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Development of Ethnoscience Picture Storybooks as Learning Media in Understanding Science Concepts in Elementary Schools

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Abstract: This study aims to develop and test the effectiveness of an ethnoscience-based picture storybook to improve the understanding of science concepts in third-grade students of SDN 2 Landungsari, where learning has been limited to textbooks and minimal digital media. The book, entitled "Learning Science and Indonesian Culture with Lintang," was developed by combining daily stories of the character Lintang, science concepts, and local culture, supported by engaging illustrations. Validation by media and material experts showed average scores of 90.63% and 82.64%, respectively, confirming that the book is suitable for use. The trial showed very positive student and teacher responses (98% and 100%). Students stated that the engaging story and illustrations helped them understand the material, while teachers considered the book effective in supporting learning. Statistical analysis showed a significant increase between the pre-test (mean = 43.64) and post-test (mean = 82.73; $t = 4.08$; $p < 0.05$), with an average N-gain of 0.63, which is included in the medium-high category. These results indicate that ethnoscience-based picture storybooks are effective in improving scientific understanding, offering concrete learning media for schools that lack facilities, and utilizing the potential of Nusantara culture as an engaging and meaningful learning resource.

Keywords: Ethnoscience; Learning media; Picture story books; Science concepts

Introduction

Education has become an essential element shaping the vision of sustainable global development, in which human progress is determined by the quality of education (Conde-Zhingre et al., 2022). The quality of education cannot be measured solely based on student learning outcomes, but also by various other elements that support the learning process. Effective learning media is one of the elements that can facilitate interactive learning, thereby improving learning outcomes when the material is presented accurately and clearly (Akhlis & Wahyuni, 2019). In reality, the lack of innovative learning media that can enhance interactivity and concept exploration is a major obstacle in learning, including in understanding science concepts (Muzanni et al., 2024). The introduction of science in elementary schools is seen as an effort to build a foundation for lifelong learning and to prepare students for future success (Therrien et al., 2025). The goal of science learning in elementary schools is to develop an understanding of scientific concepts that can be applied in everyday life (Efendi et al., 2021). In practice, however, science learning often involves abstract concepts that students find difficult to understand (Saepudin & Wulandari, 2023). This aligns with Piaget's theory, which states that at the concrete operational stage (ages 7–11), children can think logically about concrete objects but still struggle to understand abstract concepts (Mutmainna et al., 2025). Science in elementary schools covers a wide

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range of topics, from the introduction of living beings and energy to natural phenomena. Therefore, it is necessary to have facilities or tools to help overcome children's difficulties in understanding abstract scientific material through learning media, and learning media function as an intermediary in delivering educational messages and material to students, so that the teaching and learning process can be carried out more effectively and attractively (Hidayat et al., 2022; Purnawati & Qohar, 2022).

Observations and interviews in grade 3 at SDN 2 Landungsari indicate that science learning remains centered on textbooks, with little support from engaging or interactive media. Students show a high interest in learning when shown examples of visual or digital media, but the school does not yet have the equipment or infrastructure to support digital media development. In addition, the appearance of school material books tends to be minimal in color and illustrations, so they are unable to attract students' attention. This condition affects students' understanding, as evidenced by misconceptions about the growth sequence of living things, reproduction, and changes in form in the chapter "Let's Get to Know the Life Cycle of Living Things."

On the other hand, it was also found that the potential of Indonesian culture has not been utilized as a learning resource. Student awareness of Indonesia's rich culture remains low, and teachers have not integrated cultural elements into science learning. However, local culture can provide relevant context for explaining scientific phenomena, helping students understand abstract concepts through real-world experiences in their environment. One approach that can bridge this need is the ethnoscience approach, a term that combines the elements "ethno," referring to culture, and "science," relating to systematic knowledge. This concept is defined as cultural science, namely, the integration of traditional knowledge with scientific principles (Kimmerer, 2012).

Media that can combine visual, narrative, and cultural aspects can be realized through the development of ethnoscience-based picture storybooks. Through picture storybooks, children's understanding of the reading content can be aided by the illustrations that support the storyline and provide visual connections to the learning material (Rosyana et al., 2021). Picture storybooks can translate abstract concepts into more concrete, easily understood forms and are easy to use because they require little equipment. Furthermore, this medium offers language and visual input that can stimulate children's verbal and visual fluency (Astari et al., 2023).

Previous research has also demonstrated the effectiveness of ethnoscience-based visual media. For example, research on the development of ethnoscience comics showed validity rates of 100% from material experts, 96% from media experts, and a practical level of 92.5% among teachers. Student interest scores were also very high, namely 90% in small-scale tests and 96% in large-scale tests (Hasibuan et al., 2023). These data analytically indicate that integrating local culture into visual media is not only feasible and practical but also has strong pedagogical value in increasing student motivation and understanding of science material. A similar finding was observed in research on ethnoscience-based student worksheets (LKPD), which reported an average validity of 97.3% and practicality of 96% (Hayandi et al., 2025). The use of these LKPDs even increased student learning motivation with a gain score of 1, which is considered high, indicating that ethnoscience can significantly improve the effectiveness of science learning. In addition, previous research also shows the effectiveness of picture story books, for example, research on the development of picture story books with validation results from material and learning experts showed an average value of 84.66% with a very feasible category; trials on 22 students produced an average value of 97.36% so that it was declared very practical (Kurniawan et al., 2025). These results indicate that developing picture storybooks is effective in increasing students' interest in reading.

However, analytically, these studies still leave a clear research gap. Not many studies have developed ethnoscience-based picture storybooks. However, from an educational perspective, picture storybooks offer a distinct learning experience from other media, combining narrative, illustrative, and affective aspects. Comics, while engaging, typically emphasize brief dialogue and simplified storytelling, while picture storybooks can provide a broader narrative space for in-depth descriptions of scientific processes. Thus, the research gap can be understood in two aspects. First, there has been little development of ethnoscience-based science learning media in the form of picture storybooks. Second, there has been no research specifically linking the Indonesian archipelago to the concept of science learning through picture-story media that aligns with the cognitive characteristics of elementary school students. This gap suggests that the research to be conducted is not only relevant but also has a strong scientific contribution to the development of ethnoscience-based teaching materials (Hidayati & Julianto, 2025). Third, there has been no research specifically developing ethnoscience-based picture storybooks to improve understanding of the life cycle of living things in grade 3 of elementary school.

Considering the gap between theory and practice, the need for culturally relevant learning media, and the

results of a critical review of previous research, the development of ethnoscience-based picture storybooks is an important innovation to undertake. This medium not only helps students understand science concepts through a narrative-visual approach, but also strengthens the relationship between science and culture in the learning process. Therefore, this study is titled "Development of Ethnoscience-Based Picture Storybooks in Understanding Science Concepts in Elementary Schools." This study specifically aims to develop ethnoscience picture storybooks as a science learning medium to improve students' conceptual understanding of the Life Cycle of Living Things material, and to test their feasibility, practicality, and effectiveness in learning.

Method

R&D is a method used to produce a product and test its effectiveness (Hardiansyah & Mulyadi, 2022). This research method was chosen because it was appropriate for this study, which aimed to produce learning media in the field of education, specifically picture storybooks used to enhance understanding of science concepts (Usman et al., 2024). The ADDIE model used includes five main stages, as visualized in Figure 1.

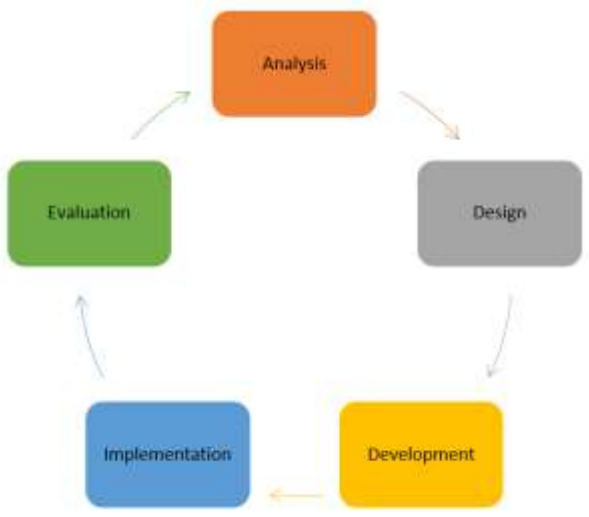

Figure 1. Schematic of the ADDIE model development process flow

This research took place at SDN 2 Landungsari, Landungsari Village, Dau District, Malang Regency. The study involved 11 third-grade students and their teachers. In accordance with the steps shown in the image above, the development will proceed through five stages. The first stage is the analysis stage, which involves identifying problems in science learning, student characteristics, learning media needs, and the integration of local cultural potential into learning. Data was obtained through observations and interviews with teachers and third-grade students, which were then used as the basis for product design. The second stage is the design stage, namely compiling media planning components, including learning objectives, indicators for achieving those objectives, the material to be included, the storyline, and product design using Canva. The third stage is the development stage, namely the stage of printing the soft-file design onto printed media or hard copies. The product is then validated by material and media experts to assess its validity.

The fourth stage of implementation, namely a limited trial, was conducted on 11 third-grade students of SDN 2 Landungsari. The trial aimed to assess the practicality of using the media with student and teacher response questionnaires and to evaluate the effectiveness of the product through pre- and post-tests. During the learning process, the media were used in real situations, not only to demonstrate, but the teacher also provided an ethnoscience picture storybook for students to read independently, while still accompanied by the teacher. Finally, the evaluation stage, namely the final revision, was carried out to make the product increasingly feasible, practical, and effective as a learning medium.

Data collection techniques in this study included observation, interviews, questionnaires, tests, and documentation. The instruments used for this study included observation sheets, interview guidelines, material expert validation questionnaires, media expert validation questionnaires, teacher response questionnaires, and student response questionnaires. The observation and interview sheets were used to analyze existing problems and to identify solutions for this study. The material and media expert validation questionnaires were used to determine the feasibility of the developed product. This test was conducted to evaluate the product's effectiveness by comparing pre-test and post-test results. The pre-test and post-test questions each consisted of 10 multiple-choice questions. The teacher and student response questionnaires were used to determine the teachers' and students' responses to the developed product. Documentation in this study included collecting references from various sources and images during the development and implementation process. In addition, a one-group pretest-posttest design was used, namely a pre-test conducted before using the ethnoscience picture storybook media and a post-test conducted after using it (Gulo & Harefa, 2022).

The data analysis techniques used were qualitative and quantitative. Qualitative analysis was used to analyze data resulting from interviews, observations, and suggestions from media and material expert validators. Quantitative data analysis techniques were used to analyze the validation questionnaire scores of media and material experts, teacher responses, student responses, and pre-tests and post-tests. The results of the data analysis of the material expert validation and media expert validation were used to measure the validity of the developed ethnoscience-based picture storybook learning media product according to the Formula 1.

$$Value\ validity = \frac{Score\ Total}{Score\ Max} \text{ x } 100\% \quad (1)$$

The assessment results are then categorized according to the criteria specified in the table below:

Table 1. Validity criteria for ethnoscience picture storybook products (Yasir et al., 2025)

Range %	Category
81-100	Incredibly Valid
61-80	Valid
41-60	Sufficienty Valid
21-40	Less Reliable
0-20	Not Valid

Data analysis of student and teacher questionnaire responses was conducted using the Guttman scale with two answer options: "yes" and "no." The maximum total score was 100 with 10 items, each worth 10 points. The questionnaire responses were then analyzed using the Formula 2.

$$Percentage = \frac{Number\ of\ correct\ answers}{Total\ of\ score} = x100\% \quad (2)$$

Table 2. Criteria for student and teacher responses (Ihsanurrijal, 2023)

Achievement Level %	Qualifications	Category
81-100	Very good	Highly recommended
71-80	Good	Worthy
51-70	Not good	Unsuitable
<50	Very bad	Highly inappropriate

The effectiveness of the developed ethnoscience picture storybook learning media was analyzed through data on student learning outcomes. Students were considered successful or completed if they obtained a score of 75 or higher, meeting the minimum completion criteria (KKM). The final stage of data analysis in this study included several procedures: a normality test to assess data distribution, a t-test to compare pretest and posttest scores, and an N-gain test to evaluate the effectiveness of the learning media in improving student learning outcomes. These steps were carried out systematically to ensure the conclusions obtained were valid (Diani & Wulandari, 2025). The N-gain calculation uses the Formula 3.

$$\text{N} - \text{Gain} = \frac{\text{Skor Posttest} - \text{Skor Pretest}}{\text{Skor maximum} - \text{Skor Pretest}} \quad (3)$$

Table 3. Criteria of N-gain (Abdilah & Wulandari, 2024)

N-Gain Value	Category
g > 0.7	High
0,3 ≤ g ≤ 0.7	Moderate
G < 0.3	Low

Results and Discussion

Analysis

The analysis stage aims to identify, in the learning process, namely: problems in science learning; student needs; student characteristics; the extent of students' knowledge of Nusantara culture; and the extent to which local culture can be integrated into learning. After conducting interviews with grade 3 teachers at SDN 2 Landungsari, it was found that monotonous learning relies solely on student textbooks, and the digital media used are limited to PowerPoint, which cannot be used at all times due to the limited tools and facilities available at the school. Thus, there is still a need to develop conventional media that make it easier for students to understand abstract material.

The teacher also mentioned that her students had difficulty understanding abstract science concepts without media. Classroom observations revealed that during the lesson, only a few students actively listened to the teacher at the beginning, and midway through, students became bored and reluctant to learn because they did not understand the abstract material the teacher had explained. The class teacher also said that Nusantara culture could be integrated into the chapter "Let's Get to Know the Life Cycles of Living Things." Based on the results of student characteristic identification, their inability to understand abstract science concepts aligns with their developmental stage at ages 7-9 years, which is the concrete thinking stage (Qorbanpoor Lafmejani, 2022). Therefore, concrete learning media, such as ethnoscience picture books, are needed to help students more easily understand science concepts through engaging stories and images.

Design

The design stage includes determining the material, learning outcomes, learning objectives, indicators of learning outcome achievement, themes and titles, collecting material, determining characters and characterization in the story, and compiling a

storyboard. The design of this picture book is followed by creating illustrations to complement the story script, assisted by Microsoft Word for writing the story and Canva for designing the images, with the concept of compiling the book represnted in Table 4. The picture story book developed is entitled "Learning Science and Indonesian Culture with Lintang", which tells the story of Lintang's daily activities raising chickens and goats. His strong curiosity about Indonesian culture is linked to science materials on the life cycles of living things.

Table 4. Draft Layout of the picture storybook

Book Layout	Book Layout Description
Beginning section	Title page
	Foreword
	Table of contents
Contents	Conceptual material
	Introduction to characters
	Story
	Summary of science material integrated into the story
	Summary of Indonesian culture integrated into the story
Final Section	Author biography
	Bibliography
	Back cover

(a) (b)

Figure 2. Display of ethnoscience story book: (a) title page and back cover of the book; and (b) Contents of an ethnoscience picture book

Development

The development stage involves turning the storyboard into a hard copy of an ethnoscience-based picture storybook with the following specifications:

Table 5. Specifications for the printed ethnoscience picture storybook

Paper size	A4 21 cm x 29.7 cm
Paper type	Art 210 grams per meter
Number of pages	34 pages
Color	Full color

During development, a validity questionnaire was also created to test the product's feasibility with expert validators. These validators included media experts and material experts, with the Table 6. Based on Table 6, the product's assessment by media experts yielded a total score of 50 out of 56, corresponding to 90.63% and placing it in the "very suitable" category. This indicates that the ethnoscience picture book is ready for testing and very suitable for use in elementary schools in the learning process.

Table 6. Media expert validation results for the ethnoscience picture storybook media

Indicators	Score Total	Score Max	Percentage %
Media practicality	19	20	95
Media appearance	17	20	85
Graphic feasibility	18	20	90
Usability safety	10	10	100
Value validity results of media expert validation			91.43

Table 7. Results of the material expert validation

Indicators	Total Score	Score Max	Percentage %
Material Coherence	17	20	85
Language	13	15	86.66
Presentation	13	15	86.66
Value validity results of material expert validation			86

The results in Table 7 show that the expert validator's assessment of the developed product content yielded a total score of 33 out of 40, representing 82.64%. This assessment indicates that the material presented in the ethnoscience picture storybook is "very suitable" for use.

Implementation

After the ethnoscience picture storybook passed the validity testing stage, it was ready to be piloted to determine student responses. The implementation involved third-grade students at SDN 2 Landungsari and their homeroom teachers.

Table 8. Student Responses to the Etnoscience Picture Storybook

Student Name	Total Score	Percentage %	Category
MMTH	20	100	Very good
ABW	20	100	Very good
AN	20	100	Very good
AFA	18	90	Very good
MAP	20	100	Very good
MKA	20	100	Very good
ZAN	20	100	Very good
MRA	20	100	Very good
FAHA	20	100	Very good
VA	20	100	Very good
MEW	18	90	Very good
Percentage of average student response results		98	Very good

Students have filled out the student response questionnaire, with 98% indicating "very good." Furthermore, student comments were very positive, such as "the story is exciting," "the pictures are interesting," "the story makes it easy to understand science material and learn about Indonesian culture," and other positive comments indicating student interest in the ethnoscience picture storybook media. Teachers also completed a questionnaire regarding the ethnoscience picture storybook; the results are presented in Table 9.

Table 9. Teacher Responses to the Ethnoscience Picture Storybook Media

Teacher Name	Total Score	Percentage %	Category
EW	20	100	Very good
Percentage of average teacher response results		100	Very good

Table 9 shows that 100% of teacher responses were categorized as "very good." Teachers were very pleased with the development of this book. The teacher believed that the ethnoscience picture storybook helped students understand abstract scientific concepts more easily and gain deeper insight into Indonesian culture, which they had previously been unfamiliar with. This book was deemed effective as a medium to support science learning. The ethnoscience picture storybook "Learning Science and Indonesian Culture with Lintang" is not just relevant to the local context in one region but can be implemented across Indonesia, as the culture integrated into the book is Nusantara culture.

Evaluation

The evaluation phase was conducted based on suggestions and comments from validators, media experts, material experts, and users of the ethnoscience picture storybook. This was done to ensure the product was suitable for use in learning. Several validator inputs and suggestions included minor revisions, such as the use of formal fonts, a smaller title font, and additional materials. Therefore, before the trial, the authors made revisions based on these inputs. The evaluation phase also assessed the effectiveness of the ethnoscience-based picture storybook media that had been developed. Before conducting a media effectiveness test, which involves comparing pre-test and post-test scores, a normality test is necessary. The purpose of the normality test is to determine whether the collected data follow a normal distribution (Ahadi & Zain, 2023). The sample size in this study was 11, so the normality test used was the Shapiro-Wilk test (Indah & Hadiana, 2024). Based on the decision-making criteria in the normality test, data are considered normally distributed if the significance value (Sig.) is greater than 0.05. Conversely, if the Sig. value is less than 0.05; the data are not normally distributed (Nisrina & Prasetyaningtyas, 2025), the results are shown in Table 10.

Table 10. Normality test

Learning Outcomes	Statistics	Df	Sig (P-Value)
Pre-test	0.936	11	0.528
Post-test	0.952	11	0.642

Based on the results in the table, the pre-test had a Sig value of 0.528 (> 0.05), and the post-test had a Sig value of 0.642 (> 0.05). The normality test for both variables indicated that they were normally distributed. Next, a t-test was conducted.

Table 11. Paired sample t test

Variable	Mean Pre-Test	Mean Post-Test	t	Df	Sig. (2-tailed)
Students Score	43.64	82.73	4.08	10	0.002

Based on the table, the paired-samples t-test results indicate a significant difference between students' pre-test and post-test scores. The average pre-test score was 43.64, while the average post-test score was 82.73. The t-value was 4.08 with 10 degrees of freedom and a significance level of 0.002 (<0.05), indicating that the students' scores were statistically significant. These

results suggest that the use of ethnoscience picture storybooks effectively improved students' understanding of science concepts. An N-gain test was then conducted to determine the effectiveness of the developed media.

Table 12. Results of the N-gain data analysis for each student

Students Name	Pre-Test	Post-Test	N-gain	Category
MMTH	10	100	1.00	High
ABW	30	100	1.00	High
AN	30	90	0.86	High
AFA	40	60	-0.50	Low
MAP	40	100	1.00	High
MKA	50	70	0.40	Moderate
ZAN	70	90	0.67	Moderate
MRA	70	80	0.33	Moderate
FAHA	30	80	0.71	High
VA	30	80	0.71	High
MEW	60	80	0.50	Moderate

Table 13. Overall N-gain of students

Parameters	N	Minimum	Maximum	Mean	Std. Deviation
N-gain	11	-0,50	1,00	0,63	0,42

Based on the N-gain results, ethnoscience-illustrated storybooks effectively improved students' understanding of science concepts, as evidenced by the moderate average N-gain. The results of this study indicate that students found it easier to understand science concepts after using ethnoscience-based illustrated storybooks, as evidenced by improved learning outcomes in the life cycle of living things material in grade 3.

Conclusion

This study shows that the ethnoscience-based picture storybook "Learning Science and Indonesian Culture with Lintang" can improve third-grade elementary school students' understanding of science concepts. Validation from media and material experts indicates that this book is suitable for use, and classroom trials received very positive responses from students and teachers. Student learning outcomes improved significantly, as indicated by an average N-gain in the medium-to-high range. This book also provides a concrete learning medium for schools with limited resources, while engagingly introducing Indonesian culture. Thus, this ethnoscience picture storybook not only supports scientific understanding but also provides a more meaningful and enjoyable learning experience for students.

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Author Contributions

Conceptualization, V.E. and A.R.W; methodology, V.E.; formal analysis, V.E.; Investigation, V.E.; resources, V.E.; developing and testing research, V. E; validate the instrument and validate the initial design of the product before going to the media expert validator and materials expert, A.R.W; supervisor who guided and directed the first author, A.R.W.

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There is no conflict of interest between the authors.

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