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Development of Pop-Up Book Media Based on Multisensory for Scientific Literacy of Early Chidhood

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***Abstrak**: One of the common problems that occurs in kindergartens is the lack of development of learning media for children. This is a problem that must be solved in order to develop children's abilities, especially scientific literacy. This research aims to develop multisensory-based Pop-Up book media for early childhood science abilities. This research uses the Borg and Gall model of Reach and Development research method with 9 learning steps, namely; 1) identifying objectives with evaluation, 2) conducting learning analysis, 3) analyzing students and the learning context, 4) writing core objectives, 5) developing evaluation instruments, 6) developing learning strategies, 7) selecting and developing teaching materials, 8) designing and implementing formative learning evaluations, and 9) revising learning. Data collection techniques in this research used documentation and questionnaires. Aiken's V validation is used as a data analysis technique. The results obtained from this research are 1) lesson plan design, 2) children's conditions in the field and the problems they face, 3) child development indicators, 4) child development indicators, 5) development competencies, 6) development design pop up book media, 7) media development evaluation results with a percentage of 91.25% (valid) and material media validation of 90.77% in the appropriate category (valid). The results of measuring children's science abilities in 3 kindergartens in Pasaman Regency which were carried out in the middle class showed a test assessment result of 87.16%, which means that children's scientific literacy abilities are developing well.*

***Keyword:** Multisensory, pop up book, science, early childhood.*

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INTRODUCTION

Early childhood is a vulnerable individual aged 0-8 years who is in the early stages of human life development (Yaswinda, 2018). Early childhood education (PAUD) is implemented through a play process according to the child's needs (Suryana, 2013). The results of the Central Statistics Agency in 2023, in total, 33.4% of young children have used gateways and 24.96%

have accessed the internet (BPS, 2021). Based on the results of data from the Central Statistics Agency, it shows that almost half of Indonesian children use gated. Children experience various impacts, both positive and negative. However, the most obvious impact of enthusiastic use of gadgets on children is that it causes children's concentration to decrease, they cannot control their emotions, they are irresponsible, and they have difficulty making decisions (Glenda, 2009) and result in a decrease in children's literacy levels. This shows that learning is needed that can help children overcome this problem.

The development of PAUD education in the 21st century explains the stimulation that can be given to PAUD through science learning. This is because science learning can help children recognize various things (Suryana, 2018). Science learning is related to how individuals learn (V. M. Putri & Yaswinda, 2022), observe, pay attention, evaluate and manage their environment (Anggraini et al., 2019) so that children can be trained to use their thinking, abilities, honesty and use the techniques taught (Broadbent et al., 2018). Science has two components, namely the content component and the process component (Helena, 2019). Through science, children are given real, direct experience (Yaswinda, 2018), so that the development of children's scientific abilities can develop and improve. To improve children's literacy or science skills, learning methods should be used that can stimulate children to explore and participate (V. M. Putri, 2016). And can stimulate all of the child's senses (multisensory) (Nafi'ah et al., 2018). Therefore, the use of multisensory models can be a solution in providing stimulation of visual sensory and kinesthetic literacy skills, which can be stored for a long period of time and can stimulate the effectiveness of children's brain processes (Izzuddin, 2019). Sensory ability is an intervention using stimuli that can facilitate brain and nerve. Sensory abilities do not only use one category but a combination of several categories, such as; kinesthetic, tactile, visual, taste, smell, auditory, and/or vestibular.

Many innovations have been carried out, one of the innovations that can be offered is the development of learning media in the form of pop-up book media for early childhood. Pop-up book media is a book with a three-dimensional design, containing colors, pictures and interesting stories (Gross, 2012). The use of learning media in early childhood is one method of providing stimulation that is appropriate to use according to the child's age growth (Nur Aisiyah, 2017). Pop-up media books are designed according to the themes in the early childhood education curriculum (Embarek-Hernández et al., 2022). The easy use of pop-up book media makes this media a means of developing innovation to improve children's abilities (Junker et al., 2021). This media can also be adjusted to the content and material according to the results you want to achieve. And pop-up book media can be used in various scientific developments.

When viewed from the field of development, science includes mastery of products, processes and scientific attitudes (Mirawati & Nugraha, 2017). Science learning in kindergarten is aimed at the dimensions of introduction and mastery of scientific products, processes and attitudes (Rahmi, 2019). Children have scientific potential because every child is born with their own intelligence to explore science (Deiniatur, 2018). Science learning in kindergarten is carried out using integrated methods which are summarized in thematic learning. Science skills are the ability to apply a series of scientific methods so that children can understand, develop and discover knowledge (Marlina, 2019). Science skills provide children with the ability to apply scientific methods (Arin & Sa'dun Akbar, 2023) in developing science into knowledge. This systematic review of research on early childhood programs seeks to identify effective approaches capable of improving literacy and language outcomes for preschoolers. It applies consistent standards to determine the strength of evidence supporting a variety of approaches,

which fell into two main categories: comprehensive approaches, which include phonemic awareness, phonics, and other skills along with child-initiated activities, and developmental-constructivist approaches that focus on child-initiated activities with little direct teaching of early literacy skills. Inclusion criteria included use of randomized or matched control groups, evidence of initial equality, a minimum study duration of 12 weeks, and valid measures of literacy and language. Thirty-two studies evaluating 22 programs found that comprehensive early childhood programs that have a balance of skill-focused and child-initiated activities programs had significant evidence of positive literacy and language outcomes at the end of preschool and on kindergarten follow-up measures (Shavlik et al., 2022). Effects were smaller and not statistically significant for developmental-constructivist programs. One way to improve children's science abilities in kindergarten is to use children's multisensory development.

Multisensory science-based learning is learning that prioritizes science process and content skills through multisensory development (activities involving the children's senses of sight, hearing, smell and touch) as well as important interactions between children and the environment to improve children's cognitive abilities (Ruhaena, 2015). Sensory stimulation is the process of receiving sensations that the body receives from its environment, then organizing and processing them which are then interpreted to produce reactions (Ibrahim, Gunawan, Marwan, 2019), providing sensory stimulation should be given from an early age through play activities (Correia, N., Aguiar, C., & Consortium, 2022) so that children can process and interpret the information provided and can carry out activities to improve learning, cognitive skills, and problem solving (Maryatun, 2016).

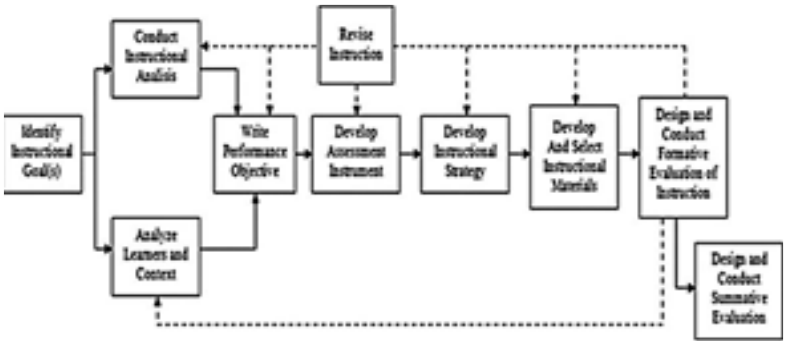
Developing children's abilities can use help from learning media. Learning media is a tool in the learning process so that children are able to be actively involved in the learning process and optimize their development (Nahdi & Yunitasari, 2019). The use of learning media must be able to stimulate children's sense of sight so that learning becomes more effective (Safriyani et al., 2021), because through sight, it can give the impression that it is easier to understand, remember and concepts will be ingrained in the brain for a long time (Lynch, 2008). Learning media has an important role in the process of teaching activities so that delivering learning material becomes easier (Devi, 2016). Learning media are tools, materials, methods or techniques used by teachers or teaching staff in conveying information so that learning objectives can be achieved perfectly and accepted by children (G. F. Putri & Pranata, 2018).

This pop-up media is designed with attractive colors, three-dimensional shapes, interesting and unique images, and gives a distinctive impression so that children will be more enthusiastic about following the existing learning process (Sudarna, 2014). The benefits of pop-up book media are: 1) Provides pleasure in reading stories, 2) Increases children's knowledge by providing an introduction to an object, 3) Stimulates children's imagination and fosters creativity, 4) Children can interact with the stories told either through observation or through touch (Suryana, 2018). The uses of Pop-up media are: 1) To develop children's love of reading, 2) Encourage the desire to read, 3) Can capture meaning through interesting images, 4) Can be used for critical thinking and developing children's creativity (V. M. Putri, 2020). The advantage of pop-up books is that they can provide a more interesting story visualization starting from the display of illustrations that have dimensions, images that can move, and can change shape.

The aim of this research is to design multisensory-based pop-up book media to improve children's science skills in kindergarten; 2) validating multisensory-based pop-up learning media to improve children's science skills in kindergarten; 3) Test multisensory-based pop-up book media to improve science skills.

METHOD

In the research, the Research and Development (R&D) method was used as a method for developing pop-up book media. Media development is designed and adapted to the preschool curriculum so that it contains multisensory-based science elements for children's learning. R&D research is oriented towards developing educational products that can be used to develop and validate educational products. This research is included in development research (R&D) using the Borg & Gall method, Gall (2003) which explains that, R&D development research is industry (Gall, M., Gall, Joyce, Borg, 2003) based development, research findings are in the form of products that are designed and tested systematically so that they become quality products and can be used systematically and effectively. This research uses the Research and Development method by combining the Borg & Gall (1989) method with the Borg & Gall (2007) method with the following design which can be seen in Figure 1:



Ficture 1. Borg & Gall Development Procedure, Gall (2003)

There are 10 research steps proposed by Borg & Gall, Gall (2003), but this research only uses 9 research steps by Gall, Gall. & Borg (2003), which has special characteristics and is modified by: 1) Assessing the Need to Identify Goals, 2) Carrying out Instructional Analysis, 3) Analyzing Students and Context, 4) Writing Performance Goals, 5) Developing Assessment Instruments, 6) Developing Learning Strategies, 7) Developing and Selecting Teaching Materials. 8) Designing and conducting formative evaluation of instruction. 9) Revision of Instructions and improvements (Borg & Gall, 2003). The following are the development stages carried out;

1. Observation and Information Collection, carried out based on the results of previous research, namely research by the research team related to early childhood science and FGD.
2. Identify learning objectives, carried out by developing general competencies that will be used in the learning process
3. Learning analysis, is a procedure used to determine the relevant skills and knowledge needed by students to achieve competencies that have been determined by developing lesson plans
4. Identify children's initial behavior and student characteristics which are carried out directly in learning situations;
5. Write down objective performance (special instruction), that is, this objective learning stage must be formulated systematically and specifically;
6. Developing instruments, used to measure children's success in achieving learning goals, at this stage theories related to science learning are developed

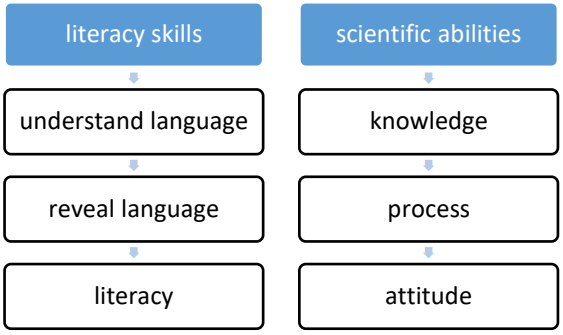
7. The process of developing and selecting teaching materials/media
8. Strategy preparation (designing lesson plans related to time, methods, science learning techniques using Pop Up media)
9. Design and conduct evaluations to test the effectiveness of multisensory-based pop up media on a small scale in Kindergarten;

This research was conducted using the R&D method according to Borg & Gall, Gall (2003) using data collection techniques using observation and documentation. The research was carried out in kindergartens in Pasaman Regency. The research target was children aged 5-6 years as the main object of research with a total of 58 children and 6 teachers as secondary objects. Data analysis in this study used descriptive statistical analysis, using a Likert scale as a reference in assigning media suitability categories

RESULT AND DISCUSSION

After developing studies and product assessments, a product will be produced in the form of a multisensory-based pop-up book media for the science abilities of early childhood in kindergarten. Through the Borg & Gall development method, Gall (2003) found the following research results;

1. Identify Instructional Goals;
   In the initial stage, learning objectives were identified by conducting reference studies related to material on literacy and science skills in early childhood as well as the use of multisensory-based learning media in children's gardens. Identification is carried out to better understand the problem and the solution that will be provided.
2. Learning analysis,
   This stage is the second stage. At this stage, identification is carried out regarding what skills, attitudes and knowledge must be developed to achieve learning goals. In this research, researchers developed multisensory-based pop-up book media with the aim of describing media development so that it can improve children's literacy and science skills. At this stage, the results of the analysis of indicators of literacy and language skills are obtained:



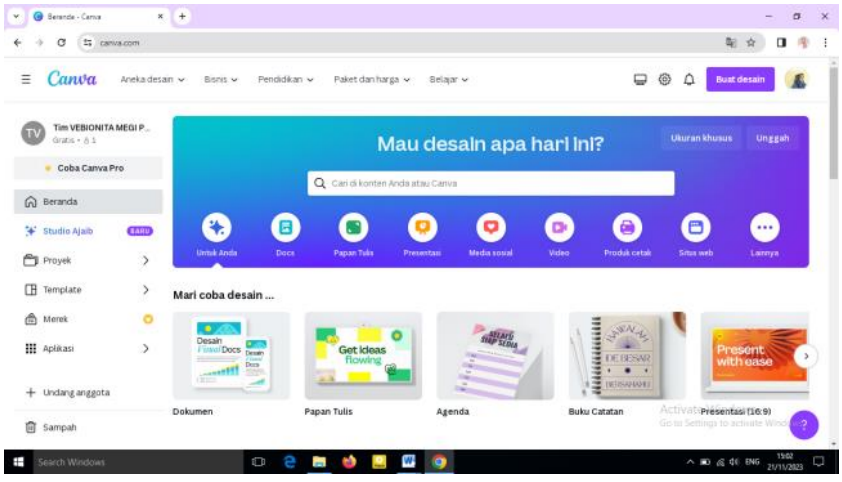
Ficture 2. Instructional analysis of learning

3. Write Performance Goals
   Next, indicators for the literacy and science abilities of children aged 5-6 years are created which are explained based on the material that has been analyzed. In this case it is related to the cognitive and language theories of children aged 5-6 years.

4. Develop indicators
   Indicators adapted to the Criteria; grids prepared based on the learning theory of ability science for early childhood. a) The child understands several commands given, b) The child can repeat several sentences, c) The child enjoys and appreciates reading, d) The child can answer the questions given, 5) The child can name the pictures he sees, 6) The child can name the symbols letter symbols, 7) Children can introduce themselves, 8) Children can find ideas through the pictures they see, 9) Children can understand information through pictures, 10) Children can observe the objects presented, 11) Children can classify pictures based on function, 12) Children can use their senses in observing objects (seeing, touching, hearing and smelling), 13) Children can name the characteristics of the objects they see, 14) Children know the names of objects shown, 15) Children dare to ask questions 16) Children have a desire to high knowledge, and 17) Children are able to say thank you after being praised.
5. Develop Learning Strategies
   The learning strategy is designed according to the product or design that you want to develop, namely multisensory-based pop-up book media for early childhood science abilities.
6. Developing and selecting teaching materials
   At this stage the product is developed based on certain types, types and models according to the specified format and criteria.
7. Design and Implement Formative Evaluation of Instruction

At this stage, development design is carried out which is designed to become media and is carried out in a formative evaluative manner. At this stage there are several steps to take;

a) Development of pop-up book design
   At the design development stage, the design is adapted to the characteristics of children aged 5-6 years and the relationship between the design and the material to be conveyed so that it becomes more objective. At this stage the pop-up book media developed uses a plant theme with a sub-theme of ornamental plants. The design development process is carried out using the Canva application as follows;



Ficture 3. Canva App Home Screen

b) Expert validation

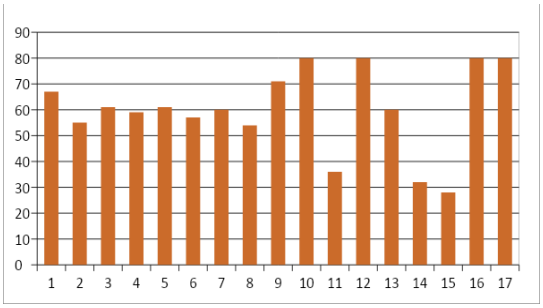
The validation process was carried out by two (2) experts in their fields, namely validation by material expert Dra. Yul Syofriend, M.Pd, M.Pd Postgraduate Lecturer at UNP, obtained a validation score of 90.7% (very valid) as well as media validation by media expert Dr. Abna Hidayanti, M.Pd Lecturer in Educational Engineering at UNP obtained a result of 91.25% which is in the very valid category and can be used for trials in the learning process in Kindergarten.

c) FGD (Focus Group Discussion)

After the product was declared valid by experts, the researchers continued the research by conducting FGDs in 3 kindergartens with 6 teachers in Pasaman Regency to test the suitability of the media. Based on the discussions carried out, the results were 94.6% (very feasible) so that the media can be used in kindergartens.

8. Test media

The next step is to carry out small class trials assessed from observation sheets on September 5 2022 at RA Aisyiyah Batu Batindih. Assessment is carried out after learning by asking children to provide responses or asking children several questions about the product being developed. The results of the child's responses will be given a checklist score which is then validated and converted into an assessment of the suitability of pop up book media as teaching material for child observation, which can be seen in the graph below:



Ficture 4. Small Class Trial Display

Based on the results of children's responses at the small class test stage, it can be seen that the pop-up book media display indicator received a percentage of 60.06% which was in the very feasible category with revision. After revising the small class test, the next step was to carry out a middle level test with a larger scope which was carried out in 3 kindergartens in Pasaman Regency with a total of 58 children aged 5-6 years. So the following results are obtained:

Ficture 5. Medium Class Trial Display

Based on the results of measuring children's science abilities in 3 Kindergartens in Pasaman Regency, the results of the medium class trial assessment were 87.16%, which means that children's science abilities are developing well and the media used is appropriate to the learning process in Kindergarten.

1. Revision

Next, revisions are made regarding deficiencies and additional suggestions in the product development process stage which are linked to the previous steps so as to produce a learning media product that is suitable for use in the learning process. The following are the results of the media revision;

Ficture 5. Pop-up book media display after revision

Researcher develop media pop-ups book based multisensory with objective describes the development of media that can improve the science abilities of early childhood. At the ***Write stage Performance Objectives, researchers*** created indicators of the science abilities of children aged 5-6 years explained based on cognitive theory and science learning theory for children aged 5-6 years. Instruments Then developed based on grille Which arranged based on study theory ability literacy and ability science for child age early. Evaluation results Study carried out through assessment authentic with instruments form sheet observation. The instrument is then validated by experts and then a trial of the instrument is carried out. During the trial, the research team experienced no problems

CLOSING

The choice of pop up book media design is adjusted to the criteria for delivering the material learning objectives can be conveyed well. Theme used on media time This is theme plant with sub theme plant ornamental. Making design use Canva application. Then the media is validated. Based on the results of media validation carried out by media validators a result of 91.25% was found in the category very valid and can be used for testing in the learning process in Kindergarten. Thus, the research continued with formative tests, small class trials. Based on the results children's responses at the small class test stage, it can be seen that the indicators for the display of teaching materials pop-up book media received a percentage of 60.06%, namely in the very category worthy of revision. Then media revisions were carried out and the researchers continued the middle class formative tests.

Based on the results of measuring children's scientific abilities in 3 kindergartens in Pasaman Regency obtained medium class trial assessment results of 87.16% Which means ability scientific child develop with Good And media Which used in accordance with the learning

process in Kindergarten. This is in line with the theory which states that to improve children's science abilities (Robert J Tierney, Fazal Rizvi, 2023), should use learning methods that can stimulate children deeply explore And participate. As well as can stimulating all sense (multisensory). Through a multisensory approach it can create a learning atmosphere in optimizing children's literacy and sensory activities (Tiel, 2011). Hence the model multisensory can made solution in stimulating ability literacy, visual, auditory and kinesthetic sensory (Ibrahim, Gunawan, Marwan, 2019), so they are stored for a period of time Which long And stimulating effectiveness brain processes (Hunt, 2023). The use of media in children's learning processes in kindergarten is an alternative solution that can be implemented (M. Fleer, 2010). Pop-up media is designed with attractive colors, three-dimensional shapes, the pictures are interesting, unique, and give a special impression so that children will more enthusiastic about participating in the learning process (Suryana, 2013). Benefits of pop up media book that is: 1) Stimulate imagination And grow creativity child, 2) Provides enjoyment in reading stories, 3) Increases children's knowledge until give introduction form something object, 4) Child can interact with stories(Ivanović, 2014) told either through observation or through touch. This was proven during small class and middle class trials in three kindergartens in Pasaman district. The children were very enthusiastic about being able to use media in the form of pop up books. They really admire this mutisensory-based pop up book because the book smells good, there is a floral aroma that appears when they open the book. Their olfactory sensors are stimulated.

Teachers also feel the same benefits, and this is in line with the opinion which states that the use of Pop-up media is: 1) To develop children's love for reading, 2) Can be used to think critically and develop creativity child, 3) Can catch meaning through picture Which interesting, 4) Push desire read (Husin & Yaswinda, 2021). Excess pop-ups cards can give visualization that story-more interesting Which started from appearance illustration Which have dimensions, that picture can move, and able to change shape (Shavlik et al., 2022). This can influence children's interest in studying the contents of the pop-up story book (Wen et al., 2020). Children's scientific knowledge about the contents of plant stories can finally achieve the expected results (Zucker et al., 2021).

Based on the results of measuring children's scientific abilities in 3 kindergartens in Pasaman Regency obtained medium class trial assessment results of 87.16% which means that children's scientific abilities are developing well and the media used in accordance with the learning process in Kindergarten.

CONCLUSION

Based on the results of the research carried out, it can be concluded that pop-up book media is suitable for use in kindergartens to teach and develop children's scientific lieracy skills. With a result of 81.67%, children's science and literacy abilities improved when learning was carried out using pop-up books. Researchers hope that this research can be used as a reference in developing children's literacy and science skills using learning media.

The implications for early childhood education in general include integrating the development of children's scientific and literacy abilities as an integral part of the learning process and enriching teachers' knowledge in developing learning media so as to increase children's interest in learning. Limitations of this research include the focus on one learning theme and the limited age range. This research shows that the development of multisensory media can be implemented and used to develop children's science abilities. This research can raise awareness that the development of children's science abilities can be improved through

print media from a different perspective. In future research, it is hoped that there will be researchers who examine children's science abilities through multisensory action in the form of pop-up book media with development for a wider range of ages, because this research was only conducted on children aged 5-6 years. It would also be more interesting if there was further research related to increasing children's science abilities through multisensory activities using other approaches or types of themes, such as the theme of me with the sub-theme of my environment. Additionally, longitudinal studies should be conducted to examine the long-term impact of educational media use on early childhood development.

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