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The Development of Memory Game Media for Improving Letter and Number Recognition Skills in Early Childhood

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ABSTRACT
Recognizing letters and numbers is essential in early childhood as a foundation for literacy and numeracy. This study aimed to improve these skills through memory game media. Using a Research and Development (R&D) approach with the Thiagarajan 4D model (define, design, develop, disseminate), the research involved 3 teachers and 15 students. Data were collected through observation, interviews, and questionnaires, analyzed both quantitatively and qualitatively. Results showed an increase in recognition skills from 61% (pre-test) to 71% (post-test). Teacher responses rated the media at 94.06% effectiveness. The Wilcoxon signed-rank test confirmed significant improvement (66 positive ranks; $p < 0.05$). Memory game media proved effective for enhancing letter and number recognition in early childhood. The study offers practical insights for integrating interactive media into early education and encourages further research for broader application.

Keywords: Memory Game, Letter and Number Recognition, Early Childhood

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INTRODUCTION

Early childhood is a period of rapid growth and development, ranging from birth to six years of age (Efrideanti et al., 2025; Innes et al., 2023; Nurfahma et al., 2024). This stage is often referred to as the "golden age" because it is the most critical period in human life when 90% of brain development occurs (Nasir et al., 2019; Nisak et al., 2022; Rohmah, 2021). Therefore, efforts are needed to optimize growth and development during this stage through stimulation and encouragement, one of which is through education. This effort involves providing educational stimuli to support children's physical and spiritual development in preparation for entering the next level of education, whether formal, informal, or non-formal (Wulandani et al., 2022).

John Locke (1704), a renowned scholar, introduced the "Tabula Rasa" theory, which views early childhood as a blank white sheet that will be filled based on the experiences children undergo within their environment, ultimately shaping their character in adulthood (Saputri & Sunardi, 2023). In this case, all of the child's senses are actively engaged in exploring their surroundings, whether through positive or negative experiences, making it the responsibility of adults to create meaningful environments so that children can paint positive experiences on their blank canvas (Bachtiar & Hasmawaty, 2022). There are several aspects of

development that need to be nurtured from an early age, namely religious and moral values, language, motor skills, social-emotional development, arts, and cognitive skills. These six aspects are interrelated and are essential to be developed so that children can grow and develop optimally and in accordance with their developmental stages. The aspects of early childhood development include language, cognitive, art, physical-motor, religious and moral, and social-emotional development (Sari et al., 2023; Syafitri et al., 2018).

In language development, basic skills required by children include letter and number recognition. At this stage, children begin to build the foundations of literacy and numeracy, which will support their future learning (Maromi & Pamuji, 2024; Syarfina et al., 2024). The ability to recognize letters and numbers is not only related to reading and counting skills but also plays a crucial role in children's cognitive, social-emotional, and language development (Choiriyah et al., 2023). These foundational skills equip children with the readiness for reading and counting. Introducing letters and numbers to early childhood should be done in an enjoyable and non-coercive manner. Jean Piaget (1952) explained that there are two processes underlying how children use and adapt their cognitive schemas: assimilation and accommodation. Assimilation involves incorporating new knowledge into existing knowledge structures, while accommodation occurs when children adjust to new information by modifying their cognitive schemas to align with their environment. This forms the basis of how children build knowledge through their experiences (Santrock, 2017).

Recognizing letters and numbers is essential for children from an early age (Oktina et al., 2015). Letter recognition is the foundation of reading skills, which is a core component of language acquisition, while number recognition is equally important as numbers are the basis of early mathematical ability. Both fall under the domains of literacy and numeracy. These skills do not develop naturally without support from the surrounding environment. Stimulation through appropriate teaching methods and strategies used by teachers in learning activities is essential (Papadakis et al., 2021). Children learn effectively through activities that involve direct experiences, such as through games. Considering the importance of letter and number recognition skills in supporting children's learning success and readiness for literacy and numeracy at higher educational levels — as well as the fact that most learning activities involve letters and numbers and are interconnected with other aspects of development — it is necessary to utilize appropriate media. One such media is the memory game, which also serves as a teaching aid for teachers to introduce letters and numbers in a more enjoyable way for children.

The use of memory game media can help improve early childhood letter and number recognition skills. This aligns with the opinion that memory games can make the learning process of letters and numbers more interactive and enjoyable. By using memory games, children can directly engage in recognizing letters and numbers while being motivated to collaborate with their peers. Additionally, it trains children's focus as the game exercises their memory to recall the cards they have seen (Supriyadi, 2018).

This memory game media involves card games containing letter and number symbols, which rely on the player's memory ability. Number and letter cards serve as tools used by teachers to introduce numeric and letter symbols to students in a simple and understandable way, making it easier for children to remember these symbols. Thus, using this media can enhance early childhood letter and number recognition skills (Oktina et al., 2015). Media play an important role in the learning process at school. Therefore, teachers as educators must be able to utilize and make use of various media around them to effectively deliver learning messages so that students can better understand the material being taught (Herman & Rusmayadi, 2018).

Memory games are a common children's game using a set of cards, where the cards have images on one side, and each image appears on two different cards. The game begins with all cards placed face down, and players take turns flipping over two cards. If both cards display the same image, the player keeps them; otherwise, they are turned back over. The winner is the one with the most cards when the game ends (Sivakumar, 2022)

Additionally, memory games are an appropriate activity for teachers to use in teaching vocabulary to students, which can be played in groups to increase students' motivation to compete with one another. The game involves students quickly matching pairs of images and words according to vocabulary previously introduced. This game enhances group cooperation and sharpens students' memory (Panjaitan, 2023).Through play, children learn and build their knowledge in a joyful environment, using their cognitive abilities to solve simple to complex problems, which in turn stimulates their cognitive development (Sivakumar, 2022).

A memory game is designed to train memory and concentration skills. In this game, players are faced with a number of picture cards that have pairs, and their task is to find the matching pairs during their turn. The use of memory game media can help teachers introduce numbers and letters through engaging activities (Azhima et al., 2021). Research shows that learning activities enhance attention and mental control, and children can apply such games in solving everyday problems (Sivakumar, 2022). Through this memory game, children can exercise their brains naturally and enjoyably, allowing the process to occur without pressure (Parwoto, 2024).

A study by Astuti et al.,(2021) aimed to determine the relationship between using letter card media and the beginning reading ability of children aged 5-6 years. The research results showed a positive relationship between the use of letter card media and beginning reading ability, with letter recognition being a fundamental part of reading. Thus, this study confirmed that using letter card media positively influences children's initial reading skills by first introducing letters. Another study by Fitroh Magfiroh et al., (2023) concluded that the literacy and numeracy program outcomes, delivered through a community service program, effectively implemented an engaging learning media called the "Flash Card Game." This game uses 25x30 cm cards with letters and numbers in attractive designs and colors to capture students' interest in playing. Meanwhile, Rahman & Maskun, (2023) conducted a study aiming to determine the use of letter card games in enhancing letter recognition abilities among students at RA Nur Zahra Tomohon. The study concluded that there was an increase in children's letter recognition abilities through the use of card media. This method proved effective, as evidenced by the increased success percentage in the second cycle compared to the first.

An effort to improve number recognition skills using number card media was also conducted by Salihan in 2019 with Group A students at TK PGRI 09 Kotaraja, Kecamatan Sikur. The study showed that implementing number card media improved both the children's activities and number recognition abilities. The improvement was seen in the increased activity scores, teacher performance, class average, and classical completeness level in both cycles (Salihan, 2019). Research by (Batarisaf et al., 2024)also examined the effect of memory games using geometry shapes on the logical thinking ability of children aged 4-5 years at TK Bowong Cindea. The study revealed a significant influence on children's logical thinking ability after being given treatment with geometry shape memory game media. Memory games are crucial in cognitive development, as memory enables individuals to retain information over time. Improving memory can be done by matching pairs of geometric shape images, which indirectly develops children's memory skills (Ulum & Ropikoh, 2018). According to previous research by (Rukmini, 2021)using memory game flashcards can enhance and stimulate children's memory abilities, although the presence of mothers or companions is still

needed during learning activities using flashcards. This improvement can help children express their memories, thoughts, symbols, reasoning, and problem-solving skills through the game's messages and meaning.

Based on the studies above, the researcher chose memory game media to help improve early childhood letter and number recognition skills. In this study, the researcher developed memory game media in the form of letter and number cards that children could play directly. Unlike most memory games, which are usually played through digital devices like smartphones or computers, this study developed non-digital media to reduce children's screen time and increase real-world social interaction. Additionally, alongside the memory game development, this study produced a guidebook for teachers and parents to create and use the memory game media effectively.

RESEARCH METHODOLOGY

This research is a Research and Development (R&D) study using the Thiagarajan 4D development model for the development of memory game media to improve early childhood letter and number recognition skills. Research and Development (R&D) is a process used to develop and validate products. This study follows the steps of the research process or procedures used for development, consisting of a review of the research on the developed product. (Sa'adah & Wahyu, 2022) Research and Development (R&D) is a method used in scientific research to produce a specific product and test its effectiveness. R&D research is conducted to create a new product or to improve an existing product as a new innovation. The purpose of this research is to develop memory game media to improve early childhood letter and number recognition skills at RA Al-Amin DDI Cambalagi Maros. The result of this research is a memory game media and a guidebook for the creation and use of the memory game media.

This research was conducted at RA Al-Amin DDI Cambalagi, with the research subjects consisting of 3 teachers and 15 students from group B1, aged 5-6 years. Focusing on several indicators, namely recognizing and pointing to letters, naming the letters that form a word, writing letters, recognizing and pointing to numbers, ordering numbers, and matching number symbols with pictures or objects. The data collection techniques used in this research are interviews, observations, and questionnaires. The questionnaire is used to measure the teachers' level of satisfaction with the media, while the observation is conducted to observe the children's responses when using the media in the learning process. The data analysis techniques used are quantitative data analysis and qualitative data analysis. Qualitative data analysis is conducted using a descriptive approach. This descriptive approach is used as an initial step to obtain data and information during the definition phase, design phase, development phase, and dissemination phase. Quantitative data analysis is conducted in this research to measure the extent of success in using the developed media. To assess the quality of the developed media, specific criteria are determined. The interpretation of the validation results is categorized in a table 1.

Table 1. Expert Validation Results Categories

No	Validation Result Category	Interpretation
1	$4 > RTV \geq 3,5$	Very Valid (SV)
2	$3,5 > RTV \geq 2,5$	Valid (V)
3	$2,5 > RTV \geq 1,5$	Sufficiently Valid (CV)

4	1,5 > RTV ≥ 1	Invalid (TV)

The criteria above are used to indicate that the development of memory game media for improving early childhood letter and number recognition skills has an adequate degree of validity. The average validity score for all aspects should be at least in the "sufficiently valid" category, and the validity score for each aspect should be at least in the "valid" category. The effectiveness analysis can be seen from the results of the teacher response questionnaire and the children's letter and number recognition skills. The category of responses or feedback provided by the teacher towards a criterion is determined by matching the percentage results with the effective criteria as shown in Table 2.

Tabel 2. Effectiveness Categories

No	Interval	Interpretation
1	85% ≤ 100%	Very Effective
2	70% ≤ RG < 85%	Effective
3	50% ≤ RG < 70%	Less Effective
4	RG < 50%	Not Effective

In addition to the results of the teacher response questionnaire, the effectiveness of the memory game media can also be seen from the children's letter and number recognition skills after using the memory game media, which are then compared with the children's initial abilities before using the memory game media. Thus, the effectiveness of the memory game media can be identified through the increase in the children's average abilities between before and after using the memory game media. The data collection procedure in this study was carried out through several stages, namely planning, administering a pretest, providing treatment, administering a posttest, and analyzing the results. The research design used is as follows:

O1 X O2

Description:
O1 = Pretest conducted before the treatment is given
X = Treatment given to the students in the form of using the memory game
O2 = Posttest conducted after the treatment is given

The steps for analyzing the effectiveness of this media are carried out as follows: Determining the score for each indicator**.** The criteria for achieving the level of children's learning development are divided into several stages, as follows:

Tabel 3. Criteria for Achieving the Level of Children's Learning Development

No	Interval	Interpretation
1	85% ≤ 100%	Very Good
2	70% ≤ HB < 85%	Good
3	50% ≤ HB < 70%	Fairly Good
4	HB < 50%	Less Good

Determining the average score using the following formula:

$$\text{Score} = \frac{\text{Total Score}}{\text{Maximum Score}} \quad X\ 100$$

Conducting data analysis using a non-parametric test based on the Wilcoxon test through the SPSS application.

The research stages consist of four phases: first, the definition phase, which includes the analysis of teachers' needs related to memory game media in improving early childhood letter and number recognition skills through a teacher response questionnaire. Then, a product design is created in the form of memory game media and a guidebook based on the needs analysis results from the previous phase. After that, the media and guidebook undergo a validation phase, where they are evaluated by two expert validators to test their feasibility regarding content, design, and readability. After making revisions according to the recommendations from both validators, the media was then tested in a limited trial with 15 students from group B1 to test the effectiveness of the media. After the trial is conducted, the packaging and dissemination stages are carried out. The Stages of Learning Media Development Are Described as Follows:

Define Stage

In the research on developing memory game media to improve letter and number recognition skills in early childhood, the define stage focuses on identifying learning needs and the problems to be addressed. At this stage, the researcher must conduct a needs analysis to understand the challenges faced in teaching letter and number recognition skills, such as children's difficulties in remembering letter and number forms or their low motivation to learn through conventional methods. The steps in the define stage are as follows:

Preliminary Analysis

This stage aims to identify and establish the fundamental problems faced by teachers in schools in improving students' letter and number recognition skills. In this stage, the researcher identifies teachers' needs in enhancing early childhood letter and number recognition abilities. Matters related to the development of this memory game media also include the extent of teachers' needs for media to improve these skills in young children. Furthermore, at this stage, the researcher needs to understand the characteristics and obstacles faced by children in the process of recognizing letters and numbers. The researcher must consider the gap that exists between the ideal conditions—what children should be able to do regarding letter and number recognition skills—and the actual conditions, as well as the stimulation needed by children to overcome these gaps.

Specification of Learning Objectives

At the define stage, the researcher also establishes the learning objectives for developing the memory game media. Formulating these objectives is a step taken after the researcher conducts a preliminary analysis of teachers and students, resulting in the determination of objectives for this study. This means formulating the targets to be achieved through the use of this media in the learning process. The learning objectives serve as guidelines for the researcher in designing appropriate media and determining the content of the accompanying guidebook, ensuring that the entire product development process aligns with the learning needs of early childhood students.

Design Stage

Based on the results of the needs analysis and the formulation of objectives from the previous stage, the researcher can determine the criteria and design specifications for developing the memory game media and its guidebook. For example, criteria for card design (size, color, and images), the number of cards used, and user instructions that are easy for teachers to understand. The guidebook should also include implementation procedures for the game, activity variations, and evaluations of children's abilities after using the media.

The purpose of this stage is to design a learning model. Activities carried out at this stage include developing learning outcome tests, selecting media, choosing appropriate formats, and drafting an initial learning model. The aim of this stage is to prepare a prototype or initial model of the memory game media, which consists of four steps: compiling criterion-referenced tests, selecting media appropriate to the learning objectives, selecting a suitable format, and creating the initial design (Al-Tabany, 2017)

Develop Stage

The development stage is a crucial phase in R&D research, encompassing product validation and product testing to ensure the effectiveness of the developed product design. In this stage, the researcher conducts a series of tests to evaluate the product's performance in real conditions. The purpose of the develop stage is to produce a revised version of the memory game media based on input from experts and trials with research subjects at RA Al-Amin DDI Cambalagi. This stage consists of two steps:

Expert Appraisal

Expert validation is conducted to validate whether the content of the learning tools or models aligns with the learning materials and objectives to be achieved by the memory game media before it is tested. The results of this validation are used to revise the initial product.

Development Testing

Development testing is the second step in the develop stage. In this step, the researcher conducts a limited trial on a small group to obtain direct feedback. The purpose is to identify potential problems when the product is used in real conditions and to gather input for improvements. The second draft produced is then simulated and subjected to readability tests to determine whether the guidebook for using the memory game media is easily understood by teachers and whether it can develop letter and number recognition skills in early childhood. The outcome of this stage is a memory game media product that has been revised based on expert feedback.

Disseminate Stage

After the limited trial and subsequent revisions based on development testing and expert validation results, the next stage is dissemination. This stage is divided into three steps: validation testing, packaging, and distribution.

RESULTS AND DISCUSSION

In general, this research follows 4 stages according to the Thiagarajan 4D model. These stages are: define, design, develop, and disseminate. The overview of the results of this research is as follows:

Define

In this study, the initial step taken was the define (definition) phase to understand the needs for developing memory game media to improve letter and number recognition skills in early childhood. The analysis at this stage is described based on the initial needs analysis of the students and the teachers' needs analysis, which are explained as follows:

Analysis of Teacher Response Questionnaire (ARG)

The needs analysis was conducted by directly observing the phenomena at RA Al-Amin DDI Cambalagi, Maros Regency, with the aim of identifying field conditions that did not align with expectations. In this stage, the needs analysis was carried out through observation, interviews, and the distribution of questionnaires to teachers. Based on the initial observations, during the learning process to develop letter and number recognition skills in early childhood, teachers used a question-and-answer method, typically employing media such as whiteboards and letter or number cards. The question-and-answer activities involved the teacher writing letters or numbers on the board and asking the children to name the letters or numbers being pointed to. In addition, teachers also used number or letter posters displayed on the classroom walls. The recapitulation of the analysis results regarding the need for memory game media and a guidebook to improve early childhood letter and number recognition skills can be seen in the following table:

Table 4. Recapitulation of Media Needs Assessment Results

No	Question	Yes	No
1	Do you use learning media in the learning process to improve letter and number recognition skills?	100% (3 teachers)	—
2	Have you ever used memory game media in the learning process to improve children's letter and number recognition skills?	—	100% (3 teachers)
3	Do you know the benefits of memory game media?	67% (2 teachers)	33% (1 teacher)
4	Have you ever heard of memory game media for improving children's letter and number recognition skills?	—	100% (3 teachers)
5	Have you ever created memory game media for improving early childhood letter and number recognition skills?	—	100% (3 teachers)
6	Do you need memory game media to improve children's letter and number recognition skills?	100% (3 teachers)	—
7	Do you know the steps to create memory game media for improving children's letter and number recognition skills?	—	100% (3 teachers)
8	Do you need a guidebook for using memory game media to improve children's letter and number recognition skills?	100% (3 teachers)	—

The purpose of the recapitulation above was to assess the extent of teachers' needs for memory game media in improving early childhood letter and number recognition skills. Based on the recapitulation results in Table 4, it is known that for the first question, all 3 teachers answered "Yes" (100%). In the second question, all 3 teachers answered "No" (100%). In the third question, 2 out of 3 teachers stated that they knew the benefits of memory game media (67%), while 1 teacher admitted not knowing its benefits (33%). For the fourth question, all 3 teachers answered "No" (100%). In the fifth question, all 3 teachers stated that they had never created memory game media (100%). For the sixth question, all 3

teachers stated that they needed memory game media (100%). In the seventh question, all 3 teachers reported not knowing the steps for creating memory game media (100%). Lastly, in the eighth question, all 3 teachers expressed the need for a guidebook on how to create and use memory game media to improve early childhood letter and number recognition skills (100%), as it would facilitate the teachers in the creation and implementation process.

Based on these results, it can be concluded that no teachers had ever used memory game media, particularly for improving early childhood letter and number recognition skills. Thus, teachers need more innovative and varied media in the learning process that can be used to improve these skills in young children. Additionally, teachers also require a guidebook on how to create and use memory game media, so that they can easily learn how to develop and implement the media effectively, ultimately making the learning process more engaging. Therefore, memory game media and its accompanying guidebook were developed to enhance early childhood letter and number recognition skills.

Design

After conducting a needs analysis, the next stage based on the 4-D research design is the design stage. This design stage is carried out to determine the design of the learning media that will be developed to enhance early childhood letter and number recognition skills. The initial design in creating the memory game media begins with designing letter cards, number cards, and picture cards that will be part of the memory game. The design of the memory game media is tailored to the objective of the media, which is to help improve letter and number recognition skills in early childhood. The development format for the memory game media and its guidebook is as follows:

Memory Game Media

The developed memory game media is a learning tool that involves activities using letter cards, number cards, picture cards, and a magnetic whiteboard. The letter cards, number cards, and picture cards are designed differently from before by using magnetic paper so that the cards can be attached to the magnetic whiteboard. The letter cards, number cards, and picture cards are first designed using the Canva application with attractive colors and images for children. After that, they are printed, laminated, and then attached to magnetic paper, and cut according to the card pattern. The difference between this memory game and the typical letter and number cards is not only in the magnetic paper layer but also in the concept of the game. Previously, letter and number cards were used in a question-and-answer format, where the teacher would show a card, and the child would name the letter or number on the card. In the development of this memory game media, the gameplay prioritizes the child's ability to remember the symbols of the letters and numbers on the cards. The gameplay concept of this media is that the students must find matching pairs of cards with the cards facing down or covered. Therefore, the position of the matching letter and number symbols on the cards must be remembered by the child. The use of the magnetic board in this game is to help the child arrange the letters and numbers after the game has been played, reinforcing the child's memory of letter and number recognition.

This memory game media can be played by more than one child, which helps foster sportsmanship among the children and increases their motivation to recognize letters and numbers in an engaging way. Additionally, children are excited to remember the letter or number symbols on the cards in order to win more card pairs. In addition to recognizing letters and numbers, children can also learn to write letters through this game. For example, after finding a matching pair of cards, the child is asked to attach any letter they have found a match for, and then write the letter on the magnetic whiteboard. Furthermore, children can

also connect the number symbols or numerals with the quantity of images on the picture cards. Therefore, children are not only directed to remember number symbols but also to count objects and remember the number of items.

Guidebook

The design format of the guidebook for the memory game media to enhance early childhood letter and number recognition skills is created using the Canva application. The detailed design is as follows:

Picture 1 Guidebook

Front Cover

The front cover of this user guidebook for the memory game media, aimed at improving letter and number recognition skills in early childhood, is designed with light green and sky blue colors. It depicts two children learning and playing in an open natural setting — a flower garden under a bright sky, complete with a sun and colorful kites. Near the two children, there are number cards, letter cards, a chalkboard, and ABC letters as symbols representing the memory game media, which is intended to enhance children's skills in recognizing letters and numbers. The front cover also includes the title of the book, the author's name, as well as the names of the supervisor and validators involved in the preparation of this guidebook.

Foreword

The foreword is written to express gratitude to the author's parents, both supervising lecturers, and the two validators who have provided support, guidance, and direction to the author in compiling this guidebook for the use of memory game media in improving letter and number recognition skills in early childhood.

Concept Map

The concept map in this guidebook is designed to illustrate the flow of material discussed in the guidebook for using memory game media to enhance early childhood skills in recognizing letters and numbers.

Instructions for Using the Book

The instructions for using this book are intended to make it easier for teachers to use or read the guidebook for using memory game media in developing early childhood skills in recognizing letters and numbers.

Introduction

The introduction in this guidebook consists of the background for creating the memory game media and the guidebook for its use in improving early childhood letter and number recognition skills. In addition, it also outlines the benefits and objectives of writing this guidebook.

Theoretical Review

The theoretical review in this guide contains materials related to memory game media and early childhood skills in recognizing letters and numbers, starting from the concept of memory game media to the skills of letter and number recognition in early childhood.

Media Creation Guide

The media creation guide includes the process of making the memory game media, which serves as a reference for teachers. This guide contains the tools and materials needed, along with step-by-step instructions for creating the memory game media. The purpose of this creation guide is to enable teachers who read this guidebook to create the media themselves.

Media Usage Guide

The media usage guide contains instructions on how to use the memory game media in the learning process, the roles of teachers and students during learning, supporting aspects of the learning process, indicators of letter and number recognition skills, and the assessment criteria for early childhood's letter and number recognition skills.

Closing

The closing section of the guidebook contains a concluding statement and the author's hopes following the completion of this guidebook particularly in efforts to improve early childhood skills in recognizing letters and numbers.

References

The references section of the guidebook lists the sources used in compiling the guidebook for memory game media in enhancing early childhood skills in recognizing letters and numbers.

Back Cover

The back cover of the memory game media guidebook for improving early childhood letter and number recognition skills is designed with the same background as the front cover, but with several objects removed to create a simpler design for the back cover.

Develop

This development stage consists of expert validation and developmental testing, which aim to produce the memory game media and guidebook that have been revised based on feedback from experts and trial results. The complete description of this stage is as follows:

Validity Testing

After completing the design stage, the design results are first tested for validity. This validity test is conducted by two validators. The validation results of the memory game media

development for improving early childhood skills in recognizing letters and numbers can be seen in the following table:

Table 5. Memory Game Media Validation Result

No	Assesmen Aspect	V1	V2
1	Media Physical Appearance	2,8	3,8
2	Media Durability	3,0	3,7
3	Media Usability	3,0	3,8
	Average of each aspect (Ai)	2,9	3,8
	Total Average Validation (TAV)	3,3	
	Description	Valid (V)	

Based on the validation results conducted by the validators in Table 5, the total average validity score for the memory game media product in improving early childhood skills in recognizing letters and numbers was 3.3**.** According to the predetermined criteria, this score falls within the Valid (V) category, which is in the range of 3.5 > TAV ≥ 2.5.

The validation results of the guidebook for using memory game media to improve early childhood skills in recognizing letters and numbers can be seen in the following table:

Table 6. Validation Results of the Memory Game Media Guidebook

No	Assesmen Aspect	V1	V2
1	Book Components	2,6	3,8
2	Book Format	3,0	3,7
3	Book Content	3,0	3,3
4	Language Accuracy	3,0	3,7
5	Illustration and Image Layout	3,0	2
6	Benefits or Usefulness of the Guidebook	3,0	3,5
	Average of each aspect (Ai)	2,9	3,3
	Total Average Validation (TAV)	3,1	
	Description	Valid (V)	

Based on the validation results conducted by the validators in Table 6, the total average validity score for the guidebook product on the use of memory game media to improve early childhood skills in recognizing letters and numbers was 3.1. According to the predetermined criteria, this score falls within the Valid (V) category, which is in the range of 3.5 > TAV ≥ 2.5.

Disseminate

In the final stage of developing the memory game media based on the 4-D model design is the disseminate stage. This stage consists of three parts: validation testing**,** packing**,** and diffusion and adoption. The validation testing is carried out to implement the product on the actual target users in order to determine the effectiveness of the developed memory game media in improving early childhood skills in recognizing letters and numbers. At this stage, implementation was limited to children aged 5–6 years at RA AL-Amin DDI Cambalagi, Maros Regency**,** specifically in Class B1 with a total of 15 children**.** This implementation was conducted in two phases: the pre-test phase and the post-test phase**.** The pre-test was conducted to determine the children's level of letter and number recognition skills before receiving the treatment using the memory game media. Meanwhile, the post-test was conducted to find out how much influence the memory game media had on improving the children's letter and number recognition skills.

Table 7. Pre-test Data on Early Childhood Letter and Number Recognition Skills

No	Indicator	Category			
		BSB	BSH	MB	BB
1	Recognizing and pointing at letters	2	3	10	0
2	Naming the letters in a word	2	3	9	1
3	Writing letters	3	3	9	0
4	Recognizing and pointing at numbers	1	5	9	0
5	Arranging numbers 1–20 in order	1	6	8	0
6	Matching number symbols with objects	0	4	11	0

Based on the results of the pre-test analysis, it can be concluded that most of the participants were still at the early stages of development, with only a small number of children reaching the "Developing as Expected" category. Therefore, it is necessary to provide stimulation for early childhood letter and number recognition skills so that these skills can achieve higher percentages in each indicator.

Table 8. Post-test Data on Early Childhood Letter and Number Recognition Skills

No	Indicator	Category			
		BSB	BSH	MB	BB
1	Recognizing and pointing to letters	3	6	6	0
2	Saying letters that form a word	3	5	7	0
3	Writing letters	5	6	4	0
4	Recognizing and pointing to numbers	2	7	6	0
5	Sequencing numbers 1–20	4	6	5	0
6	Matching number symbols with objects	2	9	4	0

The results of the post-test above indicate an increase in the number of children who achieved higher categories, with no children remaining in the 'Not Yet Developed' category. This finding shows that there was a significant improvement between the pre-test and post-test results. After identifying the differences in the pre-test and post-test scores, the researcher then conducted a statistical test to determine whether the use of memory game media had an effect on the early childhood skills of recognizing letters and numbers at RA Al-Amin DDI Cambalagi.

The indicators used at this stage focus on 6 indicators observed in the children, which include the ability to recognize and point to letters, the ability to name the letters that form a word, writing letters, recognizing and pointing to numbers, ordering numbers, and connecting number symbols with objects. The results obtained at this stage can be seen in the image below:

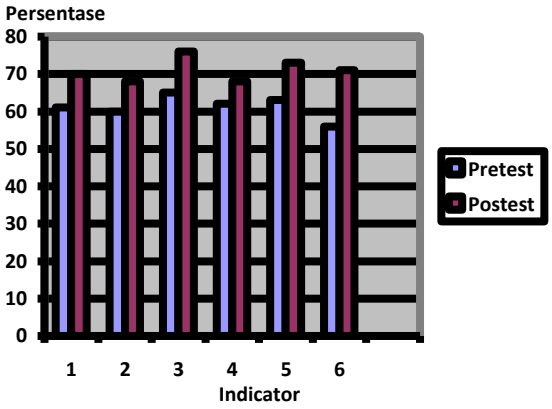

Figure 2. Pre-test and Post-test Results

Based on the observations in picture 2, it can be stated that after the implementation of the memory game media or the post-test, there was an improvement in early childhood letter and number recognition skills at RA Al-Amin DDI Cambalagi compared to the previous results. The results from the post-test above indicate that there was an increase in the number of students who achieved a higher category, and no students remained in the "not developed" category. This shows that there was a significant improvement between the pre-test and post-test results. After obtaining the pre-test and post-test results, the researcher conducted a statistical test to determine whether the memory game media had an effect on early childhood letter and number recognition skills at RA Al-Amin DDI Cambalagi. The researcher used a nonparametric statistical test due to the small sample size. The nonparametric test used was the Wilcoxon test. The Wilcoxon test is used for related samples to analyze paired observation results from two datasets to determine whether there are significant differences. The results of the Wilcoxon test conducted by the researcher are as follows:

Tabel 9. Ranks Result

		N	Mean Rank	Sum of Ranks
Posttest - Pretest	Negative Ranks	0[a]	.00	.00
	Positive Ranks	11[b]	6.00	66.00
	Ties	4[c]		
	Total	15		

The ranks data in Table 9 shows that the number of negative data is **0**, while the number of positive data is **66**. Thus, it can be concluded that there was a significant increase between the pre-test and post-test data. The results of the statistical test in this study can be seen in the following table:

Table 10. Statistica Test Result

	Posttest - Pretest
Z	-2.949[b]
Asymp. Sig. (2-tailed)	.003

The hypothesis for the effectiveness test in this study is:

Ho = There is no effect of the memory game media on early childhood skills in recognizing letters and numbers.
Ha = There is an effect of the memory game media on early childhood skills in recognizing letters and numbers.

The significance level in this study is 0.05. Referring to the obtained p-value of 0.003, where this value is smaller than 0.05 (p-value < 0.05), thus Ha is accepted and Ho is rejected. Therefore, it can be concluded that the memory game media has an effect on early childhood skills in recognizing letters and numbers.

Based on the data analysis of the teacher response questionnaire regarding the effectiveness of the media, the total average score obtained in the analysis of the effectiveness of the memory game media development in improving early childhood skills in recognizing letters and numbers was 94.06%. Referring to the predetermined assessment criteria, it can be concluded that the development of the memory game media in enhancing early childhood skills in recognizing letters and numbers falls into the very effective category, which is within the 81–100% score range.

After carrying out the validation testing stage, the next step was the packaging stage. The packaging conducted in this stage involved printing the guidebook and creating a link for the digital version of the guidebook. The next step was the dissemination stage. The dissemination of the product was done both offline and online. Offline dissemination of the memory game media and guidebook was carried out on a limited basis, namely at three Raudhatul Athfal (RA) schools in Maros Regency, including RA Al-Amin DDI Cambalagi**.** Meanwhile, online dissemination was conducted by sharing the guidebook's ebook link via social media, so that it could be accessed and used by anyone (Adoption).

Numerous prior studies have demonstrated that the use of educational game media significantly enhances early childhood cognitive and recognition skills, particularly in literacy and numeracy. Research by Syam et al., (2022) found that the implementation of letter recognition games increased early literacy skills by 23% in kindergarten students after three weeks of intervention. Similarly, Singh et al., (2021) showed that memory card games had a positive effect on number recognition abilities among early learners, with an average increase of 18% in post-test scores. Another study by Amri et al., (2021) concluded that interactive games not only improved recognition but also sustained children's attention longer compared to conventional methods. Supporting these findings, Chin et al., (2024) reported that using pictorial memory games enhanced symbol recognition and memory retention in 4–5-year-old children, as evidenced by a statistically significant improvement in test outcomes ($p < 0.05$). Moreover, Anjani et al. (2014) emphasized that integrating game-based learning into early childhood education fostered motivation and enjoyment, leading to better learning outcomes in recognizing numbers and letters.

In addition to cognitive benefits, other research also highlighted the pedagogical effectiveness and practicality of memory game media. A study by Alzubi et al., (2018) indicated that teachers perceived memory games as highly effective in facilitating recognition skills because they provided multisensory learning experiences, scoring an effectiveness rating of 92% in teacher questionnaires. Likewise, research by Liu et al., (2024) revealed that the development of memory-based educational media was categorized as very valid and practical based on expert validation results, with effectiveness scores above 90% in trials involving 20 kindergarten children. These studies align with the present findings, confirming that memory game media can significantly improve early childhood skills in recognizing letters and numbers, while also receiving positive acceptance from educators regarding its usability and effectiveness.

CONCLUSION

This study concludes that memory game media effectively enhances early childhood skills in recognizing letters and numbers, as shown by significant improvements between pre-test and post-test results among children at RA Al-Amin DDI Cambalagi. Before intervention, most children were at emerging development levels, but after using the media, many advanced to expected and very good categories, confirming its effectiveness as an engaging learning tool. The findings support cognitive and constructivist learning theories, emphasizing the importance of interactive, playful media in early childhood education. Furthermore, this research provides a practical, low-cost instructional strategy for teachers seeking to improve cognitive skills through game-based approaches. However, limitations remain, including the small sample size, single institutional setting, short study duration, and focus solely on manual (non-digital) media. Future research should explore digital adaptations of memory games, expand trials across diverse early childhood education contexts, and assess long-term impacts on broader cognitive and language skills.

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REFERENCES

Al-Tabany, T. I. B. (2017). *Mendesain Model Pembelajaran Inovatif, Progresif dan Kontekstual* (T. T. T. Trianto (ed.); 3rd ed.). KENCANA.

Alzubi, T., Fernandez, R., Flores, J., Duran, M., & Cotos, J. M. (2018). Improving the Working Memory During Early Childhood Education Through the Use of an Interactive Gesture Game-Based Learning Approach. *IEEE Access*, *6*, 53998–54009. https://doi.org/10.1109/ACCESS.2018.2870575

Amri, K., Mauliza, R., & Syarfina, S. (2021). Letter's recognition in early literacy through snakes and ladder games. *Atfaluna: Journal of Islamic Early Childhood Education*, *4*(2), 46–56. https://doi.org/10.32505/atfaluna.v4i2.3474

Anjani, D. A., & Nurjanah, S. (2014). Permainan Puzzle mempengaruhi Perkembangan Kecerdasan Visual-Spatial Anak Usia 4-5 Tahun di TK Al-Fath Desa Keboan Anom Gedangan Sidoarjo. *Jurnal Ilmiah Kesehatan*, *7*(2), 37–72. https://www.researchgate.net/publication/269107473_What_is_governance/link/548173090cf22525dcb61443/download%0Ahttp://www.econ.upf.edu/~reynal/Civil wars_12December2010.pdf%0Ahttps://think-asia.org/handle/11540/8282%0Ahttps://www.jstor.org/stable/41857625

Astuti, A. W., Drupadi, R., & Syafrudin, U. (2021). Hubungan Penggunaan Media Kartu Huruf dengan Kemampuan Membaca Permulaan Anak Usia 5-6 Tahun. *KINDERGARTEN: Journal of Islamic Early Childhood Education*, *4*(1), 73–81. https://doi.org/10.24014/kjiece.v4i1.11958

Azhima, I., Meilanie, R. S. M., & Purwanto, A. (2021). Penggunaan Media Flashcard untuk

Mengenalkan Matematika Permulaan Pada Anak Usia Dini. *Jurnal Obsesi : Jurnal Pendidikan Anak Usia Dini*, *5*(2), 2008–2016. https://doi.org/10.31004/obsesi.v5i2.1091

Bachtiar, M. Y., & Hasmawaty. (2022). *Pendidikan dan Pengasuhan Anak Usia Dini* (I. Vidyafi (ed.)). Rajagrafindo Persada.

Batarisaf, N. P. T., Amal, A., & Herman, H. (2024). Pengaruh Memory Game Menggunakan Geometrik Shapes terhadap Kemampuan Berpikir Logis pada Anak Usia 4-5 Tahun. *Journal of Education Research*, *5*(3), 2810–2818. https://doi.org/10.37985/jer.v5i3.1285

Chin, A. R., Meridor, N. A., Sincero, J. B., Sombise, M. G. D., & Siat, G. O. (2024). The Application of Interactive Games in Enhancing Kindergarten's Level of Letter Recognition. *Cognizance Journal of Multidisciplinary Studies*, *4*(12), 634–647. https://doi.org/10.47760/cognizance.2024.v04i12.058

Choiriyah, C., Widiati, D. P., & Emiliana, W. (2023). The Role of Literacy in Increasing Children's Reading Interest in Early Childhood. *Indonesian Journal of Early Childhood Education Studies*, *12*(2), 191–203. https://doi.org/10.15294/ijeces.v12i2.73749

Efrideanti, T., Vitaloka, W., & Zaki, A. (2025). *The Role of Parents in Managing Negative Emotions in Early Childhood. 5*, 124–134. https://doi.org/10.31958/jies.v5i1.14940

Fitroh Magfiroh, A., Agustin Puspitasari, R., Somadiya, W., Mahmudah, A., Yusuf Wicaksono, A., Puji Wahyono, D., & Yaumi, S. (2023). Implementasi dan Pengembangan Media Pembelajaran Game Flash Card untuk Meningkatkan Literasi dan Numerasi di SD Negeri Sumberejo. *Jurnal Ilmiah Ekonomi Dan Manajemen*, *1*(2), 113–119. https://doi.org/10.61722/jiem.v1i2.75

Herman, & Rusmayadi. (2018). Pengaruh Metode Proyek Terhadap Kemampuan Kognitif Anak Di Kelompok B2 Tk Aisyiyah Maccini Tengah. *PEMBELAJAR: Jurnal Ilmu Pendidikan, Keguruan, Dan Pembelajaran*, *2*(1), 35. https://doi.org/10.26858/pembelajar.v2i1.5430

Innes, R. M., Priyanti, N., Warmansyah, J., & Yandira, R. (2023). Crafting Dexterity : Enhancing Fine Motor Skills in 4-5-Year-Olds through the Art of Paper Folding Origami. *Indonesian Journal of Early Childhood Education Research (IJECER)*, *2*(1), 1–9. https://doi.org/10.31958/ijecer.v2i1.6757

Liu, W., Pulie, N., Tan, L., Liu, X., & Zhang, X. (2024). The Effect of Tablet App with Different Learning Content on Preschoolers' Implicit Memory Development: Numbers and Literacy. *International Journal of Human–Computer Interaction*, *40*(7), 1765–1781. https://doi.org/10.1080/10447318.2022.2154889

Maromi, C., & Pamuji, P. (2024). When a Child is Speech Delay: Causes, Diagnosis, and Intervention. *Indonesian Journal of Early Childhood Educational Research (IJECER)*, *3*(1), 61. https://doi.org/10.31958/ijecer.v3i1.12476

Nasir, N., Rahmawati, R., & Adam, A. (2019). Identifikasi Nilai Pedagogis Tarian Lulo untuk Memperkuat Rasa Persatuan pada Anak Usia Dini. *Jurnal Obsesi : Jurnal Pendidikan Anak Usia Dini*, *4*(1), 371. https://doi.org/10.31004/obsesi.v4i1.336

Nisak, F. F., Munawaroh, H., & Abbas, S. (2022). The Effect of " Kids Moderations "

Interactive Multimedia on Religious Moderation Attitudes in Early Childhood. *Indonesian Journal of Early Childhood Education Research*, *1*(1), 38–47. https://doi.org/10.31958/ijecer.v1i1.5811

Nurfahma, S. A., Saputri Imran, K., Rohayani, F., & Qadafi, M. (2024). Implementation of the Integrative Holistic Program in Early Childhood Education. *Indonesian Journal of Early Childhood Educational Research (IJECER)*, *3*(1), 23. https://doi.org/10.31958/ijecer.v3i1.12209

Oktina, H., Rini, R., & Kurniawati, A. B. (2015). Permainan Kartu untuk Meningkatkan Kemampuan Mengenal Lambang Bilangan dan Huruf Anak. *Jurnal Pendidikan Anak*, *1*(5), 1–11. http://jurnal.fkip.unila.ac.id/index.php/PAUD/article/view/10440

Panjaitan, A. I. (2023). Perancangan Aplikasi Memory Card Games Dengan Menerapkan Metode Multiplicative Random Number Generation. *Journal Global Technology Computer*, *2*(1), 24–30. https://doi.org/10.47065/jogtc.v2i1.2463

Papadakis, S., Kalogiannakis, M., & Zaranis, N. (2021). Teaching mathematics with mobile devices and the Realistic Mathematical Education (RME) approach in kindergarten Literature review. *Advances In Mobile Education Research*, *1*(1), 5–18. https://doi.org/10.25082/AMLER.2021.01.002

Parwoto. (2024). *Bermain, Belajar dan Model Pembelajaran Anak Usia Dini* (1st ed.). Deepublish.

Rahman, A., & Maskun, J. (2023). Permainan Kartu Huruf Untuk Meningkatkan Kemampuan Mengenal Huruf Pada Peserta Didik RA Nur Zahra Tomohon. *Indonesian Journal of Early Childhood Education (IJECE)*, *03*(02), 49–66. https://doi.org/10.30984/ijece.v3i2.832

Rohmah, N. A. N. (2021). Modifikasi Perilaku Tantrum Melalui Permainan dan Metode Time-Out pada Anak Usia Dini. *Early Childhood Education and Development Journal*, *3*(2), 93–101. https://doi.org/10.20961/ecedj.v3i2.50251

Rukmini, R. (2021). Bermain Kartu Flash Dan Kemampuan Kognitif Anak Usia 4-6 Tahun Di Wilayah Manukan Loka Tandes Surabaya. *Adi Husada Nursing Journal*, *6*(2), 122. https://doi.org/10.37036/ahnj.v6i2.181

Sa'adah, R. N., & Wahyu. (2022). *Metode Penelitian R&D* (A. R. Abdullah (ed.); 3rd ed.). CV Literasi Nusantara Abadi.

Salihan, B. (2019). Upaya Meningkatkan Kemampuan Mengenal Angka Melalui Media Kartu Angka Pada Kelompok a Tk Pgri 09 Kotaraja Kecamatan Sikur. *Jurnal Pendidikan Dan Dakwah*, *1*(1), 40–57. https://doi.org/10.36088/pandawa.v1i1.315

Santrock, J. W. (2017). *Psikologi Pendidikan* (2nd ed.). KENCANA.

Saputri, D. Y., & Sunardi, S. (2023). The Development of The Flows of Educational Philosophy: Theoretical Concept and Implementation in 21st-Century Learning. *DWIJA CENDEKIA: Jurnal Riset Pedagogik*, *7*(1), 19. https://doi.org/10.20961/jdc.v7i1.67804

Sari, I. P., Warmansyah, J., Yuningsih, R., Sari, M., & Yandira, R. (2023). The Effect of Realistic Mathematics Education (RME) Learning Approach on the Ability to Recognize Number Concepts in Children Aged 4-5 Years. *Journal of Islamic Education Students (JIES)*, *3*(1), 38. https://doi.org/10.31958/jies.v3i1.8654

Singh, P., Hoon, T. S., Md Nasir, A., Md Ramly, A., Md Rasid, S., & Meng, C. C. (2021). Card game as a pedagogical tool for numeracy skills development. *International Journal of Evaluation and Research in Education (IJERE)*, *10*(2), 693. https://doi.org/10.11591/ijere.v10i2.20722

Sivakumar. (2022). Effectiveness Of Memory Game On Academic Performance Of Primary School Students. *Global and Lokal Distance Education*, *8*(1), 15–23. https://www.glokalde.com/pdf/issues/21/Article2.pdf

Supriyadi. (2018). Pengaruh Media Pembelajaran Interaktif terhadap Kemampuan Mengenal Angka Pada Anak Usia Dini. *Jurnal Pendidikan Anak*, *2*(4).

Syafitri, O., Rohita, R., & Fitria, N. (2018). Peningkatan Kemampuan Mengenal Konsep Lambang Bilangan 1 – 10 Melalui Permainan Pohon Hitung pada Anak Usia 4 – 5 Tahun di BKB PAUD Harapan Bangsa. *JURNAL Al-AZHAR INDONESIA SERI HUMANIORA*, *4*(3), 193. https://doi.org/10.36722/sh.v4i3.277

Syam, N., Afiif, A., & Damayanti, E. (2022). The role of alphabet book in improving preschool children's letter recognition. *Journal of Early Childhood Care and Education*, *5*(1), 59–72. https://doi.org/10.26555/jecce.v5i1.3991

Syarfina, S., Maulidia, M., Dari, U., Hawary, D., Hendriani, E., & Maisari, S. (2024). Understanding Earth and Space Science Concepts for Children: A Learning Media "Galaxy Gift" Development. *Journal of Islamic Education Students (JIES)*, *4*(1), 186. https://doi.org/10.31958/jies.v4i1.12360

Ulum, M. S., & Ropikoh, I. (2018). Upaya Meningkatkan Daya Ingat Anak Melalui Metode One Day One Hadits Pada Anak Usia Tk (Di Madrasah Baitul Hikmah Naringgul Tegallega Bungbulang Garut). *WALADUNA: Jurnal Pendidikan Islam Anak Usia Dini*, *2*(1), 58–70. https://jurnal.iailm.ac.id/index.php/waladuna/article/view/86

Wulandani, C., Afina Putri, M., Indah Pratiwi, R., & Sulong, K. (2022). Implementing Project-Based Steam Instructional Approach in Early Childhood Education in 5.0 Industrial Revolution Era. *Indonesian Journal of Early Childhood Educational Research (IJECER)*, *1*(1), 29–37. https://doi.org/10.31958/ijecer.v1i1.5819