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Supporting Symbolic and Cognitive Development in Early Childhood through Pop-Up Book Learning Media

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Abstract
This study aims to develop a Pop-Up Book learning media to stimulate cognitive abilities in early childhood education, particularly in recognizing letters, shapes, and symbols. The research employed a Research and Development (R&D) approach using the ADDIE model, encompassing analysis, design, development, implementation, and evaluation stages. The subjects consisted of 15 children in Group B1 at Alkhairaat Tondo Kindergarten. Data were collected through observation, interviews, documentation, and questionnaires to assess needs, feasibility, and children's responses to the developed media. Expert validation results indicated a very high level of feasibility, with scores of 98.3% from media experts and 96.6% from material experts. Classroom implementation showed positive engagement, with 60% of children developing cognitive abilities as expected and 40% beginning to show improvement. These findings suggest that the developed Pop-Up Book media is feasible, engaging, and has potential to support cognitive development in early childhood learning contexts.

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INTRODUCTION

Early childhood is widely recognized as a golden age of development, a critical period that determines the quality of growth and learning in later stages of life. During this phase, children experience rapid brain development, enabling them to absorb stimuli from their surrounding environment with remarkable efficiency (Kolb, 2020; Miguel et al., 2019). One essential domain that must be optimally nurtured during this period is cognitive development, which encompasses the abilities to think, remember, understand information, categorize objects, compare patterns, and solve simple problems (Porter, 2002; "The Cambridge Handbook of Cognitive Development," 2022). These foundational abilities form the basis for children's future academic learning and problem-solving capacities.

Cognitive development in early childhood does not occur naturally without appropriate support (Gauvain, 2022) but is strongly influenced by the quality of learning experiences and stimulation provided to children (Attanasio et al., 2021). Meaningful and continuous stimulation through play-based activities, social interaction, and well-designed learning experiences helps children construct knowledge and develop thinking skills (Darmanin & Pulis, 2023; Edwards, 2017). Conversely, limited or inappropriate stimulation can hinder cognitive growth and reduce children's opportunities to develop their full potential (Rakesh et al., 2024).

In addition to educational institutions, families—particularly parents—play a vital role in providing early cognitive stimulation. Through warm, enjoyable, and supportive interactions, parents can encourage children to explore, ask questions, and express their ideas. Play activities accompanied by positive reinforcement stimulate children's senses, develop motor coordination, enhance communication skills, and support the expression of thoughts and emotions (Essame, 2023). Such early stimulation significantly contributes to children's cognitive readiness and long-term developmental outcomes.

Despite the importance of early stimulation, learning practices in many kindergarten settings remain relatively monotonous and lack variation (Christopher & Nesbitt, 2023). Teaching activities often rely on limited instructional strategies and minimal use of engaging learning media. As a result, children may quickly become bored, lose concentration, and show low levels of active participation. This condition makes it difficult to achieve learning objectives optimally, particularly those related to stimulating children's cognitive abilities.

Learning media play a strategic role in addressing these challenges by creating more engaging and meaningful learning experiences (Gunawan & Laura, 2025; Mahyudin, 2020). One form of media with strong potential is the Pop-Up Book, a three-dimensional book that presents raised images and interactive elements when opened (Supriani et al., 2024). Its visual and tactile characteristics can attract children's attention, stimulate curiosity, and encourage active involvement (Kılıç, 2021; Raffa, 2020). Previous studies indicate that interactive and visually rich media can enhance children's interest and support their understanding of basic concepts (Pramasela & Sefriyanti, 2025; Suwahono & Mawanti, 2019). However, most existing Pop-Up Book studies emphasize general engagement or specific learning domains, while Pop-Up Books that are systematically designed, empirically validated,

and explicitly targeted to stimulate core cognitive abilities—such as recognizing letters, shapes, and symbols—remain limited.

Field observations conducted in Group B1 at Alkhairaat Tondo Kindergarten revealed that children's cognitive abilities had not yet developed as expected. Many children experienced difficulties in recognizing letters, shapes, and symbols, while the availability of supporting learning facilities was also limited. This situation highlights the need for innovative, interactive, and structured learning media that are capable of supporting cognitive stimulation in a more effective manner.

Although various cognitive learning media for early childhood have been implemented, many existing media still present notable limitations. Two-dimensional materials often lack strong visual appeal and interactivity, making them less effective in sustaining children's attention and active engagement (Bara et al., 2018; Jadán-Guerrero et al., 2020; Sylla et al., 2012). Such media may restrict children's opportunities to explore, manipulate, and actively construct understanding through direct interaction. Therefore, there is a clear need for learning media that not only offer visual attractiveness, but are also deliberately designed to support structured cognitive stimulation in accordance with early childhood developmental characteristics.

This study differs from previous research that predominantly utilized Pop-Up Books for character education or language development (Aini & Cahyo, 2024; Pebriani & Vinayastri, 2022) with limited emphasis on systematic media development and targeted cognitive stimulation in early childhood. In contrast, the Pop-Up Book developed in this study was systematically designed using the ADDIE development model and empirically grounded in the real learning needs of children at Alkhairaat Tondo Kindergarten. The focus is placed on stimulating cognitive abilities—particularly recognizing letters, shapes, and symbols—through structured and interactive learning activities, thereby addressing the limited attention given to cognitive-oriented Pop-Up Book development in previous studies.

Based on these considerations, this study aims to develop and validate a Pop-Up Book as an innovative, engaging, and cognitively oriented learning medium to stimulate early childhood cognitive development. The developed media is expected to address existing gaps in kindergarten learning practices by offering a more varied, enjoyable, and child-centered learning alternative, while also supporting teachers in delivering meaningful cognitive stimulation in early childhood education settings.

METHOD

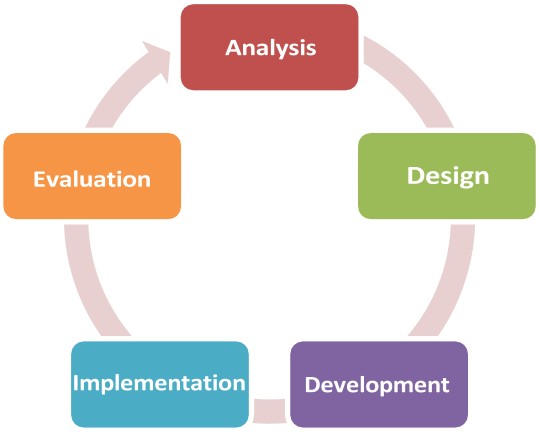
This study employed a Research and Development (R&D) approach using the ADDIE model, which consists of five stages: analysis, design, development, implementation, and evaluation. As stated by Sugiyono (2019), the R&D method aims not only to create a product but also to assess the feasibility and applicability of the product in educational settings (Sugiyono, 2019). The research focused on developing and assessing the feasibility and preliminary outcomes of a Pop-Up Book learning media designed to stimulate cognitive abilities in early childhood education. The study was not intended to measure

causal effectiveness through an experimental design, but rather to evaluate product suitability and classroom applicability.

Visually, the ADDIE model can be described as a continuous process flow, where each stage is interrelated and forms a systematic development cycle, ensuring that the resulting product is appropriate and meets the learning needs of children. The following is an illustration of the implementation of the ADDIE development model.

Picture 1

ADDIE Model Cycle



Analysis

The first stage involved analysis, which was conducted to describe the learning problems and media needs. In the next stage, the researcher conducted a survey through observation and interviews in Group B1 of Alkhairaat Tondo Kindergarten, which consisted of 15 students. The results of the learning observation showed that 10 of the 15 children still had difficulty recognizing the shapes and symbols of letters from A to Z. The observation data were analyzed descriptively and quantitatively to describe the initial condition of the children's cognitive abilities. Meanwhile, qualitative descriptive analysis was employed to identify the teachers' need for more engaging and interactive teaching materials. The following analysis results serve as the basis for designing Pop-Up Books that are suitable for the characteristics and learning needs of children.

Design

The second stage is design, where the main focus is to develop effective learning strategies based on the results of the needs analysis. In the following stages, the author formulates learning objectives that refer to indicators of children's cognitive development, determines the material to be presented, designs the media display, compiles the visual design of the media, provides the materials and tools to be used, and develops validation instruments and observation sheets.

Development

The third stage was development, in which the Pop-Up Book media was successfully developed according to the design that had been prepared. The media was made using flannel, cardboard, and other materials that had been prepared with attractive visuals and in line with the characteristics of early childhood. Next, the media underwent expert validation, which included subject matter experts and media experts. Prior to media validation, the questionnaire instrument was validated. Subsequently, the designed media was submitted to media experts and subject matter experts for review.

The results of the subject matter and media expert validation were used to assess the suitability of the developed Pop Up Book media. The validation in the following study involved two experts, namely subject matter and media experts. The instrument used was a questionnaire-type validation sheet, which was compiled based on the aspects of subject matter suitability, media appearance, language, and suitability for learning objectives. The assessment uses a rating scale, namely a score of 1 (Not Suitable), 2 (Less Suitable), 3 (Suitable), and 4 (Very Suitable). The validation data is analyzed by calculating the percentage of suitability scores using the formula:

$$P = \frac{\sum R}{N} \times 100\%$$

Description:
P = Percentage
$\sum R$ Score = Number of validator scores
N = Maximum total score

Implementation

The fourth stage, implementation, is the stage of applying the product that has been validated and improved, then tested on the study subjects, namely the children in group B1 at Alkhairaat Tondo Kindergarten. The media was used in teaching and learning activities in line with the predetermined objectives, involving the classroom teacher as a facilitator. During the learning process, the researcher observed children's engagement, participation, and observable cognitive responses using the prepared instruments.

Evaluation

The final stage is evaluation, which assesses the feasibility, usability, and preliminary outcomes of the Pop-Up Book media that has been developed. The evaluation is conducted to provide feedback to users or children. This includes observations of children's cognitive abilities and teachers' responses to the use of media in learning. Researchers also identify the strengths and limitations of the media based on findings during implementation. The findings in the evaluation stage are used as consideration in refining the media, so that the final product obtained aligns with the development objectives and can be appropriately applied in learning activities.

The participants in this study were 15 children aged 5–6 years from Group B1 at Alkhairaat Tondo Kindergarten. Participants were selected using purposive sampling, considering developmental characteristics relevant to the use of learning media in early childhood settings. In addition to the children, the classroom teacher was involved as an informant, contributing to media

validation, implementation feedback, and evaluation of media usability during classroom activities.

The instrument for measuring children's cognitive abilities is in the form of an observation sheet designed according to the cognitive development parameters of 5–6-year-old children, covering the skills of recognizing letters, identifying simple shapes and symbols, naming letters, and matching letters with corresponding pictures.

The assessment uses the categories of BB (Not Yet Developed), MB (Beginning to Develop), BSH (Developing as Expected), and BSB (Developing Very Well) to describe the level of achievement of children's cognitive abilities during the learning process.

Data were collected using observation, interviews, documentation, and questionnaires. Observations were conducted to examine children's engagement, responses, and participation during the use of the Pop-Up Book media. Interviews were carried out with classroom teachers to obtain qualitative insights regarding the suitability, ease of use, and relevance of the media to learning objectives. Questionnaires were administered to assess the feasibility of the media, covering aspects of visual appearance, content appropriateness, and usefulness in stimulating children's cognitive abilities. Documentation supported the analysis by recording learning activities and media implementation processes.

The collected data were analyzed using descriptive, qualitative, and quantitative techniques. Observation and interview data were analyzed descriptively to identify patterns of engagement and teacher perceptions. Questionnaire responses were converted into percentage scores to determine feasibility levels, which were then interpreted according to predetermined criteria. This analysis aimed to provide an overview of the media's feasibility and its potential contribution to cognitive stimulation in early childhood learning contexts, without making causal effectiveness claims.

The research was conducted over a period of approximately two months. The development stage of the Pop-Up Book media was carried out for about one month, including material preparation, design, and expert validation. The limited trial stage was conducted over two weeks during regular classroom learning activities to observe children's engagement and responses to the media. The evaluation and revision stage took an additional two weeks, during which the product was refined based on classroom observations and feedback from teachers.

RESULT

The development design model in the following development research uses the ADDIE model, which includes:

Needs Analysis Results

The results of the needs analysis show that children's cognitive abilities, especially in recognizing letters, have not developed as expected. Based on observations, many children still struggle to recognize the shapes and symbols of the letters A to Z. Interviews with teachers reveal that the availability of media or teaching aids to help children recognize letters remains

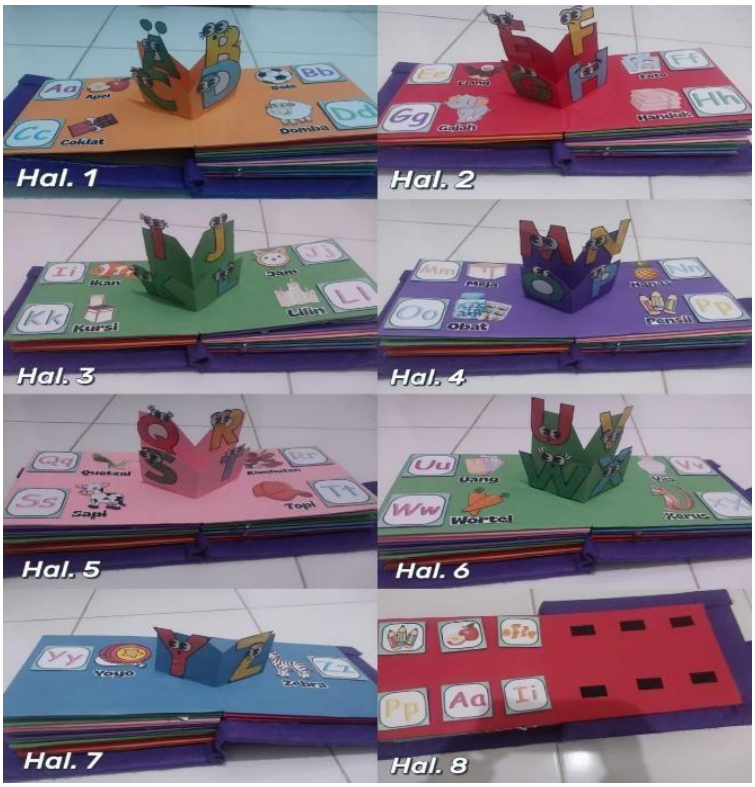
very limited, resulting in the underutilization of teaching materials in learning activities.

Product Design Results

Based on the results of the needs analysis, teaching materials in the form of a pop-up book were designed in accordance with the indicators of children's cognitive development. This media is designed to feature three-dimensional illustrations, attractive colors, contextual images, and simple activities that can directly engage children. Each page of the Pop-Up Book contains material and activities to stimulate the ability to recognize, name, and match letters according to images. The product design was developed with consideration for ease of use by teachers and safety for children.

Picture 2
The Pop-Up Book Cover

Picture 3
Inside view of the pop-up book



Pictures 3 and 4

Appearance of cards for matching pictures with letters, as shown in Picture 2.

Expert Validation Results

The results from media and material experts show that the Pop-Up Book meets the standards of feasibility. This validation shows that the media received a score of 98.3% from media experts and 96.6% from material experts, both of which are in the highly feasible category. Thus, this media is declared ready for use in the learning stage.

Table 1
Results data from validity testing by experts

NO	Validators	Percentage	Description
1.	Media Expert	98,3%	Highly Recommended
2.	Learning material expert	96,6%	Highly Recommended

Media Trial Results

The results of product testing show that Pop Up Books can be applied to designed learning activities. During the lesson, the children appeared enthusiastic when participating in each activity carried out through this media and were able to interact with the available Pop-Up elements and images. The teacher explained that this media is a simple and effective tool, capable of attracting children's interest and facilitating the process of delivering lesson material. Observations also revealed that this media creates a diverse learning experience and optimizes children's participation in the learning process.

Pictures 5 and 6
Pop-up book media trial process

The data from the observations show that the children's cognitive skills have improved. Of the 15 children studied, the number of children in each of the three areas of learning and problem solving, as well as in symbolic and logical thinking, was the same. No children were classified as BSH (very well developed) or BB (not yet developed), with a percentage of 0%. Nine children were classified as BSH (developing as expected), which is 60%. Meanwhile, six children, or 40%, were classified as MB (starting to develop). This can be seen in the following histogram:

Evaluation

The evaluation results indicate that the pop-up book meets the standards of feasibility, as assessed by subject matter and media experts. The suggestions obtained from the validation and testing stages served as the basis for revising the product. The learning objectives using this media were declared to have been achieved. This can be observed in the ability of children in Group B1 to recognize letters and match them with their corresponding pictures. In addition, the children demonstrated positive attitudes during the activity, exhibiting joy, enthusiasm, and excitement as they participated in the learning process. When the Pop-Up Book media was shown, the children appeared very interested and had a high level of curiosity about the book's contents, making the learning process more active and enjoyable.

DISCUSSION

The results of this study indicate positive changes in children's observed cognitive responses after being introduced to Pop-Up Books, although this increase is indicative, and some children are only showing initial development. The data shows that 60% of children developed as expected, while 40% began to show an increase in their ability to recognize letters and match them with pictures. These findings confirm that visual, interactive, and engaging learning media have the potential to make it easier for children to understand material and stimulate their thinking processes.

This finding may be related to the visual and tactile characteristics of the Pop-Up Book, which allow children to interact directly with learning symbols. As stated by Raffa (2019) and also Supriani et al. (2024), Pop-up books engage young readers through interactive, tactile, visual, and textual modalities (Raffa, 2020; Supriani et al., 2024). Thereby it supports early symbolic representation and attention processes (Sari & Suryana, 2019; Wulandari et al., 2024). These multimodal interactions were reflected in classroom observations, where children actively engaged with Pop-Up elements while recognizing and matching symbolic representations during learning activities.

In addition to reinforcing the findings of Khamidah and Yulia (2022) and Masykuroh and Wahyuni (2023), this study makes a new contribution to the literature on Pop Up Books (Khamidah & Yulia, 2022; Masykuroh & Wahyuni, 2023). Unlike previous studies that emphasized character education or language development (Aini & Cahyo, 2024; Pebriani & Vinayastri, 2022), this research shows that Pop-Up Books show potential as a medium for supporting logical and symbolic thinking skills in early childhood. This contribution is important because it extends previous Pop-Up Book research beyond character and language domains by demonstrating its potential as a

systematically designed medium for targeted cognitive stimulation in early childhood.

Unlike previous studies that primarily emphasized affective or linguistic outcomes, this study highlights the relevance of structured visual media in supporting early cognitive processes, particularly symbolic recognition, within a developmentally appropriate learning context. Research demonstrates that becoming "symbol-minded" is a crucial developmental milestone (DeLoache, 2004). Symbolic thinking enables children to mentally represent objects not physically present, forming the foundation for abstract and imaginative thinking (Mufida & Hibana, 2024). In line with this opinion, Porto stated that symbolic representation is crucial for human development, enabling communication and experience depiction (Porto, 2023). Mi Tian et al., (2019) specifically identified ages 4-5 as a critical period for symbolic representation development, showing how children progressively transfer relational information through symbolic tools (Tian & Luo, 2021). D. Hyde et al. (2021) further demonstrated that symbolic aids can enhance children's numeracy skills, providing concrete evidence of symbols' learning facilitation (Hyde et al., 2021).

Within the theoretical framework, Pop-Up Books could function as concrete symbolic tools that transform abstract letters and symbols into visually and physically manipulable representations, enabling young children to engage in symbolic thinking through direct interaction. Bluemel et al. (2012) specifically highlights pop-up books' unique ability to "help build motor skills, teach cause and effect, and develop spatial understanding of objects (Bluemel & Taylor, 2012). In line with that, Raffa et al. (2019) describes pop-up books as a "hypertext" that communicates through intuitive, experiential metalanguage beyond traditional alphabetical text (Raffa, 2020). Rusanti et al. (2023) demonstrated that when pop-up books convert two-dimensional text into three-dimensional images, children become more interested and active in language learning (Rusanti et al., 2023).

In practical terms, teachers can use Pop-Up Books as an alternative learning method that is both enjoyable and stimulates children's ability to understand basic concepts. This study also opens up opportunities for further research to explore the influence of Pop-Up Books on other aspects of development, such as creativity, social-emotional skills, and language skills, so that this medium can be utilized more optimally.

However, this potential should be interpreted cautiously, as the findings are based on descriptive observations within a limited classroom context and do not represent generalized effectiveness across broader populations.

This study has several limitations, including the small sample size, the brief implementation duration, and the absence of a comparative or experimental design. Therefore, future studies are encouraged to employ quasi-experimental approaches with larger samples to further examine the effectiveness of Pop-Up Book media on early childhood cognitive development.

CONCLUSION

Based on the results of the study, the development of Pop Up Books through the ADDIE model is deemed feasible for use in early childhood education, with

subject matter and media expert validation scores of 98.3% and 96.6%, respectively. The use of this media was observed to support children's engagement, enthusiasm, and learning experiences, making learning more enjoyable and interactive.

Pop-up books indicate an increase in children's cognitive abilities, particularly in recognizing, naming, and matching letters with pictures. Sixty percent of children develop as expected, while 40% begin to show development. Theoretically, these findings support the notion that pop-up books have the potential to foster logical and symbolic thinking skills in early childhood. Practically, this medium can be utilized by teachers as an alternative and innovative learning method, while also opening up opportunities for further research on its influence on other developmental aspects, such as children's creativity, social-emotional skills, and language abilities.

It is recommended that teachers consider using Pop-Up Books as part of learning activities to support children's engagement and early cognitive development. The development of media with more creative designs and greater variety can be continued, while further research may explore the influence of this media on other aspects of development, allowing for a more comprehensive understanding of its benefits.

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