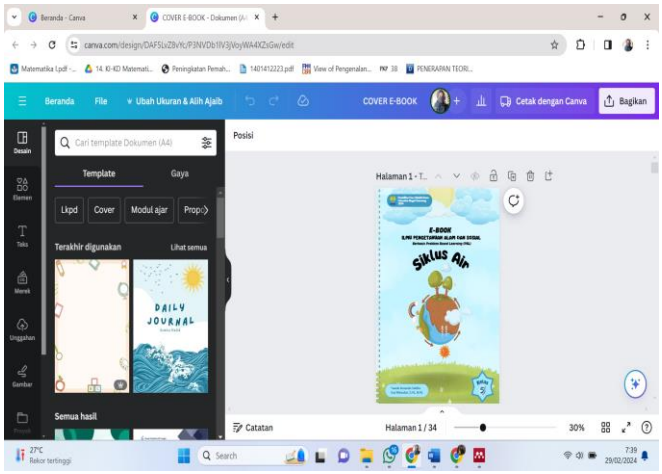

Figure 3. Front cover

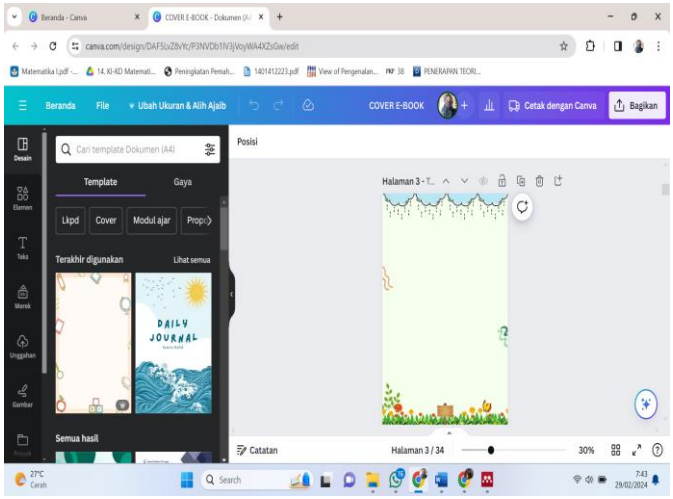

Figure 4. E-book frame

Make the Contents of the E-Book in the Form of a Flipbook, and Save it in PDF Form

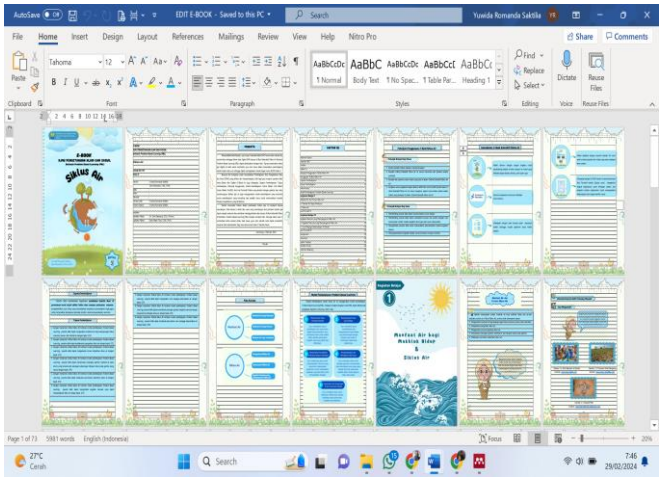

Figure 5. Contents of the e-book

Operate the Heyzine Website and Upload PDF Files for Conversion

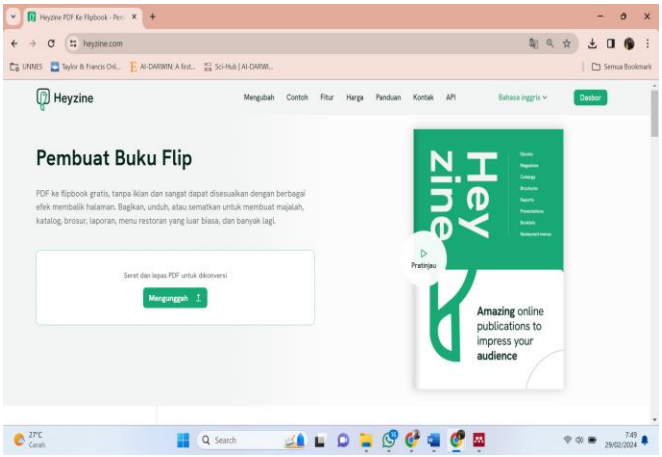

Figure 6. Heyzine website

Start by Typing the Flipbook Title > Clicking Customize to Edit

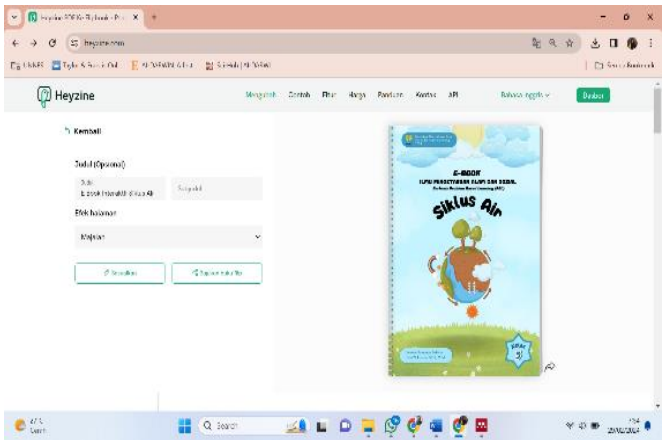

Figure 7. Flipbook editing start

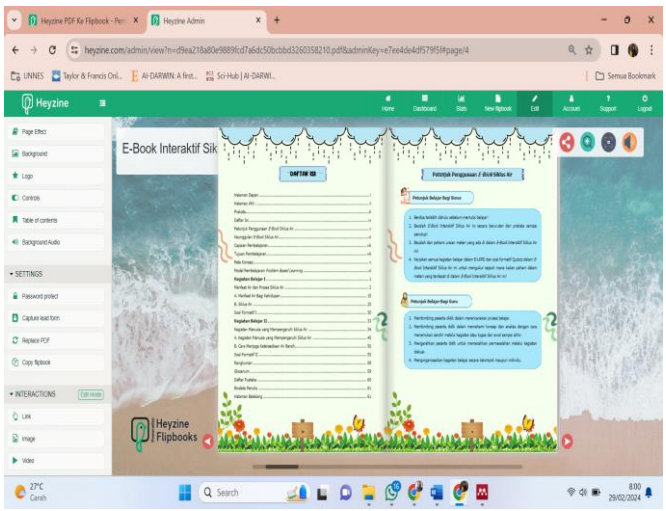

Figure 8. Heyzine parts to edit

Once the File is Saved, Publish it by Clicking the share icon> Copy the Link

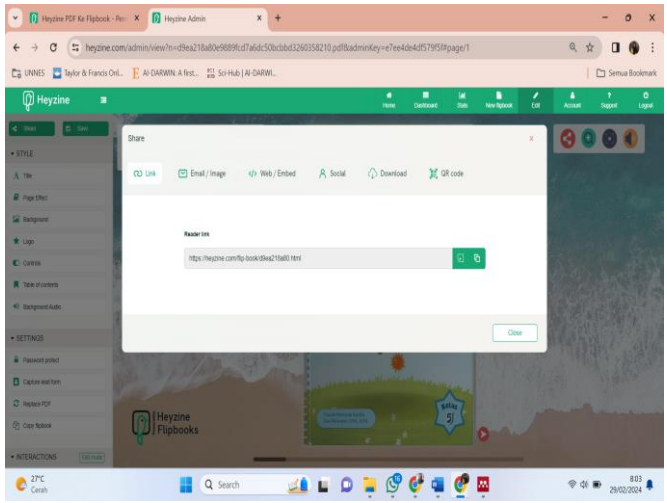

Figure 9. Create a flipbook in the form of a link

Feasibility of Product Design Validation E-Book in the Form of an Interactive Flipbook Based on a Problem Based Learning (PBL) Model

Product Design Validation

At this stage, researchers will validate products to two PGSD lecturers at Semarang State University, namely competent media expert validators, namely lecturers of Elementary School Learning Media and Teaching Materials courses and material experts, namely lecturers of Elementary Science Learning Development courses to test product feasibility. After being assessed by validators, there will be input related to the product developed by the researcher so that the researcher can revise the product developed.

Table 7. Material Expert Validation Tabulation

Assessment Aspect	Percentage (%)	Criterion
Content eligibility	82.86	Highly valid
Language eligibility	93.33	Highly valid
Eligibility of presentation	90.00	
Suitability of images to material	95.00	Highly valid
Sum	90.23	Highly valid

Table 8. Media Expert Validation Tabulation

Assessment Aspect	Percentage (%)	Criterion
Content eligibility	92.00	Highly valid
Language eligibility	93.33	Highly valid
Eligibility of presentation	93.33	Highly valid
Eligibility of use	90.00	
Sum	92.17	Highly valid

Table 7 and Table 8 show that the validation results provided by validators have very valid results because they obtain values above 80% which are included in the very feasible criteria (Arikunto, 2018). be E-Book in the

form of an interactive flipbook based on the Problem Based Learning (PBL) learning model declared perfectly valid in its entirety content or material, display or media, and language and ready for trial. This indicates that the product be E-Book in the form of an interactive flipbook based on the Problem Based Learning (PBL) learning model which is developed is very feasible and can be used as additional alternative teaching materials in the science learning process in elementary schools. This is in accordance with research conducted by Ainy et al. (2024) stated that the digital flipbook-assisted E-Module obtained a media validation value of 90.3% and a material validation value of 89.58% so that it showed very positive results which means that the flipbook-assisted E-Module is suitable for use.

Design Revision

After obtaining the results of product validity, the next revision stage is carried out. Researchers revised the design according to input from material and media experts. The advice given by the material expert validator was in the form of adjusting the learning steps in interactive flipbook-based e-books with the sequence of Problem Based Learning (PBL) procedures in the teaching module so that learning can run regularly and improve sentences. editing rules. Suggestions given by media expert validators include completing academic identity covers and adding animations to make them more interactive and interesting. Here are suggestions for improvements from material and media expert validators.

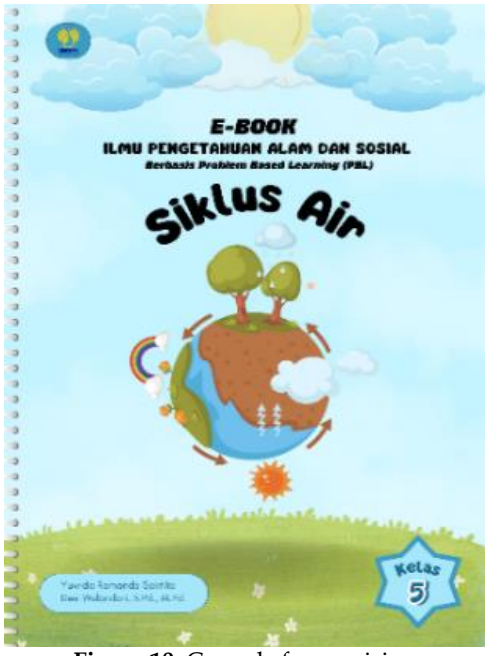

Figure 10. Cover before revision

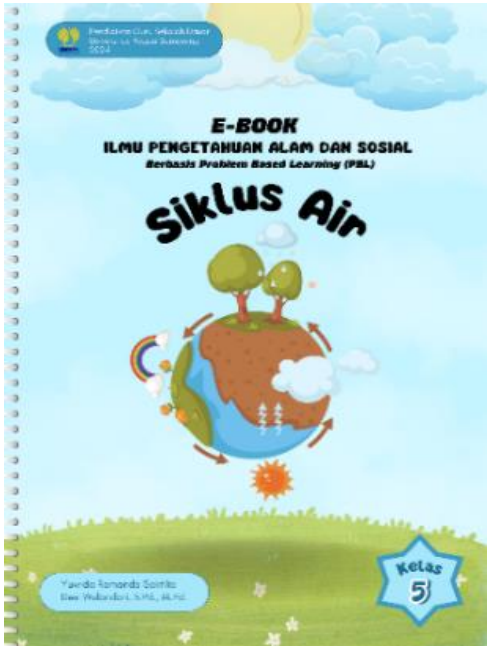

Figure 11. Cover after revision

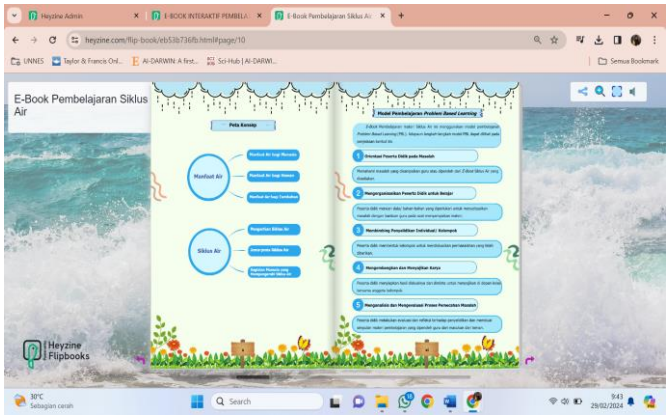

Figure 12. PBL syntax before revision

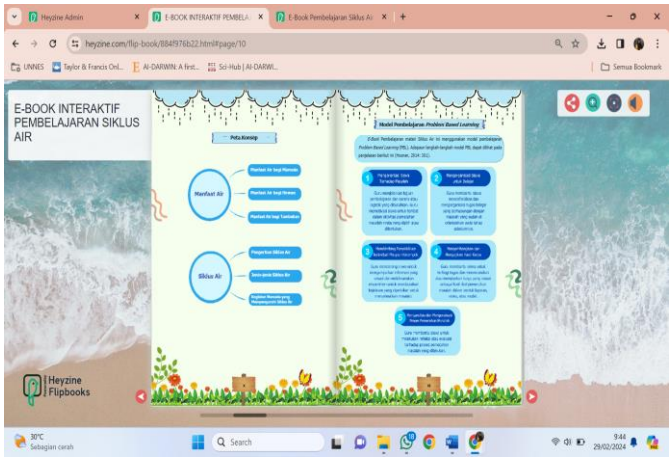

Figure 13. PBL syntax after revision

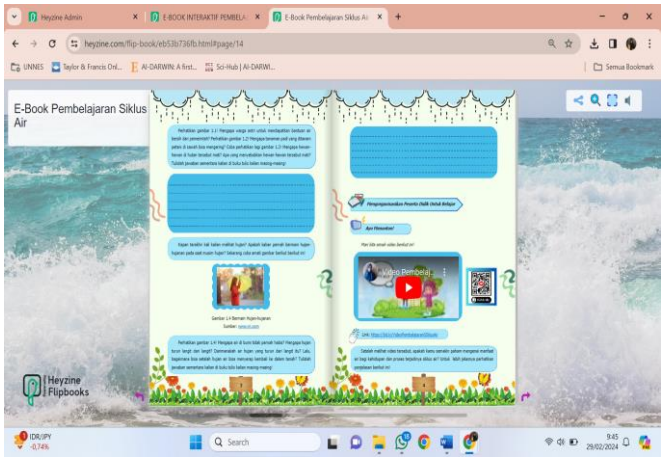

Figure 14. No animation before revision

Figure 15. There is an animation after revision

Product Trials

After teaching materials E-Book in the form of an interactive flipbook with Problem Based Learning (PBL) syntax Obtaining validation from material expert validators and media experts, then small-scale product trials were carried out which aimed to determine related responses and comments E-Book in the form of an interactive flipbook with Problem Based Learning (PBL) syntax before being tested on a large scale. A small-scale trial was conducted at SD Negeri 2 Banjaran, Jepara Regency with a sample of 5 students from class VB. Sampling is done by Purposive Sampling technique. The selection of students is based on the ranking order in the class, which is 2 top-ranked students, 2 low-ranked students, and 1 middle-ranked student. After the students learned, students and teachers were distributed response questionnaire sheets which had 3 aspects, namely content or material, media quality, and language to E-Book is an interactive flipbook with Problem Based Learning (PBL) syntax. The results of student and teacher response questionnaires are used to improve the teaching materials developed. The results of student and teacher responses consist of four criteria, namely: 82%-100% (Very Feasible), 63%-81% (Eligible), 44%-62% (moderately decent); and 25%-43% (Not Feasible). The following are the results of a recapitulation of student and teacher responses to product trials on a small scale:

Table 9. Results of Teacher and Student Responses to E-Books in the Form of Interactive Flipbooks with Problem Based Learning (PBL) Syntax in Small-Scale Trials

Respondents	Evaluation (%)	Information
Teacher	100.00	Very positive
Student	100.00	Very positive

Table 9 shows that the results of teacher and student responses E-Book in the form of interactive flipbooks with Problem Based Learning (PBL) syntax has very positive results because it obtained a score above 75%. The interactive flipbook eBook with Problem Based Learning (PBL) syntax was declared very positive based on 15 questions. Because all questions scored 1, this shows that the E-Book in the form of an interactive flipbook with Problem Based Learning (PBL) syntax received a very positive response.

Figure 16. Small-scale product trials

Product Revisions

After obtaining the results of the recapitulation of teacher and student responses to the E-Book in the form of an interactive flipbook with Problem Based Learning (PBL) syntax, the revision stage was then carried out. Despite obtaining very positive results, researchers realized that there are still some uses of foreign words that are still written upright. Because in learning water cycle material there are many foreign terms that must be understood by students. So every word in the E-Book needs to be corrected to conform to the General Guidelines for Spelling Indonesian (PUEBI).

The Effectiveness of Trial Use of E-Book Products in the Form of Interactive Flipbooks Based on Problem Based Learning (PBL) Learning Models

Usage Trial

Large-scale product trials were carried out on VA class students of SD Negeri 2 Banjaran, Jepara Regency.

The design used is a Pre-Experimental design with a One Group Pretest-Posttest design model. Students first do pretest questions to find out students' initial abilities before getting water cycle material using an interactive flipbook-shaped E-Book with Problem Based Learning (PBL) syntax. At the end of the lesson, students do posttest questions to find out the changes after getting the water cycle material.

Figure 17. Large-scale product trials

Based on Table 10, it is known that the average student learning outcomes showed an increase of 28 in large-scale product trials. Data shows that there are differences in student learning outcomes regarding the content of water cycle science subject matter in the VA class of SD Negeri 2 Banjaran, there are differences before and after using an interactive flipbook-shaped E-Book with Problem Based Learning (PBL) syntax. To determine the criteria for increasing the average pretest and posttest, N-gain analysis was carried out by comparing the difference between SMI and pretest.

Table 10. Student Pretest and Posttest Results on Usage Trials

Test Type	Average	Average Difference
Pretest	53.00	28.00
Posttest	81.00	

The effectiveness of E-Books in the form of interactive flipbooks with Problem Based Learning (PBL) syntax is based on student learning outcomes in large-scale product trials. According to Ibrahim et al. (2023) learning outcomes can be seen from the abilities that arise in students after following the learning process consisting of cognitive, affective and psychomotor abilities. Therefore, based on Table 11, it is known that the average difference is 28 in large-scale product trials. This shows that the score of grade 5 students of SD Negeri 2 Banjaran has increased by an average of 0.61 and is included in the moderate criteria. The average increase shows that the use of E E-Book in the form of an interactive flipbook with Problem Based Learning (PBL) syntax used in science learning water cycle learning materials has succeeded in improving student learning outcomes. The statement is reinforced by Djarwo et al. (2022) that the use of Digital Flibook makes students participate actively and increases student motivation in learning so that they can achieve the learning goals that have been set.

Table 11. Average Test Results (N-Gain)

Average Difference	N-Gain	Criterion
28	0.61	Keep

In addition to using tests, the effectiveness of the product can be seen from the results of student and teacher responses presented in Table 12. Based on Table 12 shows that the results of teacher and student responses E-Book in the form of interactive flipbooks with Problem Based Learning (PBL) syntax has very positive results because it obtained a score above 75%. Thus, the use of E-Books in the form of interactive flipbooks with Problem Based Learning (PBL) syntax can affect student learning outcomes.

Table 12. Results of Teacher and Student Responses to E-Books in the Form of Interactive Flipbooks with Problem Based Learning (PBL) Syntax in Large-Scale Trials

Respondents	Evaluation (%)	Information
Teacher	100.00	Very positive
Student	100.00	Very positive

Another study that supports is research conducted by Damayanti et al. (2023) entitled "Development of Flipbook-Based E-book Teaching Materials on Subtheme 2 Environmental Change". Based on the results of the expert test, the percentage of media experts of 97.33% was declared very feasible. Then the percentage of linguists 94.54% was declared very feasible, and the percentage of material experts 92% with very feasible criteria. Based on the average pretest, posttest, and n-gain scores of 77.33, 95.06 respectively with an effective effectiveness rate. Meanwhile, based on the questionnaire, the responses of teachers and students were 94% and 92% respectively with very feasible categories. Thus, it can be concluded that E-Book in the form of an interactive flipbook with Problem Based Learning (PBL) syntax is feasible to be used to assist teachers in delivering learning materials and help students to foster interest in participating in learning activities.

Previous research that has been done by Yuliana et al. (2021) entitled "Development of Interactive Digital Teaching Materials with a Contextual Approach to Microeconomic Theory Courses" states that digital teaching materials can improve student learning

outcomes. Large-scale trial data found that the average pretest score was 52.73 and the average posttest score was 91.59. Based on the obtained scores, it can be seen that the increase in learning outcomes was 38.86 and the N-Gain was 0.82 in the high category. Therefore, the use of interactive digital teaching materials has a major impact on understanding and learning outcomes.

In line with research conducted by Abdi et al. (2023) titled "Development of STEM-Based Digital Flipbook Module for Human Digestive System Material to Improve Science Literacy". The pretest results obtained an average score of 51.56, but after using the digital flipbook module the average posttest score obtained by students increased to 82.81 with an N-Gain value of 0.4 in the medium medium category. Based on the results of his research, the implications obtained are to increase literacy skills in understanding scientific concepts, especially in the material of the human digestive system.

Research conducted by Rino et al. (2022) titled "Development of E-Book Type E-Flip PDF with Guided Self-Study Based on Problem Posing Using Creative Ideas Scamper". Posttest scores from 29 students obtained results, 24 students obtained scores above KKM (≥75) and 5 students obtained scores below KKM (<75). The developed E-Bokk has an average effectiveness rate of 82.75% with very effective criteria.

Based on these results, it can be concluded that E-Book in the form of an interactive flipbook with Problem Based Learning (PBL) syntax can improve student learning outcomes in science subjects class V water cycle material SD Negeri 2 Banjaran.

Conclusion

Based on the results of research that has been conducted, it can be concluded that E-Books in the form of interactive flipbooks with Problem Based Learning (PBL) syntax can improve science learning outcomes of grade V students of SD Negeri 2 Banjaran on water cycle material. This is evidenced by the results of the product validation assessment in the very decent category by obtaining an average of 90.23% from material experts and 92.17% from media experts. Data analysis of students' pretest and posttest scores increased by an average difference of 28 and N-Gain of 0.62 which was included in the moderate criteria. This proves that the E-Book in the form of an interactive flipbook with Problem Based Learning (PBL) syntax is effective in improving the learning outcomes of grade V students in science subjects about the water cycle.

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Author Contributions

Yuwida Romanda Saktilia contributes to conducting research, developing products, analyzing data, and writing articles. Desi Wulandari as a supervisor in research activities to article writing.

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Conflicts of Interest

The authors declare that there is no conflict of interest regarding the publication of this paper.

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