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Enhancing Cognitive Skills in Early Childhood Through Science-Literacy-Based Pop-Up Books: A Development Study

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ABSTRACT

Purpose - This study aimed to develop and assess a science-literacy-based Pop-Up Book to enhance cognitive abilities in Group B kindergarten children. The research was motivated by the limited use of interactive media in kindergartens, which often restricts effective cognitive stimulation essential for building thinking and problem-solving skills in early childhood.

Methodology - The study employed a modified Borg & Gall development model with six stages, including expert validation and small-scale trials. Data were collected through observation, interviews, and questionnaires. The sample comprised Group B kindergarten children. Instruments included validation sheets for media and material experts, teacher response questionnaires, and cognitive ability tests. Data analysis involved descriptive statistics and paired sample t-tests to examine the significance of cognitive improvements.

Findings - The Pop-Up Book demonstrated high feasibility with validation scores of 95% from media experts, 97.22% from material experts, and 96.15% positive responses from teachers. Cognitive scores of children increased from an average of 61.25 (pre-test) to 90.62 (post-test), with the improvement confirmed as significant ($p < 0.05$). These results indicate that the Pop-Up Book is both feasible and effective in supporting cognitive development.

Novelty - This research offers an original contribution by integrating science literacy into an interactive Pop-Up Book specifically designed to stimulate cognitive skills in early childhood, which has been underexplored in prior studies.

Significance - The findings are beneficial for kindergarten teachers, early childhood educators, curriculum developers, and educational media designers seeking effective tools to enhance cognitive development in young learners.

Keywords: Cognitive development; Early childhood; Learning media; Pop-Up book; Science literacy.

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1. Introduction

Early childhood is a vital period marked by continuous growth and transformation across various developmental domains, including motor coordination, intellectual abilities, emotional regulation, social interaction, and language acquisition (Salsabila & Ninawati, 2022). Cognitive development during this stage serves as a foundation for lifelong learning and academic success. Piaget (1972) argues that children construct knowledge through active engagement with their surroundings, while Vygotsky (1978) highlights the significance of social interaction and guided instruction in advancing cognitive growth. These foundational theories underline the need for educational tools that align with children's developmental stages and encourage exploration, curiosity, and higher-order thinking.

Learning is a dynamic process where children interact with both teachers and instructional media within the classroom environment (Wahyuni, 2022). The use of appropriate learning media enables educators to present material in a more engaging and effective manner, thereby enhancing children's cognitive development. As one of the essential elements in the educational process, learning media continues to evolve to meet the growing demands of modern pedagogy (Susanti et al., 2023). When integrated effectively, such media can significantly boost student engagement and motivation in the classroom (Rahmawati et al., 2022).

However, many early childhood education settings still depend on conventional and repetitive teaching methods that fall short in activating children's full cognitive potential (Siraj-Blatchford et al., 2002). The disconnect between theoretical frameworks and classroom application is particularly pronounced in developing nations such as Indonesia, where international assessments like PISA continue to reflect low levels of science literacy among students (OECD, 2019). Although previous studies have highlighted the appeal of Pop-Up Books as effective learning media (Matin et al., 2019; Putri et al., 2019), most have been limited to promoting narrative skills or general thematic content, with little emphasis on integrating scientific concepts. Moreover, few have examined their direct influence on specific and measurable aspects of children's cognitive development.

This study seeks to fill the existing gap by developing a Pop-Up Book that combines visual interactivity with science literacy to support cognitive development. In contrast to previous models, the media is structured around real-world scientific themes—such as natural disasters—and directly linked to cognitive indicators like logical reasoning and problem-solving. Through the integration of creative design and educational theory, this research offers empirical evidence for the effectiveness of science-literacy-based media in fostering early childhood cognitive growth.

2. Methods

The development of the Pop-Up Book media grounded in science literacy employed a Research and Development (R&D) approach adapted from the Borg and Gall model. Although the original framework consists of ten stages, this study implemented only six key phases due to practical limitations related to time and scope. The selected stages provided a focused yet systematic process for media development, beginning from initial analysis to small-scale trials. The research and development steps can be seen in the image below:

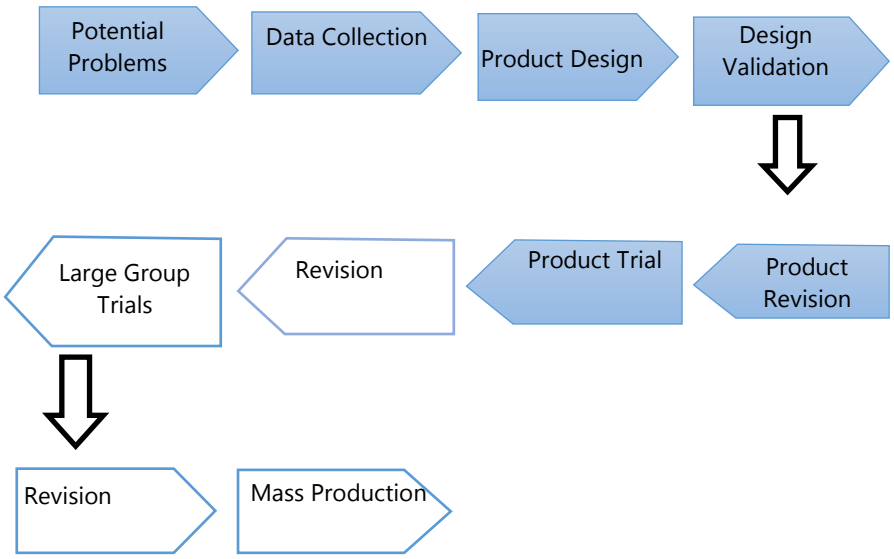


Figure 1. Chart of steps for using the Borg & Gall method

The initial stage involved identifying potential challenges through direct classroom observations and interviews with kindergarten teachers. Results indicated that the available learning media were generally monotonous and lacked the capacity to effectively stimulate children's cognitive development. In the second stage, data collection was conducted through a review of relevant literature on early childhood cognitive growth and science literacy, alongside informal interviews with teachers to gain deeper insights into classroom needs.

The third stage involved the design of a preliminary Pop-Up Book centered on the theme of natural disasters. Each page incorporated core science literacy concepts—such as observation, data collection, and cause-and-effect reasoning—adapted to cognitive development indicators for children aged 5 to 6 years. In the fourth stage, product validation was carried out by three evaluators: a media expert (5 indicators, 15 items), a material expert (3 indicators, 9 items), and a kindergarten teacher (3 indicators, 13 items). They completed a total of 37 questionnaire items, using a 4-point Likert scale (1 = strongly disagree, 4 = strongly agree). Content validity was confirmed through expert judgment.

In the fifth stage, product revisions were made based on feedback from the validators, which included improvements to the text, visual layout, and alignment with science literacy principles. The sixth stage involved a limited-scale trial with eight children aged 5–6 years from Group B at Dellia Creative School Kindergarten in Bengkulu City. The trial aimed to observe

cognitive changes before and after the use of the Pop-Up Book media. To evaluate the media's effectiveness, a paired sample t-test was performed using SPSS version 16. , while the instrument's internal consistency was verified with a Cronbach's Alpha score of 0.871, indicating strong reliability. Prior to this, data normality was assessed using the Shapiro-Wilk test, which showed that the data were normally distributed ($p > 0.05$). Validation results, teacher responses, and observational data were analyzed descriptively and presented in percentage form.

Table 1 - Observation Sheet Grid

Variables	Cognitive Aspect	Indicator
Cognitive Development	1. Recognizing simple concepts in everyday life (learning and problem solving)	1. Children are able to recognize the concept of natural disasters (volcanic eruptions, earthquakes, tsunamis, and tornadoes) well.
	2. Sort objects by size from smallest to largest or vice versa (logical thinking)	2. Children are able to sort images by size from smallest to largest or vice versa correctly and precisely.
	3. Demonstrates exploratory and investigative activities (learning and problem solving)	3 Children are able to demonstrate exploratory and investigative activities well.
	4. Matching numbers with number symbols (symbolic thinking)	4 Children are able to match the number of pictures with number symbols correctly and precisely.
	5 Mentioning number symbols (symbolic thinking)	5. Children are able to name number symbols well and correctly.

This study employed participant observation, where the researchers were directly involved with the data sources throughout the research process (Sugiyono, 2016). The purpose of this observation was to gather responses following the validation and trial phases, particularly regarding the cognitive stimulation experienced by the children. The effectiveness of the media was tested experimentally by comparing the children's cognitive abilities before and after using the Pop-Up Book. Observational data were collected using structured observation sheets aligned with cognitive indicators for children aged 5 to 6 years and analyzed using percentage scores (Sugiyono, 2016). To assess the difference in cognitive outcomes, a dependent (paired samples) t-test was conducted using SPSS software.

This study applied both qualitative and quantitative data analysis methods. Qualitative data were obtained from interview results and feedback provided by experts during the validation phase. Meanwhile, the quantitative data consisted of results from the development and testing of the science-literacy-based Pop-Up Book. These data were collected using validation instruments and trial questionnaires, which were analyzed using descriptive statistics based on a Likert scale ranging from 1 to 4. This mixed-method approach allowed for a

comprehensive and in-depth understanding of the research findings, which then served as a foundation for refining and improving the developed product.

Table 2 - Likert Scale

No	Quantitative Analysis	Score
1	Strongly agree	4
2	Agree	3
3	Don't agree	2
4	Strongly disagree	1

The feasibility of Pop-Up Book media based on science literacy to stimulate cognitive will be tested using a validation sheet that will be filled in by three validator experts. The scores generated by the three validators will be calculated as a percentage using a formula:

$$\text{Percentage} = \frac{\text{Scores are obtained from validators}}{\text{Maximum possiblescorefrom a validator}} \text{ X } 100\%$$

Table 3 - Eligibility Criteria

Percentage score (%)	Interpretation
85– 100	Very feasible
70 – 85	Feasible
50 – 70	Quite decent
0– 50	Not feasible

Children and teachers' trials were conducted to see their responses to the products that had been developed. The trials were conducted using trial sets with a Likert scale ranging from 1 to 4. The results obtained will be entered into the formula:

$$\text{Percentage} = \frac{\text{Total Score}}{\text{Maksimum Score}} \text{ X } 100$$

Table 4 - Trial Percentage

Presentation Score	Interpretation
0- 25	Not good
26 - 50	Pretty good
51 - 75	Good
76 -100	Very good

3. Results and Discussion

3.1 Results

Based on the research and development activities conducted using the Borg and Gall model—specifically implementing six key stages—the following findings were obtained at each phase. In the first stage, which focused on identifying potentials and problems, initial classroom observations revealed a limited use of interactive learning media. This condition often led to

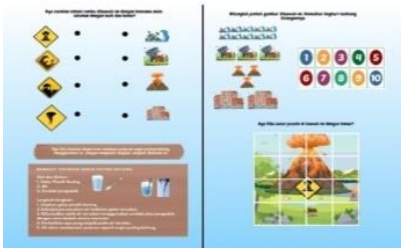
student boredom due to repetitive activities. These findings highlighted the need to develop more engaging teaching materials that could better support the cognitive development of young children.

The second stage involved data collection through a review of relevant literature. Prior studies have shown that the use of Pop-Up Books in early childhood education, such as at Aisyiyah Bustanul Athfal Kindergarten in Central Lampung, has proven effective (Nuryani et al., 2023). Expert evaluations indicate that this type of media demonstrates high validity. Additionally, product trials have shown a notable improvement in children's storytelling abilities, with most participants—particularly those in the developing category—showing significant progress (Munawwaroh, 2023).

Interviews were also conducted with teachers at Dellia Creative School Kindergarten in Bengkulu City to explore the types of learning media previously used and to determine the direction of product development. The results revealed that the school had never implemented Pop-Up Books as part of its instructional tools. Based on the identified problems and the supporting data collected, the researcher decided to develop a science-literacy-based Pop-Up Book with a thematic focus on natural disasters. This led to the next stage, which involved designing the learning media.

Table 5 - Pop-Up Book Product Design

Initial Product Design	
Front and Back Cover 	Page 1  Contains the process of observing, collecting information and asking or discussing material on volcanic eruptions.
Page 2  Contains the process of observing, collecting information and asking or discussing earthquake material.	Page 3  Contains the process of observing, collecting information and asking or discussing the material on tornadoes.

Page 4	Page 5
	
Contains the process of observing, collecting information and asking or discussing tsunami material.	Contains games and science activities to create a tornado. So that children can carry out the science process in communicating what is practiced and observed.

In the fourth stage, namely the design validation process aims to determine whether the product design is appropriate and useful when implemented or tested. For design validation, experienced experts or specialists are asked to examine the new product created for validation, requiring 3 validations, namely; media experts, material experts and teacher responses.

Table 6 - Media Expert Assessment Results

Criteria	Indicator Items	Score Acquisition	Max Score
Media efficiency	1,2,3	11	12
Media accuracy	4,5,6	11	12
Text and image design	7,8,9,10	16	16
Layout	11,12,13	11	12
Design conformity with the pop up book concept	14.15	8	8
Total Score		57	60

The assessment of the material expert was assessed by the validator, Dr. Nesna Agustriana, M.Pd. Based on the results of the validation of the material above the average obtained was:

$$\text{Percentage} = \frac{57}{60} \text{ X } 100\% = 95\ \%$$

Assessment score the result obtained is 57 from a maximum score of 60 with 5 assessment indicators with a feasibility percentage of 95 % and categorized as very feasible.

Table 7 - Results of Material Expert Assessment

Criteria	Indicator Items	Score Acquisition	Max Score
Contents	1,2,3	12	12
Compliance	4,5,6,7	16	16
Basic conceptual aspects of the material	8.9	7	8
Total Score		35	36

The assessment of the material expert was assessed by the validator, Dr. Fitri April Yanti, M.Pd. Based on the results of the validation of the material above the average obtained was:

$$\text{Percentage} = \frac{35}{36} \text{ X } 100\% = 97.22\ \%$$

Assessment score the result obtained is 35 from a maximum score of 36 with 3 assessment indicators with a feasibility percentage of 97.22 % and categorized as very feasible.

Table 8 - Results of Responses from Delia Creative School Kindergarten Teachers

Criteria	Indicator Items	Score Acquisition	Max Score
Contents	1,2,3	11	12
Compliance	4,5,6,7	15	16
Aspects of suitability of presentation with learning guidelines that are centered on students	8,9,,10,11,12,13	24	24
Total Score		50	52

Teacher responses were assessed by Mrs. Emi Yuliana, S..Pd. I Based on the results of the validation of the material above, the average obtained was:

$$\text{Percentage} = \frac{50}{52} \text{ X } 100\ \% = 96.15\ \%$$

The assessment produced a score of 50 out of a maximum of 52 across three evaluation indicators, resulting in a feasibility percentage of 96.15%, which is categorized as very feasible. After the design was validated by experts, identified weaknesses were addressed based on the suggestions and input provided by the validators. These recommendations were used by the researcher to revise and improve the product during the fifth development stage. The following section outlines the updated version of the media design.

Table 9 – Product Design Revisions

Before Revision	After Revision	Before Revision	After Revision
Front and Back Cover		Page 5	
			

Page 1

Page 6

Page 7

Page 2

Page 8

Page 9

Page 3

Page 10

Page 4

In the Sixth stage effectiveness of the developed product was seen in the product trial carried out by researchers on a small scale Involving 8 children from group B at DeLLia Creative School Kindergartenn, Bengkulu City, through observation and filling out questionnaires.

Table 10 - Results of Child Trial Before Using Pop-Up Book (Before)

No	Name	Score Obtained	Maximum Score	Mark	Category
1	AA	12	20	60	Pretty good
2	R	11	20	55	Pretty good
3	S	12	20	60	Pretty good
4	AO	12	20	60	Pretty good
5	J	12	20	60	Pretty good
6	B	17	20	85	Good
7	RZ	10	20	50	Pretty good
8	H	12	20	60	Pretty good

No	Name	Score Obtained	Maximum Score	Mark	Category
Amount		98	160	490	
Average				61.25	Pretty good

Table 11 - Results of Child Trial After Use of Pop-Up Book (After)

No	Name	Score Obtained	Maximum Score	Mark	Category
1	AA	19	20	95	Very good
2	R	18	20	90	Very good
3	S	18	20	90	Very good
4	AO	19	20	95	Very good
5	J	18	20	90	Very good
6	B	20	20	100	Very good
7	RZ	16	20	80	Good
8	H	17	20	85	Good
Amount		145	160	725	
Average				90.62	Very good

The results show that the average score before using the Pop-Up Book was 61.25, while the post-use average increased to 90.62. This indicates a substantial improvement in children's cognitive abilities following the use of the science-literacy-based Pop-Up Book. These findings suggest that the media had a positive effect on learning outcomes, leading to the next stage of analysis hypothesis testing.

This analytical approach was used to determine whether the use of the Pop-Up Book media had a statistically significant effect on the cognitive abilities of Group B children. The comparison between pre-test and post-test data was conducted using the dependent t-test (Paired Samples T-Test) to evaluate the effectiveness of the intervention. The following section presents the results of the hypothesis testing.

H0: There is no difference the average between before and after the use of pop-up book media based on scientific literacy (variable X) on cognitive stimulation (variable Y).

Ha: There is a difference the average between before and after the use of pop-up book media based on scientific literacy (variable X) on cognitive stimulation (variable Y).

The data will be analyzed using the dependent t-test *(paired sample t-test)* with the basis for decision making based on the level of significance:

1. If the sig value (2-tailed)<0.05; then H0 is rejected and Ha is accepted.
2. If the sig value (2-tailed)>0.05; then Ho is accepted and Ha is rejected.

Table 12 - Paired Samples Statistics

		Me.an	N	Std. Deviation	Std. Error Mean
Pair 1	Before using pop-up books	61.2500	8	10.26436	3.62900
	After using pop-up book	90.6250	8	6.23212	2.20339

Table 13 - Paired Samples Correlations

		N	Correlation	Sig.
Pair 1	Before using pop-up book & After using pop-up book	8	.768	.026

Table 14 - Paired Samples Test

		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference Lower	Upper	t	df	Sig. (2-tailed)
Pair 1	Before using pop-up book - After using pop-up book	-2.93750E1	6.78101	2.39745	-35.04407	-23.70593	-12.253	7	.000

Based on the results of the dependent t test (paired samples t test) above it can be seen that the Sig. (2-tailed) value is 0.00 < 0.05, so H0 is rejected and Ha is accepted or both average values before and after using Pop-Up Book are significantly different. It can be concluded that there is a difference in the average value of cognitive abilities of group B children before and after the implementation of this Science Literacy-Based Pop-Up Book media which is appropriate and effective to be applied in order to stimulate the cognitive abilities of group B children.

Table 15- Reliability Statistics

Cronbach's Alpha	N of Items
.871	5

Table 16 - Tests of Normality

	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
Class	**Statistic**	**df**	**Sig.**	**Statistic**	**df**	**Sig.**
Pre-test	.221	8	.200*	.961	8	.784
Post-Test	.238	8	.200*	.958	8	.729

Content validity was ensured through expert input, while a reliability test using Cronbach's Alpha yielded a score of 0.89, indicating high reliability. Prior to this, data normality was tested using the Shapiro-Wilk test, and the results indicated a normal distribution ($p > 0.05$).

3.2 Discussion

The development of this learning media aligns with Piaget's perspective, which emphasizes that children acquire knowledge through play and interaction with tools and media in their environment. The use of diverse educational resources allows children to explore and understand the world around them. The Pop-Up Book serves as an innovative medium that supports various aspects of child development (Susanti et al., 2023). To ensure its quality, the media was evaluated through expert judgment, which provided critical feedback for further improvement and refinement. Such evaluation, as noted by Warsita (2013), plays an essential role in enhancing the effectiveness of instructional media.

The findings of this study indicate a significant improvement in children's cognitive scores following the use of the Pop-Up Book media, suggesting its effectiveness in supporting cognitive development. This outcome aligns with Piaget's theory, which posits that young children learn more effectively through concrete and visual experiences (Piaget, 1972). The three-dimensional features and vibrant illustrations within the Pop-Up Book enable children to associate visual symbols with meaning, making it highly appropriate for their developmental stage.

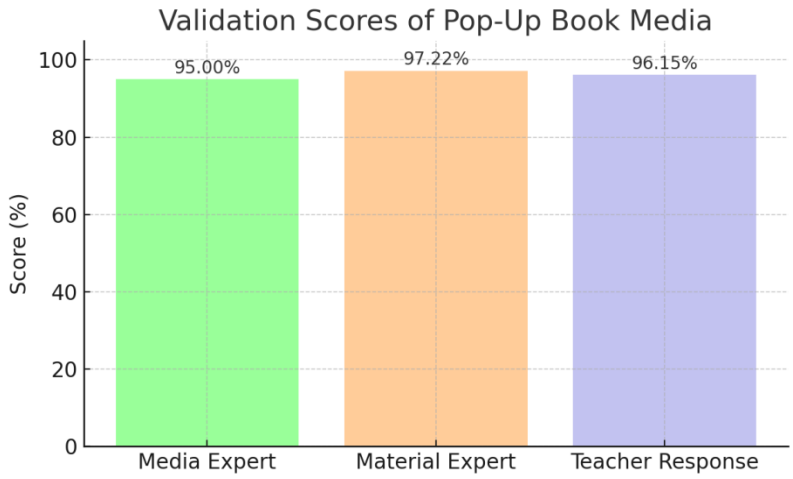


Figure 2. Validation Score

The validation chart presents results from three assessors: a media expert, a material expert, and a kindergarten teacher. All three provided exceptionally high scores—each exceeding 95%—indicating that the Pop-Up Book was perceived as highly appropriate for classroom use. These findings suggest that the product is not only effective in supporting learning but also well-crafted and pedagogically suitable for early childhood education.

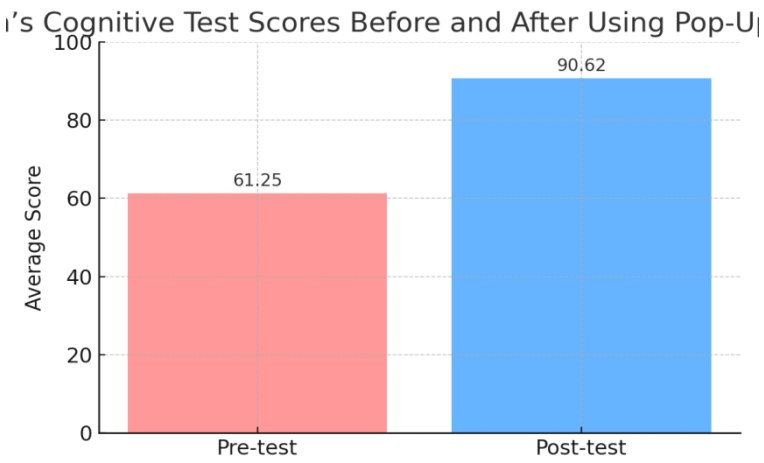


Figure 3 Chart of Cognitive Test Score

The trial results before and after the use of the science-literacy-based Pop-Up Book demonstrated a marked improvement. The average pre-test score was 61.25, while the post-test score increased to 90.62. This significant difference suggests that the use of the Pop-Up Book media effectively enhanced the cognitive abilities of Group B kindergarten children. The results from the small-scale trial indicate that the media is a valuable tool for stimulating early cognitive development.

The development of this learning media offers an alternative tool to support cognitive stimulation in early childhood. Media serves as a means for children to communicate, interact, socialize, and receive new information. This approach aligns with several cognitive development theories. Piaget emphasizes that cognitive growth occurs through active interaction with the environment. Vygotsky highlights the role of social context and guided learning in shaping children's thinking, while Ausubel underscores the importance of meaningful learning, where new information is linked to prior knowledge. These theoretical perspectives reinforce the value of educational media in promoting cognitive development during early childhood.

Similar findings were reported by Adeyele (2023), who demonstrated that inquiry-based science learning significantly enhances young children's critical thinking, pattern recognition, and problem-solving abilities. This study expands on that work by integrating science-related content—such as natural disasters—and linking it directly to five targeted cognitive skills: concept identification, logical classification, symbolic thinking, number matching, and scientific exploration. What sets this research apart is its unique integration of science literacy with early cognitive learning objectives; the use of engaging, expert-validated media rooted in sound pedagogical principles; and its implementation in an underrepresented context like Indonesia, where access to science-oriented learning tools for early childhood remains limited.

Shows that the impact is not just statistically significant but also educationally meaningful. It proves that this Pop-Up Book is not just another classroom tool—it can be used as a strategic way to grow scientific thinking from an early age. Future research could try using

this media in other cultural or economic settings, or expand the content to include environmental topics or early math skills.

4. Conclusions

This study concludes that Pop-Up Book media incorporating science literacy is both feasible and effective in enhancing the cognitive abilities of children aged 5 to 6 years. Its visual and interactive design effectively captured children's attention and contributed to improvements in essential cognitive domains, including logical reasoning, symbolic comprehension, and early problem-solving skills. Despite its promising results, this study has several limitations. It was conducted in a single kindergarten with a relatively small sample size, which may restrict the generalizability of the findings to broader populations. Furthermore, the research focused solely on printed, physical media and did not explore the potential integration of digital formats or wider implementation across diverse educational settings.

To ensure the production of high-quality learning media, the development of science-literacy-based Pop-Up Books still requires refinement. Based on the research findings, it is recommended that future development includes a variety of themes to enrich the learning experience. Secondly, further efforts should be made to enhance the media's scientific content and instructional design. Third, integrating this media into the broader learning process is encouraged, as it can contribute meaningfully to children's cognitive development. By implementing these suggestions, it is hoped that the science-literacy-based Pop-Up Book will continue to improve and offer a valuable contribution to early childhood education.

Future studies are encouraged to involve multiple research sites with more diverse educational settings and larger sample sizes to enhance the generalizability of findings. Researchers may also explore the development of a digital version of the Pop-Up Book to improve accessibility and accommodate remote or hybrid learning environments. Additionally, investigating the long-term effects on children's scientific thinking and their ability to apply knowledge in real-world contexts would further strengthen the educational value of this approach. This study contributes to the growing body of research that supports the use of science-based, interactive media in early childhood education, especially in contexts where access to hands-on science materials is limited.

Conflict of Interest

The authors declare no conflict of interest.

References

Adeyele, V. O. (2023). *Inquiry-based science approach in kindergarten: A systematic review.* Al-Mudarris: Journal of Education, 6(2), 160–173.

Aditomo, A., & Faridz, N. F (2019). Inequality of Quality and Access to Education in Indonesia: A Portrait Based on the 2015 PISA Survey. August. https://doi.org/10.31227/osf.io/k76g3 .

Amini, S., & Sinaga, P. (2021). Inventory of scientific literacy ability of Junior High School Students Based on the Evaluation of PISA Framework Competency Criteria. Journal of

Physics: Conference Series, 1806(1). https://doi.org/10.1088/1742-6596/1806/1/012017
Anawati, R. (2021). Development of Pop Up Book Media Based on Cultural Literacy in Thematic Learning for Class II Elementary Schools. (Thesis). Elementary School Teacher Education. Raden Intan State Islamic University of Lampung.
Andari, T. F & Friska., N. (2024). Development of Pop Up Book Media in Improving Cognitive Skills of 5-6 Year Old Children at UPT SPF TK Negeri 03 Beringin in the 2022/2023 Academic Year. Journal Of Social Science Research 4(3), 14.
Donatrin, S., Hananta, B. , & Mahmudin. (2017). Fun Learning Guide Through Science for Children Aged 3-4 Years. Ministry of Education and Culture . Center for Development of Early Childhood Education and Community Education .
Eliza, D. (2022). Development of Science Literacy Learning Videos for Early Childhood 5-6 Years for Learning from Home. 6(4), 3648–3658. Jurnal Obsesi: Jurnal Pendidikan Anak Usia Dini, https://doi.org/10.31004/obsesi.v6i6.1350 .
Fuadi, H., Robbia, A. Z, Jamaluddin, J., & Jufri, A. W (2020). Analysis of Factors Causing Low Scientific Literacy Skills of Students. Scientific Journal of Educational Profession, 5(2), 108–116. Https://Doi.Org/10.29303/Jipp.V5i2.122 '
Handika., Zubaedah, T., Witarsa, R. (2022). Analysis of Jean Piaget's Cognitive Development Theory and Its Implications in Mathematics Learning in Elementary Schools. Didactical: Journal of Education and Science , 22 (2), 127
Khadijah. (2016). Early Childhood Cognitive Development: Theory and Development . Perdana Publishing.
Lolang, E. (2014). Null Hypothesis and Alternative Hypothesis. Journal of Teacher Training and Education, 3(3), 685-695.
Magdalena, I. (2021). Joint Writing on Elementary School Learning Media . Pabuaranmekar: CV Jejak, member of IKAPI.
Martini, & Sitorus , M . (2023). Cognitive Development in Early Childhood. Al-Abyadh, 6(1), 41–50. https://doi.org/10.46781/al-abyadh.v6i1.746
Mashuri, S. (2019). Mathematics Learning Media . Jakarta: Deepublish.
Matin, R. H., Rohaety, E. E., & Nuraeni, l. (2019). Application of Pop-up book learning media for early childhood in group B to improve early literacy skills in Nusa Indah Kindergarten. Ceria Journal (Smart, Energetic, Responsive, Innovative, Adaptive), 2(2), 49-56.
Maydiantoro, A. (2020). Research Development Model. Chemistry Education Review (CER) , 3 (2), 1.
Novitasari, K. (2023). Early Childhood Cognitive Development: Yogyakarta PGRI University.
Nurhikmah, A., Madianti, H. P, Azzahra, P. A, & Marini, A. (2023). Development of Learning Media Through Educandy Games to Improve Students' Learning Character in Elementary Schools. Journal of Elementary Education and Social Humanities Vol.2 No.3, 441.
Nuryani., Normawati., & Marlisa, L., (2023). Application of pop-up books to scientific literacy in group B at TK Aisyiyah Bustanul Athfal, Central Lampung. Student Scientific Journal, 2(1). 8-14. DOI: 10.24127/thufulah.v2i1.5200 .
OECD. (2019). *PISA 2018 results: What students know and can do*. OECD Publishing. https://www.oecd.org/pisa/publications/pisa-2018-results.htm
Pertiwi, N & Fitria, T (2022). Development of pop-up book learning media in integrated thematic learning on theme 9 for grade IV elementary school students. Journal of Education and Teaching, 6(1). http://dx.doi.org/10.33578/pjr.v6i1.8535 .
Piaget, J. (1972). *The psychology of the child*. New York: Basic Books.
Putri, Q. K, Pratjojo, P., & Wijayanti, A. (2019). Development of Pop-Up Book Media to Improve

Listening Skills on the Theme of Caring for Plants and Animals Around Us. Journal of Pedagogy and Learning, 2(2), 169. https://doi.org/10.23887/jp2.v2i2.17905 .

Rahmawati, E., Harahap, N. B, Maswariyah, Agara, L. R, & Wandini, R. R (2022). The Importance of Learning Media to Motivate Students of SDN Muarasitulen . Tambusai Education Journal, 6(2), 14114–14120. https://doi.org/https://jptam.org/index.php/jptam/article/view/4675 .

Ramadani, N. A, Kirana, C. K, Astuti, U., & Marini, A. (2023). The Influence of the Use of Learning Media on the World of Education (Literature Study) Journal of Elementary Education and Social Humanities. 2(6), 751 -755.

Regulation of the Minister of Education and Culture Number 137 of 2014 concerning National Standards for Early Childhood Education. Permendikbud RI

Regulation of the Minister of Education, Culture, Research and Technology Number 8 of 2024 concerning Content Standards in Early Childhood Education, Elementary Education Level, and Secondary Education Level. Permendikbudristek.

Research and Education Agency of the Ministry of Education and Culture. (2019). Indonesian Education Based on the Results of PISA 2018. Jakarta: Research and Development Agency of the Ministry of Education and Culture.

Salsabila, I., & Ninawati, M. (2022). Development of Contextual Pop-up Book Learning Media for PPKN Subject Content for Grade IV Elementary School. Journal of Paedagogy , 9(4), 684-694. https://doi.org/10.33394/jp.v9i4.5665 .

Saputra, A., & Suryandi, L. (2021). Early Childhood Cognitive Development in Vygotsky's Perspective and Its Implications in Learning. PELANGI: Journal of Islamic Thought and Research for Early Childhood, 2(2), 198–206. https://doi.org/10.52266/pelangi.v2i2.582.

Serly Anggraini. (2023). Development of Educational E-Books Based on Flipbuilder with the Theme Animals to Develop Cognitive Abilities in 5-6 Year Old Aud. (Thesis). Early Childhood Islamic Education. Raden Intan State Islamic University of Lampung.

Sholeha, V. (2019). "The effectiveness of the guided discovery method in science learning on the cognitive development of children aged 5-6 years." Journal of Child Education 8 (1), 78–83. https://doi.org/10.21831/jpa.v8i1.26680 .

Sholeha, V., Wahyuningsih, S., Hafidah, R., & Syamsuddin, M. M (2022). Implementation of Class-Based Science Literacy by PAUD Teachers in Surakarta City. Obsesi Journal: Journal of Early Childhood Education, 6(3), 2013–2019. https://doi.org/10.31004/obsesi.v6i3.1237 .

Siraj-Blatchford, I., Sylva, K., Muttock, S., Gilden, R., & Bell, D. (2002). *Researching effective pedagogy in the early years (REPEY)*. London: Department for Education and Skills. https://dera.ioe.ac.uk/4650/1/RR356.pdf.

Sugiyono. (2016). Quantitative, Qualitative and R&D Research Methods (April Issue).

Susanti, E., Nasution, A. S, Syaroh, A., Arif, M. F, & Irwansyah, R. (2023). Developing Early Childhood Learning Media at Ainun Mahya Preschool, Lobu Huala Village, South Kualuh District, North Labuhan Batu Regency. Atthufulah : Journal of Early Childhood Education, 3(2), 88–95. https://doi.org/10.35316/atthufulah.v3i2.2915 .

Umam, N. K, Bakhtiar, A. M, & Iskandar, H. (2019). Development of Indonesian Pop Up Book Based on Slempitan Culture. Trapsila: Journal of Elementary Education, 1(02), 1. https://doi.org/10.30742/tpd.v1i02.857.

United Nations International Children's Emergency Fund. UNICEF Indonesia Annual Report 2022. UNICEF Indonesia.

Vygotsky, L. S. (1978). *Mind in society: The development of higher psychological processes*. Cambridge, MA: Harvard University Press.

Wahyuni, I. (2022). Analysis of Numeracy Literacy Skills Based on Learning Styles in Early Childhood. Jurnal Obsesi: Jurnal Pendidikan Anak Usia Dini , 6(6), 5840–5849. https://doi.org/10.31004/obsesi.v6i6.3202 .

Waruwu, M. (2024). Research and Development (R&D) Methods: Concepts, Types, Stages and Advantages. Scientific Journal of Educational Professions , 9(2), 1220–1230. https://doi.org/10.29303/jipp.v9i2.2141

Warsita, B. (2013). Evaluation of Instructional Media As a Quality Control. Jurnal Teknodik , 17 (1), 438–447.

Widayati, J. R, Safrina, R., & Supriyati, Y. (2021). Educational Game Tools: Analysis of Early Childhood Science Literacy Development Abstract. Obsesi Journal: Journal of Early Childhood Education, 5(1), 654–664. https://doi.org/10.31004/obsesi.v5i1.692 .

Zr, Z., & Eliza, D. (2021). Development of Children's Science Books for the Introduction of Literacy and Character Based on Minangkabau Natural Culture. Jurnal Obsesi: Journal of Early Childhood Education 5(2), 1567–1577. https://doi.org/10.31004/obsesi.v5i2.896 .