DEVELOPING AI-INTEGRATED E-POP UP BOOK MEDIA FOR ENHANCING VOCABULARY INTERPRETATION FOR ELEMENTARY STUDENTS

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Article Info	Abstract
Article History Received: November 2024 Revised: April 2025 Published: July 2025 *Keywords* *Learning outcomes;* *E-pop up book;* *Interpreting vocabulary;* *Teaching media;*	*This research started from the problem of low learning outcomes in interpreting the vocabulary of grade IV students in the Indonesian subject. Interpreting vocabulary is very difficult for students because of the large number of vocabulary in Indonesian and the lack of use of learning media in the classroom. In addition, there is a lack of interest in learning because teachers are not able to use learning media that are in accordance with the characteristics of grade IV students. Therefore, AI-based e-pop up book media can help students interpret vocabulary. From these problems, this study aims to describe e-pop up book media, describe the results of the feasibility test of e-pop up book media, and describe the results of the effectiveness test of e-pop up book media. This research method uses R&D research with the development of the Borg and Gall model which was carried out up to stage 8 only due to time and cost limitations with a sample of 35 students. The media created is then tested by material and media experts. The results of the media feasibility test were obtained from assessments according to material experts of 95% (very feasible) and according to media experts of 92.5% (very feasible). The study found that AI-integrated e-pop up books significantly improved students' vocabulary interpreting skills, with a t-test result of 17,791 and an N-gain score of 0.7084 (high category). Based on the results of the study, it shows that the use of artificial intelligence-based e-pop up book media is very effective in improving learning outcomes in interpreting elementary school grade IV vocabulary.*

INTRODUCTION

Education is a form of strategy that has been designed by the government as a benchmark in achieving national goals to measure the achievement of a nation's achievements (Fadhlurrohman, 2024; Mansir, 2020). The Preamble to the 1945 Constitution on the 4th Amendment explains that education is the spearhead in educating the generation of the Indonesian nation. In the learning process, there is a scope of subjects given at the elementary school education level as stated in the Regulation of the Minister of Education, Culture, Research, and Technology of the Republic of Indonesia Number 7 of 2022 concerning Content Standards for Early Childhood, Primary Education, and Secondary Education, one of which is Indonesian (Makarim, 2022).

The learning process in the classroom, precisely in the subject of Indonesian in elementary school, will produce a learning outcome as a benchmark in learning (Sirefar & Syaputra, 2022; Subakti, 2020). The learning results are obtained in the form of grades through assessments given by teachers to determine the understanding in students during the learning process (Afifah et al., 2022). Learning outcomes are also a form of evaluation for students to

find out their cognitive, psychomotor, and affective abilities that have been learned while participating in learning activities (Prasetyo & Dasari, 2023). Learning in the classroom is usually done by only reading the student handbook on each subject (Widiyanto & Istiqomah, 2020). Books that are used as guidelines by students usually only contain a lot of writing and a lack of pictures in the book. So that students feel less interested and bored when studying in class. Because students will be happier when the reading book has a large font size and is full of colored pictures (Ula et al., 2023; Azizatunnisa et al., 2022). In addition to using reading books, every teacher also needs interesting media in each lesson (Nadia & Desyandri, 2022). According Nikmah & Rahmawati, (2022), to support the learning process, media is needed to be used to attract students when understanding a subject matter.

Based on the results of the researcher's observations during his time as a student of the Teaching Campus Batch 6 and the results of interviews that have been conducted with grade IV teachers at SDN 02 Mayangan, there are several problems experienced in the Indonesian learning process. The low interest in reading of students when studying in class can hinder the Indonesian learning process (Suryana et al., 2022). The learning media is less than optimal and there is a lack of media use, namely still using teacher books, student books and LKPD in the learning process. This makes the lack of use of media that aims to support students' learning so that their attractiveness in learning will be reduced (Dewi et al., 2022; Adam, 2023).

Empris data obtained by researchers related to vocabulary interpretation material in grade IV students shows that students' learning outcomes are still categorized as low. Because in this material, there are 11 students who complete and 24 students who do not complete with an average learning outcome of students which is only 59.5. Even though the average that should be achieved by students in Indonesian subjects is 70. So it can be concluded that the learning outcomes of students in grade IV of vocabulary interpreting material in Indonesian subjects have not been able to achieve the criteria for achieving learning objectives. This can happen because it is caused by several factors including low interest in learning students, strategies used in Indonesian learning that are not appropriate, and the use of media in the learning process (Putri & Kasriman, 2022; Puthree et al., 2021). So that the learning outcomes of students become low and the learning goals are not achieved properly (Lestari & Irawati, 2020).

The characteristics of grade IV elementary school students should be able to interpret vocabulary well. In accordance with the learning outcomes listed in the policy of the Ministry of Education, Culture, Research, and Technology, it states that Indonesian subjects in the elements of reading and watching students must be able to interpret vocabulary in daily life. These learning outcomes are a reference for a teacher in the Indonesian learning process. However, in reality, the majority of students at SDN 02 Mayangan have not been able to interpret vocabulary well. So that the problem must be solved with the aim that the learning results are not low and the learning objectives can be achieved properly.

The latest of this research is to overcome these problems with e-pop up book learning media which is packaged in the form of technology-based applications. Because in the current era, students are closer to technology, so they will become interested when learning to use technology-based media (Usmaedi et al., 2020; Susilawati & Rusdinal, 2022). In addition, looking at adequate facilities can be used as an alternative in developing technology-based learning media. The development of e-pop up book media is one of the predictions of this problem because it utilizes technology by using Chrome books so that students can understand new vocabulary well.

The media is in the form of an application that contains the features of learning materials by providing many advantages in learning for both students and teachers. The ability to present pictures, the size of the elements in the media, color factors, language factors, the relationship between images and sounds make students more interested in learning (Syadida & Erita, 2022; Hanisah et al., 2022). The development in this study has a novelty centered on the local cultural

heritage of Batik Jlamprang Pekalongan which is known for its very simple motifs but has its own characteristics. This media is developed through narrative texts by combining dual vocabulary in it to improve students on vocabulary that is often used in daily life. In addition to encouraging students' understanding, this research aims to foster a sense of love for local culture. The next significant benefit can overcome the research gap, because learning Indonesian introduces the language in general without adding local culture.

The Batik Jlamprang e-pop up book media is a learning media inspired by the local wisdom of the Pekalongan area and packaged in the form of a digital book that displays 3-dimensional effects based on Artificial Intelligence (AI) in which there is narrative text focusing on daily life in the student environment. This media is aimed at students so that they can get to know the local wisdom around their area. Artificial Intelligence (AI) is technological intelligence that is packaged like human thinking carried out by a robot system. The use of AI in this media is assisted by the Smart Apps Creator application with extraordinary sophistication capable of creating applications without deep coding. In addition, this application has various features that can be easily accessed to create a Batik Jlamprang e-pop up book media application.

By introducing the Jlamprang Batik e-pop up book, this research aims to overcome the lack of instructional learning process and be able to create a more interesting learning atmosphere for students so that the learning environment becomes more dynamic. This e-pop up book aims to be a link between students' use of vocabulary on the meaning of words by visualizing the material with Batik Jlamprang so that learning runs well. The combination of these two elements can be expected to be able to be adjusted to the level of understanding of students and ensure solutions that can be applied to the learning process.

In this discussion, the gap can be evidenced by the lack of combining media with relevant local cultural content to improve students' vocabulary understanding in elementary school. Several previous studies have explored interactive media used in the learning process by investigating and evaluating the use of such media with narrative texts. The purpose of this study is to provide new innovations in this gap by developing and investigating the success of the use of Batik Jlamprang e-pop up book media on students' vocabulary understanding.

Thus, this development research aims to design the design of e-pop up book media, describe the results of the feasibility test of e-pop up book media, and describe the results of the effectiveness test of e-pop up book media as an effort to improve students' learning outcomes in interpreting vocabulary and be able to contribute widely as an effort to improve innovative and effective learning in the current era. This research was also created with the intention of providing useful and flexible tools for teachers, which can be easily integrated into existing language curricula. The following research questions can guide this research: How can the form of e-pop up books that combine Batik Jlamprang with artificial intelligence improve students' understanding of their vocabulary? And what is the quality of the Batik Jlamprang e-pop up book based on artificial intelligence?

RESEARCH METHOD
Research Design
This study uses development research or Research and Development (R&D) with a quantitative descriptive approach. Research and Development (R&D) is research that produces a new product or improves a product from another researcher who has carried out research (Syavira, 2021). According Okpatrioka, (2023) to explaining that development research or R&D is research that focuses on developing a new product or can improve from products that have been developed by other researchers. The method used in this study is based on the Research and Development (R&D) method with the theory of Borg and Gall adapted by Sugiyono in (Winaryati et al., 2021). The development model consists of 10 steps, namely 1) potential and problem, 2) data collection, 3) product design, 4) design validation, 5) design

revision, 6) product trial, 7) product revision, 8) usage trial, 9) product revision, 10) mass product. However, the implementation of this research only reached the 8th step. Because research with large-scale R&D development requires a lot of money and takes a long time. In addition, this research has been based on methodological considerations, resources, and specific objectives of the research conducted and has obtained quite valid data from operational field trials. Although this research was only carried out until the 8th step, the results of the study will not affect the future because the research can determine the effectiveness of the development of the media.

| Low learning outcomes interpret | → | Observations, interviews, and | → | Through Canva with the help *of Smart Apps Creator* | → | Validation of material and media |

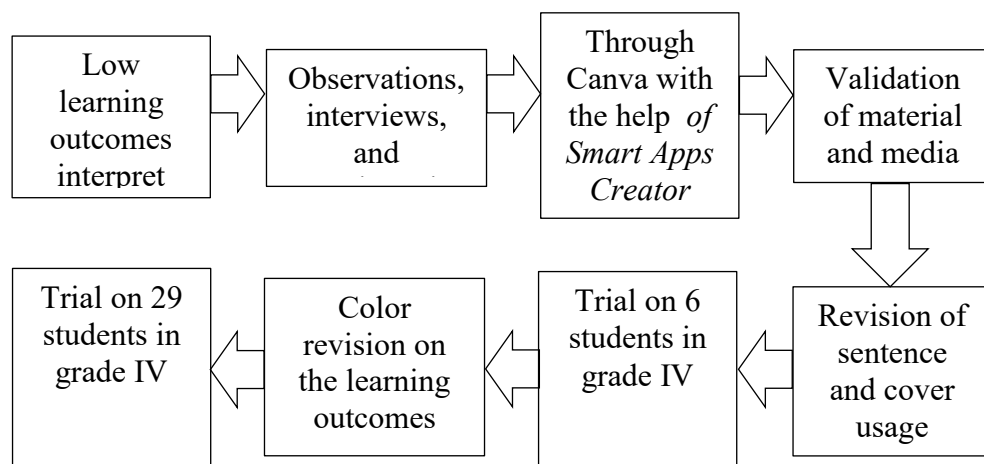| Trial on 29 students in grade IV | ← | Color revision on the learning outcomes | ← | Trial on 6 students in grade IV | ← | Revision of sentence and cover usage |

Figure 1. Research Steps

The use of artificial intelligence in e-pop up book media is considered to be able to improve students' vocabulary understanding because it provides attractive visuals, images, and colors. Artificial intelligence also tailors the learning experience to the needs of each learner and incorporates interactive elements such as games, quizzes, and challenges that make learning vocabulary more engaging and fun.

Population and Sample
The subjects in this study are grade IV students of SDN 02 Mayangan with a total of 35 people. The subjects were divided into two tests, for a small-scale test involving 6 students and a large-scale test involving 29 students. The students selected are based on their understanding of vocabulary, so they become the right respondents to evaluate the influence of new media on this specific field of study. The selection of students is not based on gender but is assisted by teachers by grouping 6 students with different levels of vocabulary understanding to be carried out small-scale tests. Students who do not participate in small-scale tests automatically take large-scale tests.

Some of the important procedures carried out in this study include measuring the level of feasibility of Batik Jlamprang e-pop up book media, conducting material validation tests and media validation tests with validators who are experts in their fields. The validation test aims to assess the validity of the material for the Batik Jlamprang e-pop up book media before testing it on students and ensuring that the content on the media can be guaranteed and of high quality. To ensure alignment with educational standards and the achievement of learning objectives, media content is evaluated by subject matter experts. This research shows that the Jlamprang Batik e-pop up book has succeeded in improving students' vocabulary understanding by involving media specialists, experts in the field of study, and a sample of students. Through a strict review process, it is ensured that this media is appropriate for educational purposes and answers the needs of teachers and students. After the media is declared suitable for use in

understanding the material and interpreting vocabulary, then a response questionnaire is given to teachers and students in small-scale tests and large-scale tests.

Instruments

According Ardiansyah et al., (2023) to the data collection technique, it is a method or step taken by the researcher to solve the problem being researched. This data collection technique is one of the steps that researchers must take with the aim of obtaining accurate data that meets the standards that have been set. In this study, the techniques used in collecting research data are tests and non-tests. Data collection through this test, the researcher must compile and collect test items according to the problem in the study. As for the non-test, it consists of observation, interviews, questionnaires, and documentation. The data that has been obtained is then analyzed through several validity tests such as validity tests, feasibility tests, question difficulty tests, and differentiating power tests. Tests in the form of pretest and posttest on a large scale are also carried out normality tests to find out whether the data is normally distributed or not normally distributed. If the data is normally distributed, it will be followed by parametric statistical analysis to test the t-test. The n-Gain test must also be carried out to determine the improvement in students' learning outcomes before and after being given treatment. In addition, the products that have been developed are also assessed by validators, material experts and media experts through heat that has been made to find out the feasibility of the product before use.

To ensure that the pretest and posttest of the research meet the requirements of advanced statistical analysis, normality testing is carried out. If the data is distributed normally, the researcher can use parametric tests. The improvement in student learning outcomes was measured through a T-test, which compares pre- and post-learning scores to see if there were any significant differences. In addition, N-Gain analysis is used to measure how much improvement occurs, thus providing an understanding of how effective the interventions are applied. Assessment by experts also plays an important role in the process of developing and improving the quality of e-pop up book media. The content, design, and overall feasibility of the e-pop up book are evaluated by experienced media and material experts. Their input plays a crucial role in testing quality and ensuring product conformity with pedagogical principles. This careful evaluation process aims to make the e-pop up book not only interesting and interactive, but also a reliable and effective means to improve students' understanding of new vocabulary and double meaning words.

Data Analysis

The data used in this study consists of two types, namely quantitative data and qualitative data. Quantitative data is in the form of numerical data through questionnaires that have been systematically compiled by researchers. The data is in the form of validation results of material experts and media experts, the results of student and teacher response questionnaires, and pretest and posttest scores of students on a small and large scale. Meanwhile, qualitative data is in the form of data that includes input or suggestions given by lecturers, subject matter experts, and media experts. The assessment questionnaire given to material expert validators and media expert validators aims to determine the feasibility of artificial intelligence-based e-pop up book media.

The evaluation of the validation of the subject matter expert must be based on aspects that are in accordance with the developed medium. The aspects used in the assessment of the validation of material experts are divided into 4 of them, namely the content and purpose aspects, the use of language aspects, the learning aspects, and the display aspects. The following is a table of the assessment indicators for the validation of material experts.

Table 1
Material Validation Assessment Indicators

Aspects	Indicators
Content and purpose aspects	• Suitability of the material with the characteristics and objectives of learning (C4, C5, and C6)
Aspects of language use	• The language used is according to the level of development of grade IV students
Learning aspects	• Explanation of material in e-pop up book media can facilitate the understanding of grade IV students
Aspect of the display	• The type and size of the letters are correct so that they are easy to read by students • Display design according to the material

The assessment of the material validation test was statistically analyzed by adding all scores into percentage results. This percentage is a reference as the feasibility of the developed media. In addition, input and suggestions can also help researchers to evaluate the products being developed. The percentage results of the feasibility data are then converted to predetermined criteria. If the percentage produced is included in the criteria that are not feasible, then the product must be developed again to be able to make the product feasible. The following is a table of material expert validation criteria.

Table 2
Material Eligibility Criteria

Percentage	Criterion
20% - 36%	Very unworthy
37% - 52%	Not eligible
53% - 68%	Quite feasible
69% - 84%	Proper
85% - 100%	Highly feasible

Meanwhile, in the validation test of media experts, there are 3 aspects, consisting of aspects of media suitability with the material, aspects of design and appearance, as well as aspects of attractiveness and convenience. The following are the indicators of media expert assessments based on these aspects.

Table 3
Media Validation Assessment Indicators

Aspects	Indicators
Aspects of media suitability with the material	• Learning media must be in accordance with the learning objectives (C4, C5 and C6)
Design and display aspects	• The design of learning media has attractive colors • Learning media has reading text that matches the picture • Learning media has a clear picture
Interesting aspects and convenience	• Easy learning media for teachers and students in class IV learning

The results of the assessment obtained through the media validation questionnaire can be summed up which is then analyzed into the form of percentages according to (Riduwan, in Saski & Sudarwanto, 2021). The percentage of the assessment results can be converted to the following criteria.

Table 4
Media Eligibility Criteria

Percentage	Criterion
20% - 36%	Very unworthy
37% - 52%	Not eligible
53% - 68%	Quite feasible
69% - 84%	Proper
85% - 100%	Highly feasible

RESEARCH FINDINGS AND DISCUSSION
Research Findings
The research on the development of Batik Jlamprang e-pop up book media focuses on: (1) describing the product design of the Batik Jlamprang e-pop up book media based on artificial intelligence, (2) describing the results of the feasibility test of the Batik Jlamprang e-pop up book media based on artificial intelligence, and (3) describing the results of the effectiveness test of the Batik Jlamprang e-pop up book media based on artificial intelligence. This research was developed based on the results of an analysis of the needs of students and teachers. The analysis stage is the stage of collecting data from the questionnaire of the needs of teachers and students. The needs questionnaire contains several questions related to Indonesian learning which include students' difficulties, understanding of vocabulary meaning, and students' interest in Indonesian learning media based on the e-pop up book Batik Jlamprang Pekalongan. In addition, the researcher analyzed the potential problems that existed in schools by choosing one of the classes to be used as a research sample. This stage is carried out by means of direct observation in the classroom by analyzing the classroom environment, characteristics of students, and direct interviews with grade IV teachers of SDN 02 Mayangan.

Media Design E-pop up Book
In this stage, the researcher designs or creates a learning media design for the e-pop up book Batik Jlamprang (Batik Jlamprang Pekalongan) based on artificial intelligence. The Batik Jlamprang e-pop up book is a product that refers to digital services through a computer and cellphone-based system that responds to user actions by presenting animated images. This media is packaged in the form of a three-dimensional digital book that provides a visual effect of narrative text with the help of the Smart Apps Creator application which can be accessed via mobile phones or computers. This e-pop up book is designed with the needs and abilities of students who prefer technology by displaying visuals directly. Especially in the narrative text that contains short stories about Batik Jlamprang Pekalongan to support students' imagination in understanding a word.

The design of Indonesian learning media products in the form of an e-pop up book Batik Jlamprang based on artificial intelligence based on applications. This application was made by adjusting the needs of teachers and students in grade IV of SDN 02 Mayangan. The design of learning media also adjusts to the indicators and objectives of Indonesian learning. The design of the development of Indonesian learning media in the form of an artificial intelligence-based Batik Jlamprang e-pop up book application consists of ten parts including: (1) opening design, (2) design of instructions for use, (3) design of the main menu, (4) design of learning outcomes, (5) design of learning objectives, (6) design of Batik Jlamprang pop up book, (7) design of learning materials, (8) design of vocabulary interpretation, (9) design of learning quiz, and (10) developer profile design. The following is an example of the appearance of the Batik Jlamprang e-pop up book media that can be operated via mobile phone or computer.

Table 5
Media *Results E-pop up book* Batik Jlamprang

Yes	Display	Display Description
1.		The cover design contains the title of the learning material, logo (Ministry of Education and Culture, Unnes, and Kampus Merdeka), class, developer, and a start button that functions to start the application and enter the next page.
2.		The menu section contains several menus in this application, namely learning outcomes, learning objectives, learning materials, pop up books Batik Jlamprang, vocabulary interpretation, learning quizzes and developer profiles. Each menu choice goes to the next page according to the content of the menu.
3.		The e-pop up display contains narrative text based on Batik Jlamprang Pekalongan which contains several new vocabulary words and double meaning words that can be analyzed by students. The e-pop up book also displays various images that can attract students' attention when using this media.

Validation Results of Material Experts and Media Experts

Product validation is carried out on validators who already have experience in the field of vocabulary interpreting material and in the field of learning media development. This validation aims to determine the feasibility of the media before it is tested on students. The results of the validation of material experts showed that the percentage of 95% was included in the criteria of very feasible. Meanwhile, the validation results of media experts obtained a percentage of 92.5% which is included in the criteria is very feasible. The following are the results of the validation recapitulation of material experts and media experts. However, there are three inputs from media experts, namely: (1) addition to the opening design title section to strengthen the media, (2) characterization in the narrative text, and (3) the use of command words. Here's an example of a before and after revision view by a media expert validator.

Table 6
Revision of the Display by Media Expert Validator

Yes	Before Revision	After Revision
1.		
2.		

The recapitulation of the results of the experts' assessment can be concluded if the Indonesian learning media based on the Batik Jlamprang pop up book meets the criteria is very feasible. Therefore, the Batik Jlamprang pop-up book-based learning media is very feasible to be used as an Indonesian learning medium to interpret new vocabulary and double meaning words in grade IV SDN 02 Mayangan.

Table 7
Results of the Validation of Material Experts and Media Experts

Expert Validation	Overall Score	Scores Obtained	Percentage	Criterion
Material	80	76	95%	Highly Worth It
Media	40	37	92,5%	Highly Worth It

Product Effectiveness Results

A small-scale trial using artificial intelligence-based Batik Jlamprang e-pop up book learning media in the form of the Smart Apps Creator application was carried out to 6 students in grade IV of SDN 02 Mayangan with three boys and three girls. This small-scale trial was carried out with the aim of finding out the shortcomings of artificial intelligence-based Batik Jlamprang pop up book media in the form of the Smart Apps Creator application that has been developed by researchers. Meanwhile, a large-scale test was carried out on 29 students in grade IV of SDN 02 Mayangan.

The effectiveness test process started from small-scale testing with 6 students to conduct product trials. The results showed that the small-scale pretest score had an average of 53.3 and the average posttest score of 82.6. Meanwhile, large-scale results with a total of 29 students showed that the average pretest score was 41 and the average posttest score was 82.8 which means that the results of both there were improvements in learning outcomes before and after using the Baltik Jlamprang e-pop up book learning media based on artificial intelligence. The following is a diagram of the results of small-scale and large-scale tests.
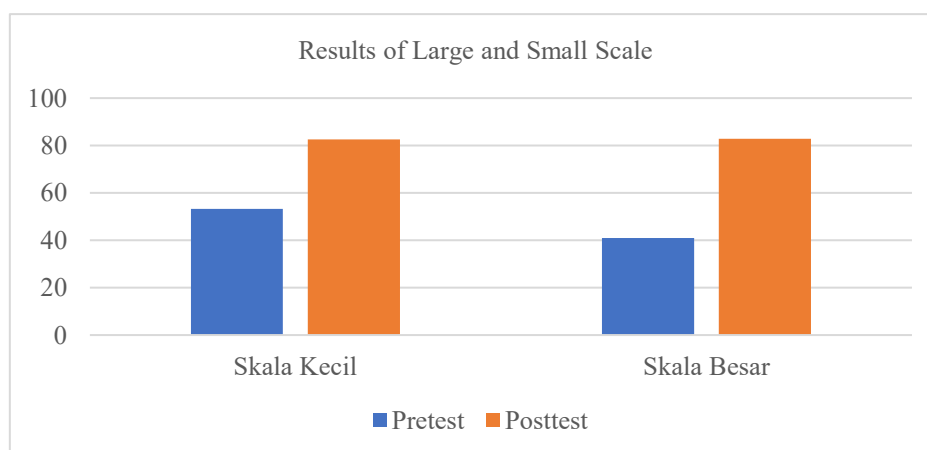
Diagram 1. Results of Small Scale and Besat Scale Tests

Based on the results of small-scale and large-scale tests on grade IV students of SDN 02 Mayangan, revisions given by teachers to e-pop up book media were obtained. Enter it in the form of the color of the letters on the learning outcomes menu that is too bright so that the letters are not too readable. The following is a before and after view of the revision given by the teacher.

Table 8
Revision of the Display by Media Expert Validator

Yes	Before Revision	After Revision
1.		

After all the needed data was collected, the researcher then tested the effectiveness of e-pop up book media to determine the improvement of students' learning outcomes in vocabulary interpretation materials. The researcher used the help of the SPSS version 30 application to conduct a normality test using the Shapiro-Wilk test. The following are the results of small-scale and large-scale normality tests using the Shapiro-Wilk test.

Table 9
Results of Small and Large-Scale Normality Tests

Normality Test				
Scale	Test			
		Shapiro-Walk		
		Statistics	Df	Sig.
Small-scale	Pretest	.925	6	.539
	Posttest	.974	6	.918
Large-scale	Pretest	.962	29	.373
	Posttest	.967	29	.479

Based on the results of the normality test using Shapiro-Wilk, it is shown that the results of the normality test on a small scale are significant because the significance value is more than 0.05 with a pretest significance value of 0.539 and the posttest significance level result of 0.918, so it can be said that the pretest and posttest values are normally distributed. Meanwhile, in the large-scale normality test, the pretest significance level was 0.373 and the posttest value had a significance level of 0.479, which means that the data is normally distributed because the significance level of both is more than 0.05. The data that has been tested through the normality test and can be declared to be normally distributed, the next step is to perform the t-test and the n-Gain test. The t-test was carried out to determine the level of effectiveness of the Batik Jlamprang e-pop up book learning media based on artificial intelligence. The researcher used the help of SPSS 30 for the t-test with the type t-Test: Paired Two Sample For Means. The following are the results of the t-test using paires sample for means.

Table 10
Small and Large-Scale T-Test Results

Paired Sample Test						
	N	Mean	Std. Deviation	t count	Df	t table
Small-scale	6	-29.33333	11.21903	-6.404	5	2.570
Large-scale	29	-41.86207	12.67090	-17.791	28	2.048

Based on the t-test in the table above, it shows that if the hypothesis including H_0 is rejected and H_1 is accepted, then the t-value is calculated $>$ t table and it can be concluded that there is a difference or influence of the use of learning media. On the other hand, if H_0 is accepted and H_1 is rejected, then t calculates $<$ t table so that it can be concluded that there is no difference and

influence of the use of learning media. The results of the small-scale t test showed that the t count obtained was 6,404 and the t table was 2,570. The t-test can be concluded that the result of t $_{calculation}$ is 6,404 > t $_{table}$ 2,048, then H_0 is rejected and H_1 is accepted. Meanwhile, on a large scale, the results of the t-test were obtained at 17,791 and the t table was 2,048, so the results of t $_{calculation}$ were 17,791> t $_{table}$ 2,048, then H_0 was rejected and H_1 was accepted. Based on the results of the t-test analysis, it can be concluded that on a small scale and a large scale there are differences and influences in learning outcomes of the material interpreting vocabulary before and after using the learning media of the Batik Jlamprang e-pop up book based on artificial intelligence.

After the test results are obtained, then the results are converted to the interpretation of the n-Gain test. According to Volunteer et al., (2024)the following criteria for improving learning outcomes based on the n-Gain test.

Table 11
Results of Small and Large-Scale Normality Tests

N-Gain Index (g)	Interpretation
$0.70 \leq g \leq 100$	Tall
$0.30 \leq g < 0.70$	Keep
$0.00 < g < 0.30$	Low
$g = 0.00$	There is no improvement
$-1.00 \leq g < 0.00$	There is a decline

Based on the results of the pretest and posttest on a small and large scale, the researcher conducted calculations to determine the improvement in students' learning outcomes, especially vocabulary interpretation material. The calculation of the N-gain test is carried out by calculating the difference between the pretest and posttest scores. These results allow researchers to determine the effectiveness of the use of artificial intelligence-based Batik Jlamprang e-pop up book media in the form of an application. The following table is the results of small-scale and large-scale n-Gain tests.

Table 12
Results of the Recapitulation of Small and Large-Scale N-Gain Tests

Scale	Category	Value
Small-scale	Average pretest	53,3
	Posttest average	82,6
	N-Gain	0,6274
	Criterion	Keep
Large-scale	Average pretest	41
	Posttest average	82,8
	N-Gain	0,7084
	Criterion	Tall

Based on the results of the N-gain test on a small scale and a large scale, it shows that there is an increase in the learning outcomes of grade IV students of SDN 02 Mayangan in the material interpreting vocabulary and words with double meanings. The increase in learning outcomes can be seen from the small-scale N-gain value of 0.571 which is included in the medium criterion and the large-scale N-gain value of 0.702 which is included in the high criterion. In accordance with the analysis that has been carried out, it can be concluded that there is an increase in learning outcomes when using the Batik Jlamprang e-pop up book media based on artificial intelligence in the form of an application. So it can be concluded that the

artificial intelligence-based Batik Jlamprang e-pop up book media is very effective to be used in the process of learning Indonesian vocabulary interpreting material.

Discussion

The needs of students in the learning process must be met, so that the knowledge they gain can be digested properly so that learning results can be in accordance with learning objectives. One of the needs that is often needed in learning is the use of learning media (Zain & Pratiwi, 2021). According Setiadi & Effendi, (2022) to learning media it is a set of tools that are used as a bridge in the learning process so that there is interaction between teachers and students so that learning goals can be achieved properly. Learning media is used as a strategy in the development of students who become supporting facilities in the learning process in the classroom (Batubara & Ariani, 2019; Masitoh, 2022; Legina & Sari, 2022). However, the use of learning media in the learning process has not been applied evenly throughout elementary schools. The existence of different factors is one of the obstacles that teachers must face in teaching (Muammar et al., 2023). According Arrum & Fuada, (2022) to these factors, it can be in the form of a lack of adequate facilities in schools, teachers' understanding of learning media that is still low, and school environment conditions that are less likely to use learning media.

Based on the results of the questionnaire, teachers' needs for learning media stated that there were some students who had difficulty understanding or interpreting new vocabulary and words with double meanings. The lack of use of media in the learning process makes students less active and not interested in learning Indonesian, especially material on vocabulary and words with double meanings. So it is necessary to develop media by displaying bright colors, letters that students like, and attractive images (Janah et al., 2023; Hayati, 2021). So researchers are interested in developing an e-pop up book based on artificial intelligence. The media that the researcher wants to develop is based on the wisdom of Pekalongan, namely Batik Jlamprang. The support from teachers adds to the enthusiasm of researchers to develop artificial intelligence-based e-pop up book media, because with this media students can learn while playing by understanding the material first and then can do the available quizzes. Therefore, it can be concluded that teachers strongly agree with the use of artificial intelligence-based e-pop up book d media in the learning process of interpreting vocabulary and words with double meanings.

The media to be developed is an Indonesian learning media on the material on new vocabulary and double meaning words based on artificial intelligence. This learning media is an e-pop up book media that is packaged in the form of an application and made through Smart Apps Creator and can be operated via mobile phone or leptop. The rapid development of technology in the current era has made researchers interested in developing technology-based learning media by displaying images, animations, and sounds. According Pradani, (2022) to the development, technology-based learning media can be applied in learning through applications on smartphones or laptops with the aim of being an alternative in overcoming learning difficulties in students. The development of this e-pop up book media is expected to improve learning outcomes and students' learning motivation, especially in the material on new vocabulary meanings.

The learning media for the Batik Jlamprang e-pop up book based on artificial intelligence has contained prerequisite material, namely there is a narrative text based on local wisdom, new vocabulary contained in the narrative text, and the meaning of the meaning of the new vocabulary. The media has included clarity of the material by using sentences that are effective and easy for students to understand. However, there are several suggestions given by the material validators, namely the choice of command words contained in the media is not clear and the use of effective sentences that must be reconsidered by paying attention to the characteristics of students. The results of the assessment recapitulation from the 20 aspects of material validation were assessed, a score of 76 was obtained with a maximum score of 80.

Therefore, the results of the assessment stated that the artificial intelligence-based Batik Jlamprang e-pop up book media obtained a percentage of 95% which is included in the criteria is very feasible. Meanwhile, the media validation assessment showed that the assessment of the 10 media validation statements assessed, obtained a score of 37 out of a maximum score of 40. Therefore, from the results of the assessment, the Jlamprang Batik e-pop up book media based on artificial intelligence obtained a percentage of 92.5% which is included in the criteria of very feasible. So that e-pop up book media is very suitable for use in the learning process.

According to Miftah & Rokhman, (2022), effectiveness in learning is a benchmark for the success of the learning process from the relationship between teachers and students to achieve a learning goal. The effectiveness of the learning media of the Batik Jlamprang e-pop up book based on artificial intelligence can be known through the learning outcomes of students in the form of pretest and posttest scores of grade IV students of SDN 02 Mayangan totaling 35 students. Pretest scores are obtained before students use learning media, while posttest scores are obtained after students use learning media. The difference in learning outcomes can be found through a small-scale test with a total of 6 students and a large-scale test with a total of 29 students. The effectiveness of Miftah & Rokhman (2022)e-pop up book media can be seen from the results of the n-Gain test on pretest and posttest data. The results of the n-gain test on a small scale obtained a value of 0.6274 with moderate criteria. Meanwhile, the results of the large-scale N-gain test obtained a value of 0.7084 which is included in the high criterion. Based on the calculation of the n-gain test, it can be concluded that the media is effective to be used in the learning process because there is an increase in learning outcomes when using artificial intelligence-based Batik Jlamprang e-pop up book media in the form of the Smart Apps Creator application in grade IV students of SDN 02 Mayangan.

The results of this study support previous research conducted by (Mahmudi et al., 2023) improving the reading ability of grade II students. The study showed that there was an increase in students' reading ability before and after using pop up book media. In line with this study, which showed an increase in small-scale trials by obtaining an average pretest score of 53.3 and an average posttest of 82.6. Meanwhile, the results of the large-scale test obtained an average pretest score of 41 and an average posttest of 82.8. In addition, the results of the responses of students and teachers in grade IV of SDN 02 Mayangan received a positive response to the e-pop up media so that the percentage of teachers of 95% was included in the very effective category and the result of the percentage of students of 90% was included in the very effective category. So that e-pop up book media is very effective in using the learning process.

Finally, the development of an artificial intelligence-based Batik Jlamprang e-pop up book is a solution to the lack of educational media by combining local content and differentiated instruction. This innovative tool not only increases students' mastery of new vocabulary, but also realizes inclusive learning, so that all students can be actively involved with the material, regardless of their ability level. This research adds to the literature that supports the importance of learning interventions that consider cultural and student-oriented aspects, while inspiring future developments in language education.

CONCLUSION

This research developed an e-pop up book Batik Jlamprang based on artificial intelligence as a learning medium that focuses on students and local culture in elementary schools. The goal is to create an engaging, accessible, and integrated learning experience through visual media. This media is designed to be student-centered by taking advantage of the rich surrounding culture. This research highlights how the merging of local heritage and digital visualization can create immersive and flexible learning. This e-pop up book not only introduces new contextual vocabulary, but is also designed adaptively to improve inclusive and effective education, addressing common problems in education that lack attention to the understanding and unique potential of each learner.

This study found that the use of the Jlamprang Batik e-pop up book had a significant impact on improving students' understanding of new vocabulary and ambiguity of word meanings. Its quality and effectiveness in the context of classroom learning is confirmed through positive feedback from educators and learners, as well as through a validation process by experts. Although its implementation faces obstacles such as the need for teacher training and technological infrastructure support, the overall results of the study indicate the great potential of this medium in improving the quality of education. This e-pop up book media is designed as a valuable educational intervention for the future, with a main focus on improving literacy through innovative methods rooted in culture. The selection of e-pop up books is based on the combination of contemporary pedagogical frameworks and interactive media, with the aim of creating educational resources that are inclusive and effective, responsive to the diverse learning needs of students, and have a meaningful positive impact on the progress of language education.

REFERENCES

Adam, A. (2023). The effect of audiovisual learning media on elementary school students' learning interest. *Journal of Contemporary Issue in Elementary Education*, *1*(1), 29–37. https://doi.org/10.33830/jciee.v1i1.5027

Afifah, D. N., Widiyono, A., & Attalina, S. N. C. (2022). Development of water cycle diorama media to improve science learning outcomes in elementary schools. *Journal of Education and Counseling*, *4*(3). https://doi.org/10.31004/jpdk.v4i3.4374

Ardiansyah, Risnita, & Jailani, M. S. (2023). Data collection techniques and scientific research instruments in qualitative and quantitative educational approaches. *Ihsan: Journal of Islamic Education*. https://doi.org/10.61104/ihsan.v1i2.57

Arrum, A. H., & Fuada, S. (2022). Strengthening online learning at SDN Jakasampurna V, Bekasi City, West Java using interactive learning media based on augmented reality (AR). *Abdimas Umtas: Journal of Community Service*, *4*(1). https://doi.org/10.35568/abdimas.v4i1.1181

Azizatunnisa, F., Sekaringtyas, T., & Hasanah, U. (2022). Development of interactive learning media in educational games for fourth-grade elementary school science learning. *OPTIKA: Journal of Physics Education*, *6*(1). https://doi.org/10.37478/optika.v6i1.1071

Batubara, R., Yetti, S. M., & Siman. (2024). Project-based learning innovation: Pop-up book development to improve the language of 5–6-year-old children. *Elementary School Journal PGSD Unimed*, *14*(1), 9–25. https://doi.org/10.24114/esjpgsd.v14i1.56315

Dewi, M. I. A., Kartini, K. S., & Wulandari, M. R. S. (2022). Improving learning outcomes using technology-based learning media at SD Pelangi Jimbaran. *Journal Widya Laksmi*, *2*(1), 34–44. https://doi.org/10.59458/jwl.v2i1.28

Fadhlurrohman, N. A., & Bektiningsih, K. (2024). Whiteboard animation learning media on economic activity material for grade IV elementary schools. *MIMBAR PGSD Undiksha*, *12*(1), 83–92. https://doi.org/10.23887/jjpgsd.v12i1.70676

Hanisah, Irhasyuarna, Y., & Yulinda, R. (2022). Development of interactive learning media using iSpring Suite 10 on plant reproduction material to measure learning outcomes. *JUPEIS*, *1*(3). https://doi.org/10.55784/jupeis.Vol1.Iss3.68

Hayati, L. (2021). Development of flashcard learning media in elementary schools. *Journal of Research and Social Studies Education*, *15*, 197–208. https://doi.org/10.21067/jppi.v15i2.5684

Janah, M., Nuroso, H., Mudzanatun, & Isnuryantono, E. (2023). The use of Canva application in mathematics learning media in elementary schools. https://doi.org/10.20961/jpd.v11i1.72716

Legina, N., & Sari, P. M. (2022). Development of interactive learning media using Articulate Storyline based on critical thinking skills in elementary science learning. *Journal Paedagogy*, *9*(3), 375. https://doi.org/10.33394/jp.v9i3.5285

Lestari, D. G., & Irawati, H. (2020). Literature review: Improving students' cognitive learning outcomes and motivation in biology through guided inquiry learning models. *BIOMA*, *2*(2), 51–59. https://ojs.unsulbar.ac.id/index.php/bioma/article/view/861

Mahmudi, M. R., Dwitri, & Hader, A. E. (2023). Development of pop-up book media to improve students' reading ability in Indonesian for second-grade students of SDN 308/VI Rantau Suli. https://doi.org/10.36989/didaktik.v9i2.985

Mansir, F. (2020). Welfare and quality of teachers as the spearhead of national education in the digital era. *Journal of PGSD Alumni Association*, *8*(2), 293–303. https://doi.org/10.36841/pgsdunars.v8i2.829

Masitoh, A. (2022). The influence of Jigsaw learning model using flipbook media on social studies learning outcomes for grade V elementary school. *Journal Belaindika: Learning and Educational Innovation*, *4*(1), 21–27. https://doi.org/10.52005/belaindika.v4i1.80

Miftah, M., & Rokhman, N. (2022). Criteria for selection and principles of using ICT-based learning media according to students' needs. *Educenter: Scientific Journal of Education*, *1*, 412–420. https://doi.org/10.55904/educenter.v1i9.92

Muammar, Ruqoiyyah, S., & Ningsih, N. S. (2023). Implementing the Teaching at the Right Level (TaRL) approach to improve elementary students' initial reading skills. *JOLLT Journal of Languages and Language Teaching*, *11*(4), 610. https://doi.org/10.33394/jollt.v%vi%i.8989

Nadia, D. O., & Desyandri. (2022). The effect of Wordwall learning media on elementary students' learning outcomes. https://doi.org/10.36989/didaktik.v8i2.497

Nikmah, N. H., & Rahmawati, F. P. (2022). Needs analysis for the development of interactive digital media based on PowerPoint in Indonesian language learning in elementary schools. *Journal Basicedu*, *6*(3), 5251–5258. https://doi.org/10.31004/basicedu.v6i3.2928

Okpatrioka. (2023). Research and development (R&D): Innovative research in education. *Journal of Education, Language and Culture*, *1*, 86–100. https://doi.org/10.47861/jdan.v1i1.154

Pradani, T. G. (2022). The use of Wordwall learning media to increase students' interest and motivation in science learning in elementary schools. *Educenter: Scientific Journal of Education*, *1*, 452–457. https://doi.org/10.55904/educenter.v1i11.162

Prasetyo, F., & Dasari, D. (2023). Literature study: Identifying math anxiety and learning motivation toward students' math achievement. *JPM*, *4*(2). https://doi.org/10.32938/jpm.v4i2.3649

Puthree, A. N., Rahayu, D. W., Ibrahim, M., & Djazilan, M. S. (2021). Analysis of the factors causing low learning motivation of elementary students during online learning. *Journal Basicedu*, *5*(5), 3101–3108. https://doi.org/10.31004/basicedu.v5i5.1279

Putri, R., & Kasriman. (2022). The influence of Smart Board learning media on students' beginning reading skills in Indonesian subject for Grade 1 elementary school. *Journal Cakrawala Pendas*, *8*(4). https://doi.org/10.31949/jcp.v8i2.2716

Safira, A. D., Sarifah, I., & Sekaringtyas, T. (2021). Development of interactive learning media using Articulate Storyline web-based in science learning for fifth-grade elementary students. *Prima Magistra: Scientific Journal of Education*, *2*(2), 237–253. https://doi.org/10.37478/jpm.v2i2.1109

Saski, N. H., & Sudarwanto, T. (2021). Feasibility of digital-based market learning media in marketing strategy courses. *Journal of Business Education (JPTN)*, *9*. https://doi.org/10.26740/jptn.v9n1.p1118-1124

Setiadi, T., & Effendi, K. N. S. (2022). Analysis of students' needs for Android-based learning media on social arithmetic material in junior high school. *Innovative Mathematics Learning Journal*, *5*(3). https://doi.org/10.22460/jpmi.v5i3.833-842

Sirefar, D. M., & Syaputra, E. (2022). The effect of learning discipline on Indonesian learning outcomes. *Dehasen Multidisciplinary Journal*, *1*(3), 119–124. https://doi.org/10.37676/mude.v1i3.2390

Subakti, H., & Handayani, E. S. (2020). The effect of tutoring on Indonesian language learning outcomes of upper-grade elementary students. *Journal Basicedu*, *5*(1), 247–255. https://doi.org/10.31004/basicedu.v5i1.648

Sukarelawa, M. I., Indratno, T. K., & Ayu, S. M. (2024). N-Gain vs stacking analysis of changes in students' abilities in a one-group pretest-posttest design (T. K. Indratno, Ed.; First Edition). Penerbit Suryacahya.

Suryana, F. I. F., Lahera, T., & Windayana, H. (2022). School library service management in increasing elementary students' reading interest. *Naturalistic: Journal of Research and Educational Learning Studies*, *7*(1), 1310–1317. https://doi.org/10.35568/naturalistic.v7i1.1736

Susilawati, T., & Rusdinal. (2022). Development of a thematic-integrated blended learning e-book in fourth-grade elementary schools. *Journal Cakrawala Pendas*, *8*(2), 378–387. https://doi.org/10.31949/jcp.v8i2.2285

Syadida, Q., & Erita, Y. (2022). Development of learning media using Smart Apps Creator in integrated thematic learning for fourth-grade elementary students. *Journal of Practice Learning and Educational Development*, *2*(1), 17–26. https://doi.org/10.58737/jpled.v2i1.31

Syavira, N. (2021). Development of interactive PowerPoint-based learning media on the human digestive system material for fifth-grade elementary students. *OPTIKA: Journal of Physics Education*, *5*(1). https://doi.org/10.37478/optika.v5i1.1039

Ula, A. P. A., Arafah, F., Hidayatullah, A., & Prayogo, M. S. (2023). The effect of pop-up book media on science learning about invertebrates in fifth grade of SDN Kebon Agung 02. https://doi.org/10.15548/jcm.v5i1.6680

Usmaedi, Fatmawati, P. Y., & Karisman, A. (2020). Development of learning media based on augmented reality technology to improve the teaching process in elementary schools. *Educatio Journal FKIP UNMA*, *6*(2), 489–499. https://doi.org/10.31949/educatio.v6i2.595

Widiyanto, D., & Istiqomah, A. (2020). Evaluation of process and learning outcomes assessment in the PPKn subject. *Journal of Pancasila and Citizenship Education*, *8*, 51–61. https://doi.org/10.25273/citizenship.v8i1.5385

Winaryati, E., Munsarif, M., Mardiana, & Suwahono. (2021). Circular model of RD&D (Educational and social RD&D model) (S. Nahidloh, Ed.; First Edition). PENERBIT KBM INDONESIA.

Zain, A. A., & Pratiwi, W. (2021). Needs analysis for the development of interactive PowerPoint media as thematic learning media for grade V elementary school. *Elementary School Journal*, *8*. https://doi.org/10.31316/esjurnal.v8i1.1205