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Developing picture storybooks assisted by word search puzzle to improve elementary students' indonesian vocabulary mastery

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Abstract

This study presents the low reading comprehension of elementary students associated with limited vocabulary mastery. It aims to develop picture storybooks assisted by a word search puzzle and examine their feasibility and the tendency of vocabulary improvement after implementation. The study employed a Research and Development (R&D) design based on Borg & Gall's model, adapted into eight stages. The participants were 30 fourth-grade students of SDN Jatilor Grobogan, including a small-scale trial (6 students) and a usage trial (24 students). Data were collected through observation, interviews, questionnaires, and pre-test–post-test using valid and reliable instruments. Product feasibility was evaluated by a media expert, a material expert, a teacher, and students. Meanwhile, effectiveness testing employed a one-group pre-test–post-test design, and was analyzed using a paired-sample t-test and N-Gain. The results indicated that the product was highly feasible, with scores above 90%. Statistical analysis showed a significant difference between pre-test and post-test scores ($p < 0.05$), with mean scores increasing from 63.75 to 80.83 and an N-Gain of 47,11% (moderate category). These findings indicate an improvement in vocabulary mastery following implementation, although these should be interpreted with caution due to the absence of a control group.

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1. Introduction

Reading is one of the main pillars of education (Sunarti, 2021), through reading, students acquire and build knowledge. Reading is a process of expanding one's knowledge and understanding through various reading materials such as books, magazines, articles, and others (Amikratunnisyah & Prastowo, 2022). Cognitively, reading is the process of understanding the content of a text to grasp the ideas and information conveyed by the author using vocabulary

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items (Emadesti, 2021; Mardiyanti et al., 2022; Ovavia & Sukma, 2020). In the context of learning in elementary schools, reading comprehension is an essential skill because it is related to students' ability to interpret the ideas, concepts, and arguments in the text (Rahmi & Marnola, 2020; Sarika et al., 2021).

Reading comprehension skills are closely related to vocabulary mastery. Good vocabulary mastery can affect the ability to understand something, including four language skills, namely reading, listening, speaking, and writing (Cahyono et al., 2024; Magdalena et al., 2021). Vocabulary mastery is the ability of students to recognize, understand, and use words in a language appropriately (Kurniawati & Santy, 2022). Research by Syafrizal et al. (2019) and Xavier (2022) shows that an increase in vocabulary mastery is directly proportional to an increase in reading comprehension skills. Research by Nurmahanani (2023) mentioned that, regarding the abilities students in the literacy program showed, the effect sizes for reading comprehension competence (0.10) and vocabulary mastery competence (0.05) were smaller than those for oral reading competence and word reading efficiency. Thus, limited vocabulary leads to poor text comprehension.

Nationally, Indonesian students' reading literacy skills still require attention. OECD data reveal that only 25.46% of Indonesian students meet the minimum competency standards in reading according to PISA criteria (OECD, 2023). Similar problems were found at SDN Jatilor Grobogan. Data from the 2023 national education assessment report indicate that SDN Jatilor students' reading literacy skills are at a medium level, at 66.67%. The assessment results reveal that fourth-grade students' reading comprehension skills are in the medium category, with an average vocabulary level below the passing criteria. The average score on daily vocabulary-mastery quizzes was 52.91, and only 3 students in Class IV A scored 70 or higher.

The results of the interview and observation underscore that the use of reading materials and innovative media is limited, resulting in low student interest in reading. Students are more interested in reading materials accompanied by attractive illustrations. Align with (SB et al., 2025) found that students' interest in reading is influenced by the engagement of the text and illustrations. This highlights the need to develop reading materials that are more interactive, contextual, and tailored to the characteristics of elementary school students. The development of reading materials is necessary, as noted by (Sb, 2018) the more reading materials there are, the richer students' vocabulary and ideas will become, which they can then express in their writing.

Picture storybooks emphasize fun learning and make it easier for students to absorb the material presented by teachers. Loh (2016) stated one of the teaching material products that can enhance students' motivation in learning was picture storybooks. Picture storybooks are textbooks that contain illustrations, provide visual and emotional information, and cannot be communicated through text alone; illustration and text are interconnected (Khotimah et al., 2021; Muhiri et al., 2021; Rusydiana, 2024; Yuliani, 2022). Story and picture books play a vital role in children's reading development, as exposure to diverse narratives and rich language enhances literacy and expands vocabulary, while engaging stories foster reading motivation and interest and support cognitive development through plot understanding, character analysis, and imagination (Du et al., 2024)

To strengthen vocabulary mastery, these teaching materials can be combined with puzzles, namely word search puzzle, a form of language activity that contains a number of target words that must be identified by students in a grid arrangement containing a collection of letters (Beelders, 2023). Word search puzzle trains accuracy and understanding of words in context by finding the concepts (answers to the questions) that are hidden horizontally, vertically, diagonally, or upside down (Fitria, 2023; Kalkan et al., 2022). Studies indicate that students perceive puzzles

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as engaging and effective for enhancing understanding, retention, and academic performance, as well as increasing motivation to learn; therefore, incorporating and developing puzzle-based activities is crucial in teaching concepts and information (Kalkan et al., 2022; Sandria & Syahri, 2023).

Previous studies have shown that picture storybooks are effective in improving students' reading skills by integrating text and illustrations, while word search puzzles enhance conceptual mastery through interactive engagement. Research by Irdana et al. (2024) shows that the use of picture storybooks effectively improves students' reading skills, as indicated by an average N-gain score of 0.5 at the medium level. Furthermore, research by Imron et al. (2023) states that word search puzzles are effective in improving students' conceptual mastery skills; the data from the test results in cycle I, with a score of 71.47%, increased in cycle II to 80.29%. However, these two approaches are generally developed separately and have not been specifically designed to strengthen vocabulary as the foundation for reading comprehension.

Therefore, this study introduces an innovation through the development of reading materials in the form of picture storybooks assisted by a word search puzzle that integrates narrative, visual, and language game aspects into a single integrated learning material, thereby expected to be more effective in improving vocabulary mastery among fourth-grade students at SDN Jatilor Grobogan.

2. Method

The present study employs a mixed-methods (quantitative-qualitative) approach using a Research and Development (R&D) research design. R&D is a scientific method for researching, designing, producing, and testing the validity of products that have been produced (Sugiyono, 2023). The research model used refers to the Borg & Gall development model. The R&D model was adapted to the researchers' needs, reducing it from 10 to 8 stages. The research stages are (1) potential and problems, (2) data collection, (3) product design, (4) design validation, (5) design revision, (6) product testing, (7) product revision, and (8) usage testing.

The development focuses on creating picture storybooks with word-search puzzles to improve students' vocabulary and understanding of new words. Data collection employs several techniques, including tests (pre-tests and post-tests) and non-tests (observations, interviews, questionnaires, and documentation). Research data are obtained using four instruments that have been tested for validity and reliability, including observation sheets, interview guides, questionnaires, and evaluation questions.

A quantitative approach is used to measure improvements in vocabulary mastery through pre- and post-tests, while a qualitative approach is used to gather supporting data, including interview results, observations, and questionnaires, to refine and improve the developed product. The effectiveness test uses a one-group pre-test-post-test design; thus, the results reveal improvement after the treatment. However, this cannot be fully interpreted as a causal relationship because it lacks a control group.

The quantitative data in this study are analyzed using a normality test to assess the distribution of the data, a paired-sample t-test to identify differences between pre-test and post-test scores, and N-Gain calculations to determine the level of improvement in students' vocabulary mastery across the low, moderate, and high categories. Meanwhile, qualitative data are analyzed through data reduction, descriptive narrative presentation, and conclusion drawing. The qualitative data are used to provide an in-depth description of student and teacher responses and to serve as a basis for refining the product at each stage of development.

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The research was conducted at SDN Jatilor, involving 30 fourth-grade students from the IV A class, who were divided into two groups. There are 6 students for small-scale testing, comprising 2 students with high abilities, 2 with medium abilities, and 2 with low abilities, and 24 students for large-scale testing. A limited pilot study involving 6 students assessed the product's readability and initial suitability. A pilot study involving 24 students tested the product's effectiveness. Subjects are selected using purposive sampling, taking into account the characteristics of fourth-grade students with varying reading abilities. All subjects came from the same school environment to ensure consistency in the learning context.

In this study, students' vocabulary mastery is measured using a 25-question pre-test-post-test instrument that has been tested for validity, reliability, difficulty index, and differential index (Sugiyono, 2023). Validity testing is conducted using the product-moment correlation, with results indicating that 32 out of 50 items were deemed valid. Reliability testing using Cronbach's alpha yielded 0.896, which falls into the very high category. The item difficulty index classifies items into 2 difficulty levels: 14 moderate and 32 easy questions. The differential index indicates 3 very low, 9 low, 17 moderate, 18 good, and 3 very good.

The media expert who evaluated the product in this study was Dr. Moh. Fathurrahman, S.Pd., M.Sn., an expert in instructional material development and a lecturer in the Elementary Education Program. Meanwhile, the material expert was Dr. Sri Sukasih, S.S., M.Pd., an expert in Indonesian language instruction and a lecturer in the Elementary Education Program, both at Universitas Negeri Semarang. Product feasibility analysis is conducted through expert validation, teacher feedback, and student feedback using the following formula.

$$P = \frac{f}{N} \times 100\%$$

Explanation:
P : Percentage
F : Score obtained
N : Overall score

The percentage results from the above feasibility data can be converted using the following criteria.

Tabel 1. Media eligibility criteria

Feasibility Scores	Criteria	Descriptions
0% - 20%	Highly unfeasible	Repeat production
21% - 40%	Unfeasible	Many revisions required
41% - 60%	Sufficiently feasible	Minor revisions required
61% - 80%	Feasible	Minor revisions required
81% - 100%	Highly feasible	No revision needed

(Sudjana, 2001)

Meanwhile, the following formula is used to measure the product's effectiveness. With the following criteria.

Tabel 2. Criteria for improving learning outcomes

Index N-Gain (g)	Interpretations
0.70 ≤ g ≤ 1.00	High

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Index N-Gain (g)	Interpretations
0.30 ≤ g < 0.70	Medium
0.00 < g < 0.30	Low
g = 0,00	No increase
-1.00 ≤ g < 0.00	Decrease

(Sukarelawa et al., 2024)

3. Results

This study used Research and Development (R&D) and adapted the Borg & Gall model. This study led to the development of picture storybooks with a word-search puzzle to improve fourth-grade students' vocabulary mastery at SDN Jatilor. This study used the Borg & Gall development model, adapting 8 of its 10 stages.

3.1 Potential and problems

The researchers analyzed the potential and problems found in the field. This was done to identify the initial problems encountered by the research subjects. Thus, the researcher identified the students' needs regarding the teaching materials to be developed. The researcher expects that this product could be used in accordance with learning needs and objectives.

The analysis of potential and problems was conducted through learning observations, interviews with fourth-grade teachers at SDN Jatilor, and the completion of questionnaires to identify problems faced by teachers and students. The results of the problem identification reveal that students had low reading comprehension due to weak vocabulary, as indicated by an average score of 52.91 on daily new-vocabulary tests, with only three students achieving a maximum score.

Furthermore, the identification revealed a lack of use of teaching materials, particularly interesting and innovative reading books, in Indonesian language learning. It was also found that students' interest in reading would only arise when the reading materials contained animations or pictures, especially in non-fiction texts. These three problems formed the basis of the researcher's study, which aimed to address issues in the fourth grade at SDN Jatilor.

3.2 Data collection

The data collection stage was carried out by analyzing questionnaires on the needs of teachers and students. The analysis of teacher needs reveals that, in terms of content, curriculum, language, and readability, there was a need to develop specific teaching materials to help students understand new vocabulary through narrative stories rather than just lists of words. Regarding the form and visual appearance of teaching materials, teachers assessed that the existing materials still needed improvement to better support teacher and student learning.

On top of that, the analysis of student needs indicates that all students agreed they had difficulty finding the meanings of new words, including synonyms and antonyms. They also agreed that textbooks containing a variety of pictures and stories were preferable to books full of text, as they tend to increase students' motivation to read.

Based on the above needs analysis, this situation necessitates the development of picture storybooks with word-search puzzles as teaching materials to learn the meanings of new vocabulary.

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3.3 Product design

Regarding the needs analysis results, 93% of students need the development of learning products in the form of picture storybooks for learning new vocabulary. The development of these books was designed with consideration of teaching materials and applicable learning standards, through several important stages.

Material Compilation

The researchers developed the material by conducting a comprehensive search of various reliable sources, including books, scientific articles, e-books, and other online references. The material was subsequently presented in a contextual and engaging manner, using a word search puzzle, to help students better understand the picture storybooks. The material covered in the compilation of picture storybooks includes several aspects of vocabulary mastery, referring to the research by (Kurniawati & Karsana, 2020) namely mastery of active receptive vocabulary by identifying the meaning of words (literal meaning in the KBBI and homonyms), word relationships (synonyms and antonyms), and word forms (affixed words).

The aspects of vocabulary mastery measured in this study included two indicators, namely 1) word meaning, which comprised the sub-indicators of specific meaning, synonyms, antonyms, and homonyms, and 2) word formation, which comprised affixed words (Kurniawati & Santy, 2022; Wijana, 2019). Furthermore, the reading method used in picture storybooks is the word method with the close reading technique (Haryadi, 2012). One of the reading stages is literal comprehension, or close reading, which is the ability to understand a text's direct meaning before moving on to more in-depth interpretation.

Creating Prototype

Before entering the picture storybook design stage, it is necessary to create a prototype that serves as an initial framework for visualizing the components and content of the picture storybooks, with a word search puzzle to assist. This prototype serves to assess the layout, the flow of the material presentation, and the balance between text and illustrations before it is developed into a more detailed book. The picture storybooks are compiled from a prototype that includes a cover, foreword, table of contents, list of illustrations, learning objectives and goals, instructions for use, KBBI pages, main content, narrative content, student activities, answer keys, student reflections, bibliography, and author profiles.

Creating Picture Storybooks Assisted by Word Search Puzzle

Picture storybooks are a fundamental multimodal and social-emotional learning resource that supports various aspects of child development. Through a combination of text, images, and narratively arranged pages, these books provide children with visual, verbal, and emotional experiences (Efastri et al., 2026). Picture storybooks have specific components, including 1) Cover, 2) Preliminary pages, 3) Main section (content), and 4) Postliminary section (Ananda et al., 2022). Putri et al. (2023) also state that the components of a picture storybook consist of cover, foreword, table of contents, instructions for use, main material, story content, student activity pages, and author's biography. This became the basis for researchers in developing a picture storybook assisted by a word search puzzle.

Picture storybooks have specific components, including a cover, foreword, table of contents, list of illustrations, learning outcomes and objectives, instructions for use, KBBI (Big Indonesian Dictionary) page, main content, narrative story content, student activities (quizzes), answer keys, student reflections, bibliography, and author profiles. The book's content design was created using Canva software. In accordance with the needs analysis, the design is created with attractive illustrations and colors, using the ISO B5 standard (17.6 cm x 25 cm), and printed on art paper 120 for the contents and ivory 230 for the cover, in A4 size (21 cm x 29.7 cm), with a total of 56

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pages. The typography uses TT Berlinerins for the title and Poppins for the content. The illustration production process is designed by Canva Pro and Gemini Pro. Word search puzzle as a quiz or students' activities designed by the official website for the online version, and the activities maker of canva for the offline version.

The following is a preview of the picture storybooks, accompanied by a word search puzzle, for Indonesian language learning in fourth grade.



Figure 1. Front cover display



Figure 2. Foreword page



Figure 3. Material contents page



Figure 4. Contents page narrative text



Figure 5. Quiz/student activity page

Based on Figure 1, the displays above are the front cover, containing the title, the author's name, the class description, and an image that reflects the book's content. Figure 2 illustrates the preface page, which contains the author's introductory text before the reading content. Figures 3 and 4 are the core pages of the book, namely the content pages that contain sub-material on vocabulary mastery, as stated by Nation (2001), including meaning, usage, and

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relationships between words, which are adapted to the material in the fourth grade of elementary school, as well as the narrative text content pages that contain the "*Ayo Membaca!*" section, which presents narrative texts and pictures explaining the content of the story. Furthermore, Figure 5 shows the student activity page, which contains interactive quizzes, including a word search puzzle, for each material session.

3.4 Design validation

The design of the picture storybooks assisted by a word search puzzle has been completed. In addition, product quality was validated through a questionnaire administered to two groups of experts in their respective fields. A media expert evaluated the book's components and design, while a materials expert assessed its material aspects. This validation aims to measure the feasibility of the book before it is used in learning. The following are the assessment results.

Tabel 3. Results of media expert assessment of picture storybooks

Aspects	Indicators	Score	Percentage
Content (Material)	Compliance with curriculum (CP/TP) and ISO standards Accuracy of concepts and examples	15	93.75%
Presentation	Narrative sequence and storyline Variation in material presentation Book size proportion in accordance with ISO standards	12	100%
Language and readability	Concise writing style Readability Compliance with Indonesian language rules Compliance with child development	14	8.,5%
Graphics	Appearance of layout elements and consistency Cover illustration colors Content illustrations Layout placement	23	96.83%
Typography and function	Font type Ease of use	12	100%
	Average score = 95		

(Depdiknas, 2008; Irdana et al., 2024; Rusydiana, 2024)

The data obtained during the media expert validation stage yields a media feasibility score of 76 out of 80, corresponding to 95% feasibility for the picture storybooks assisted by a word search puzzle. Based on the media eligibility quality scale, this score falls within the highly feasible criteria, with a recommendation to improve the media prior to assessment, specifically the placement of subject descriptions on the cover and the layout of student activities in each sub-material.

Tabel 4. Results of the material expert assessment of picture storybooks

Aspects	Indicators	Score	Percentage
Curriculum	Alignment of CP/TP/indicators with material	11	91.66%
Accuracy	Accuracy of material Importance of material Coverage of material Material is easy to understand	18	90%

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Aspects	Indicators	Score	Percentage
	Material is appropriate for the age group		
Relevance	Contextual Interest in material Practicality Action-rich	14	87.5%
Systematic presentation	Appropriateness of quizzes/student activities Readability Effective use of language	12	100%
	Average score = 91.66		

(Depdiknas, 2008; Rusydiana, 2024)

The data obtained during the material expert validation stage indicate a total score of 50 out of 60 (91.66%) and a material eligibility category of highly feasible. Thus, the design of the picture storybooks, assisted by a word search puzzle, is deemed highly feasible based on validation results from a media expert and a material expert. This proves that picture storybooks accompanied by a word search puzzle are ready and feasible for field testing after revisions.

3.5 Design revision

At this stage, media and materials experts provide researchers with suggestions for improvement. Design revision aims to minimize deficiencies by adjusting the design. The following are improvement suggestions from both experts.

Suggestions and Improvements from Media Experts

Media experts provide several recommendations for improving picture storybooks with a word search puzzle. The following are numerous improvements.



Figure 6. Cover appearance before revision



Figure 7. Cover appearance after revision

Based on Figures 6 and 7, media experts recommend adding subject descriptions to the front covers of picture storybooks.

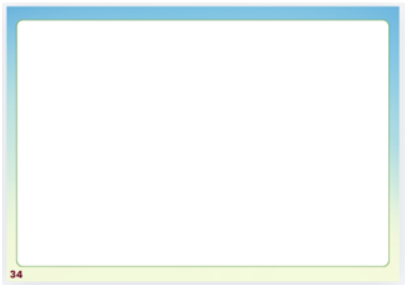


Figure 8. Layout placement before revision



Figure 9. Layout placement after revision

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Based on Figures 8 and 9, media experts suggest improving the layout placement of student activities into three parts in each sub-material, adjusted to the number of sub-materials. Thus, the layout, which initially placed all materials at the beginning, is rearranged so that each section contains student activities.

Suggestions and Improvements from the Material Expert



Figure 10. Revision of story content incorporating local wisdom

Meanwhile, a material expert underscores that the story content should be supplemented with local stories. Therefore, based on Figure 10, the researcher adds a story with local content to the homonym material by including the word "*gendang*" in the narrative as an example of local wisdom.

3.6 Product testing

After completing the revision stage, the researchers conducted a small-scale trial. The researchers selected six fourth-grade students from SDN Jatilor as participants in this small-scale trial. The sample in this product trial was determined using purposive sampling, where the selection of samples took into account certain criteria in line with the research objectives (Sugiyono, 2023).

The small-scale trial sample consisted of 6 students with different cognitive abilities: 2 with high, 2 with medium, and 2 with low. This strategy was applied to ensure that the product testing would demonstrate its effectiveness across all levels of student ability. The trial process was carried out in several stages. First, the students took a pre-test to measure their initial abilities. This was followed by learning using picture storybooks assisted by a word search puzzle. After completing the learning, the students took a post-test and filled out a student response questionnaire to measure the effectiveness of the picture storybooks. The teacher also filled out a response questionnaire to make sure the feasibility of the product.

Tabel 5. Recapitulation of teacher responses questionnaire to small-scale trials

Aspects	Indicators	Score	Percentage
Content suitability	Relevant material to CP/TP Material accuracy concepts Contextual	31	96.87%
Language Suitability	Accuracy of language structure Formal and effective sentences Appropriateness of language for student development	39	97.5%

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Aspects	Indicators	Score	Percentage
Presentation	Sequence of material presentation Relevance of illustration to the material Engagement and involvement Relevance of quiz to learning objectives	28	100%
	Average score = 98.4		
	Category = very feasible		

(Irdana et al., 2024; Rusydiana, 2024)

Based on the teacher response survey above, statements 1-25, with 3 indicator aspects covering content feasibility, language feasibility, and presentation, each receive a maximum score of 4. The picture storybooks indicate a total score of 123 (98.4%) and are categorized as very feasible for a small-scale trial. Teachers note on the KBBI page that it is better if KBBI can also be provided offline, without needing an internet connection. This is a consideration for the use of the printed KBBI in large-scale trials.

Table 6. Recapitulation of student responses questionnaire for small-scale trials

Aspects	Indicators	Score	Persentage
Graphics	Attractiveness of the title Attractiveness of images and colors Clarity of writing and font size	54	100%
Material Presentation	Ease of understanding the story content Increasing interest in reading Helping to discover new vocabulary	46	90%
Language	Easy to understand language Able to understand and retell the story	18	100%
	Average score = 98.33		
	Category = very feasible		

(Irdana et al., 2024; Rusydiana, 2024)

As described above, the indicators covering graphics, material presentation, and language indicate a score of 118 out of 120. Thus, in practical terms, the picture storybooks assisted by a word search puzzle achieve a score of 98.33% in the very feasible category. This becomes the basis for further large-scale trials with 24 fourth-grade students at SDN Jatilor.

3.7 Product revision

Based on teacher and student responses to the picture storybook, which was assisted by a word search puzzle, the trial product has been deemed highly feasible. However, the researchers took the teachers' feedback into account and made the KBBI available offline by using the printed version and adjusting the QR code settings to enable offline access. Thus, in the product revision stage, the picture storybooks that have been trialed and revised can proceed to large-scale use.

3.8 Usage testing

The final stage is to conduct usage testing. This test was conducted with 24 fourth-grade students at SDN Jatilor as part of a large-scale trial. The large-scale trial was conducted to determine the effectiveness of picture storybooks accompanied by a word-search puzzle developed by the researcher. The following describes the results of the large-scale trial data.

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Tabel 7. Normality test results for large-scale product trials

Normality Test			
Shapiro-Wilk			
Statistics		Df	Sig.
Pre-test Score	.951	24	.281
Post-test Score	.946	24	.222

As seen in the normality test above, two types of normality tests are the Kolmogorov-Smirnov and Shapiro-Wilk tests. As the number of respondents in the large-scale test is fewer than 30, the Shapiro-Wilk normality test is used in this study. The pre-test data in the Shapiro-Wilk column presents a significant result of 0.281, and the post-test data indicates a significant result of 0.222. The results of the pre-test and post-test indicate a significance level of more than 0.05. Therefore, the pre-test and post-test results are normally distributed; thus, parametric testing can proceed.

The effectiveness of picture storybooks assisted by a word-search puzzle can be determined by the significant difference between students' mean pre-test and post-test results.

Tabel 8. Results of the paired sample t-test for large-scale product trials

Paired Sample test			
Pre-test score – Post-test score	T-statistic	Degree of freedom	Sig (2-tailed)
	-10.111	23	<.001

As demonstrated in the aforementioned provisions, if S.sig. (2-tailed) < 0.05, indicating a difference between the pre-test and post-test results. In the table above, S.sig. (2-tailed) above reveals < 0.001. Thus, there is a difference between the pre-test results (before using picture storybooks with word search puzzle) and the post-test results (after using picture storybooks with word search puzzle) in the material of interpreting new vocabulary in a large-scale test.

The present study focuses on efforts to improve students' vocabulary mastery by interpreting new vocabulary through picture storybooks as teaching materials, assisted by a word search puzzle. The researcher applies the N-Gain test to measure the effectiveness of picture storybooks, providing a quantitative measure of improvement in students' abilities. The N-Gain test results are shown in the following table.

Tabel 9. N-Gain results of large-scale product trials

Pre-test Average	Post-test Average	Average Difference	N-Gain	N-Gain%	Criteria
63.75	80.83	17.08	0.4711	47.11%	Medium

As illustrated in the N-Gain results above, it can be elucidated that with the processing of the small-scale average increase test (N-Gain), the results indicate that the students of SDN Jatilor, using picture storybooks as teaching materials with a total of 24 participating students, increase by 0.4711 with a medium criterion. Thereafter, the average difference between the pre-test and post-test results is 17.08, which is classified as medium. Furthermore, to measure effectiveness, the researcher distributes response questionnaires to students and teachers. The following are the results of the recapitulation of student and teacher responses in the large-scale trial.

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Tabel 10. Recapitulation of student and teacher response questionnaire for large-scale trials

Respondents	Percentage (%)	Criteria
Teacher	96.4%	Very feasible
Students	96.87%	Very feasible

The percentage of eligibility for the picture storybooks assisted by a word search puzzle, as presented above, is 96.4% according to the teacher's assessment and 96.87% according to the students' assessment. Thus, the picture storybook developed by the researcher meets the criteria for high feasibility.

4 Discussion

The research findings indicate that using a picture storybook accompanied by a word search puzzle contributes to improving students' vocabulary mastery, as evidenced by an increase in mean scores from pre-test to post-test and a moderate N-Gain of 47,11%. These results indicate that the intervention has the potential to support vocabulary learning, despite the observed improvement remaining moderate and therefore warranting cautious interpretation.

From a pedagogical perspective, this improvement is explained through a multimodal learning approach that integrates text, illustrations, and interactive activities. Picture storybooks are crucial multimodal and socio-emotional resources that provide visual support, helping students associate word meanings with the story's context. Engagement improves vocabulary skills, in this context, thereby facilitating the comprehension of new vocabulary (Efastri et al., 2026; Yoon et al., 2021; Yuliani, 2022). Illustrations serve as concrete representations that reinforce the meaning-making of the story (Griffith, 2026), especially for fourth-grade elementary students who are still in the concrete operational stage. According to Li (2015) the child in the concrete operational stage began to independent organization the right logic operation of a variety of methods (such as classification), but also inseparable from the specific things or with the help of the image; hence, this research applied the use of picture storybooks to help students understand the words and the content story to strengthen the mastery and application of the words.

Furthermore, the narrative structure enables students to understand vocabulary in meaningful contexts rather than as isolated definitions, thereby supporting contextualized vocabulary learning. Olpińska-szkiełko & Patera (2025) pointed out that picture storybooks support children's learning through engaging narratives and relatable characters that help them understand conflicts and experiences. Combined with illustrations, they expand knowledge, enhance social skills, and strengthen both verbal and nonverbal understanding, enabling children to retain linguistic meaning effectively and supporting their cognitive and language development. Picture storybooks that are made with a lot of attractive colors can win children's curiosity to engage in reading, and help them understand the words (Kintoko et al., 2021; Li, 2015). Align with research found that colored images are likely to improve young children's engagement with books, as it is known that color has an essential role in perceptual and cognitive development (Maule et al., 2023; Newman et al., 2026).

In addition, the integration of word search puzzle functions as a form of lexical reinforcement through repetitive yet engaging activities. The word-search activity encourages students to recognize, recall, and revisit target vocabulary in a game-based format, which indirectly strengthens memory retention (Fitria, 2023; Kalkan et al., 2022; Levina & Fadjeri, 2025). This finding aligns with previous studies indicating that word search puzzles can enhance reading

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skills, student engagement, and active participation in learning (Annisa & Syamsuyurnita, 2025; Khaliza et al., 2025; Safitri & Maulana, 2024; Sandria & Syahri, 2023). Therefore, the combination of reading exposure and game-based practice is a key mechanism underlying improvements in vocabulary mastery.

These findings are also consistent with prior research demonstrating that picture storybooks are effective in enhancing various aspects of literacy, including comprehension and student engagement (Gusmawati et al., 2023; Rosvita & Anugraheni, 2021; Trisnawati et al., 2024). Other studies have reported that the use of picture storybooks can lead to moderate to high learning effectiveness, including critical and creative thinking (Gunawan et al., 2023). Similarly, the literature on word search puzzles confirms their potential to improve vocabulary mastery and learning motivation (Afifah et al., 2025; Fitria, 2023; ZA et al., 2021). However, unlike previous studies that tend to examine these media and learning materials separately, this study integrates both into a single instructional product, thereby offering a more comprehensive, holistic learning strategy.

Nevertheless, the findings should be interpreted objectively, taking into account the limitations of the research design. The effectiveness testing employed a one-group pre-test–post-test design without a control group, which limits the ability to attribute the observed improvements exclusively to the intervention. In addition, potential response bias in teacher and student questionnaires should be acknowledged, as the evaluation of product feasibility is inherently subjective. Another limitation is the study's restricted scope, which was conducted in a single school with a relatively small sample size, limiting the generalizability of the findings.

Therefore, the research results are more appropriately interpreted as evidence that the developed instructional material demonstrates high feasibility and practical utility, and a tendency to improve students' vocabulary mastery. The implications highlight the importance of developing learning materials that integrate visual, narrative, and interactive elements to enhance student engagement and support language learning processes. Future research employing more rigorous experimental designs, including control groups, is recommended to provide more robust evidence of the developed product's effectiveness.

5 Conclusion and implications

5.1 Research implications

The research findings have several theoretical, practical, and pedagogical implications, albeit within a limited research context. Theoretically, this study contributes to the growing body of literature on vocabulary acquisition and multimodal learning by demonstrating that integrating narrative texts, visual illustrations, and game-based activities may support contextualized vocabulary learning and student engagement. Practically, the developed picture storybooks, assisted by word search puzzles, offer an alternative instructional resource for elementary school teachers, particularly for facilitating vocabulary learning through more interactive and meaningful activities. For material developers, this study highlights the potential of combining narrative and game-based elements into a single instructional product to enhance learner involvement. Pedagogically, the findings underscore that integrating visual, textual, and interactive components may help create a more engaging learning environment for elementary students. However, these implications should be interpreted cautiously, as they are derived from a limited sample and a specific instructional context.

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5.2 Conclusion

This study indicates that the developed picture storybook, assisted by a word search puzzle, demonstrates high feasibility among media experts, material experts, teachers, and students, with a feasibility percentage above 90%, and is also associated with improvements in students' vocabulary mastery, as shown by the results of the paired t-test with Sig. < 0.001 and an increase in N-Gain of 47,11% (medium category). However, because this study used a one-group pretest–posttest design without a control group, these findings should be interpreted as evidence of potential effectiveness rather than definitive proof. The study is limited by its small sample size, single-school context, material limited to vocabulary mastery, and absence of a comparison group, which restricts generalizability. Therefore, further research with more rigorous designs and broader samples is needed to strengthen the evidence of effectiveness.

Credit authorship contribution statement

First Author: research, product development, data analysis, and article writing. **Second Author**: supervisor in research activities until article writing.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have influenced the work reported in this paper.

Data Availability Statement

The data that support the findings of this study are available from the corresponding author upon reasonable request. As the data include information from human participants, they are not publicly available to protect participant privacy.

Ethical Declaration

Ethical approval is required for this study. All participants provided consent after receiving an explanation prior to participating in this study. They were informed of the study's objectives, the procedures to be performed, and their right to withdraw at any time without any consequences. The researcher obtained permission from the school through a research partnership agreement, as well as parental consent (informed consent) and student consent (assent). All data collected is kept confidential and is used solely for research purposes.

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Declaration of AI statement

Portions of this manuscript were drafted using ChatGPT-4 {OpenAI} and DeepL. The authors used this tool to draft an initial version of the Introduction and Discussion sections in Indonesia and subsequently translated them using DeepL. All content generated by the AI was thoroughly reviewed, edited, and validated by the authors, who take full responsibility for the final content. The authors provided the prompts and edited the output to ensure accuracy and relevance.

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