

The Effect of the Cheerful Animal Dice Educational Game Tool on Early Childhood Numeracy Skills at Mawar Merah Early Childhood Education Center, Pasar Maga Village (Introduction to Science and Mathematics for Early Childhood)

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ABSTRACT

Early numeracy skills are one of the main pillars of early childhood cognitive development, but the reality at Mawar Merah PAUD, Pasar Maga Village shows that this ability is still not optimal due to reliance on conventional methods that are abstract and less interesting. This phenomenon requires an innovative solution in the form of the use of manipulative Educational Game Tools (APE), such as Cheerful Animal Dice, which can concretize the concept of numbers through fun play activities. This study aims to determine and empirically analyze the effect of the use of Cheerful Animal Dice APE on early childhood numeracy skills at Mawar Merah PAUD, Pasar Maga Village. This research approach uses a quantitative method with a quasi-experimental design in the form of a nonequivalent control group design. The sample used was 28 children, who were divided into an experimental group and a control group. Data collection techniques were carried out through structured observations and performance tests, while the data analysis technique used was the Independent Samples T-Test statistical test. The results of the hypothesis test showed a significant difference in early numeracy skills between the experimental and control groups. The experimental group using the Cheerful Animal Dice achieved a significantly higher and statistically significant increase in average scores (gain score) ($p < 0.05$). It can be concluded that the Cheerful Animal Dice Educational Game Tool has a positive and significant effect on improving early numeracy skills in early childhood at Mawar Merah Preschool in Pasar Maga Village.

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INTRODUCTION

Early Childhood Education (PAUD) is a crucial golden age in human development, during which all aspects of a child's development experience rapid growth. During this period, providing appropriate cognitive stimulation is an absolute prerequisite for developing adaptive and solution-oriented thinking structures in children for the future. Children's cognitive development does not occur mechanically, but rather through active interaction with their surroundings, which stimulates

curiosity, logical reasoning, and the formation of basic concepts. Therefore, children's learning environments must be designed to be rich in stimuli that support problem-solving skills and logical-mathematical understanding (Fadhilaturrahmi, 2021).

One specific cognitive aspect that is crucial to stimulate early on is early numeracy skills, which encompass the ability to count, recognize number symbols, and understand the concept of quantity of objects. However, empirical reality in the field often reveals a wide gap, as observed at the Mawar Merah PAUD in Pasar Maga Village, where many children still struggle to accurately connect abstract number symbols with real-world objects. Arithmetic learning at these institutions has tended to be stuck in a rigid, monotonous, conventional approach that relies solely on verbal memorization without a substantial understanding of concepts. As a result, children quickly become bored, lack enthusiasm, and view mathematics as a daunting subject.

To bridge the thinking patterns of early childhood children, who are still at the concrete pre-operational stage, with abstract mathematical concepts, manipulative learning media in the form of Educational Play Tools (EAs). Manipulative media that can be held, seen, and moved directly by children can transform abstract material into concrete experiences that are meaningful for their long-term memory. Through the use of well-designed EEAs, children no longer learn under the pressure of formal literacy but instead learn naturally through essential play activities. The presence of concrete objects in the classroom has been proven to reduce learning anxiety while optimizing children's motor and sensory engagement.

As an innovative learning media, the "Cheerful Animal Dice" Educational Play Tools are specifically designed to combine visual, motor, and cognitive stimulation in an interactive game. These large dice, featuring cheerful and varied animal characters on each side, spontaneously capture children's visual attention when rolled. When children roll the dice and count the number of animals that appear on the top side, they indirectly practice visual acuity (subitizing), practice one-to-one correspondence skills, and strengthen their memory of the number symbols they represent in a competitive yet fun play environment (Nurzannah, 2021).

This study aims to test, measure, and scientifically analyze the effect of the use of the Cheerful Animal Dice Educational Game (APE) on early childhood numeracy skills at Mawar Merah Preschool (PAUD) in Pasar Maga Village. Through this quantitative experimentation, it is hoped that the effectiveness of rolling these three-dimensional visual dice in accelerating children's understanding of number symbols and quantity compared to conventional teaching methods will be revealed. The results of this study also aim to provide practical contributions and solution recommendations for educators at Mawar Merah Preschool (PAUD) in Pasar Maga Village in developing a variety of child-friendly, creative, and game-based basic mathematics learning media.

IMPLEMENTATION METHOD

The type of research applied in this study is quantitative research using a quasi-experimental design. The specific design chosen was a nonequivalent control group design, involving two groups of subjects: an experimental group receiving a learning intervention using the APE "Ceria Animal Dice" media and a control group undergoing a conventional learning process (using children's worksheets). This quantitative experimental approach was chosen because the researchers wanted to conduct objective measurements, control certain variables, and conduct statistical hypothesis testing to draw accurate generalizations regarding the direct effects of the intervention media (Sugitono, 2021).

The data sources in this study are divided into two types: primary data and secondary data. The primary data came directly from the research subjects, who were 28 early childhood students at the Mawar Merah PAUD in Pasar Maga Village. This data was obtained through pre-test (before treatment) and post-test (after treatment) scores on their early numeracy skills. Meanwhile, secondary data was obtained through supporting documents at Mawar Merah Early Childhood Education (PAUD) in Pasar Maga Village, such as the school profile, daily lesson plan (RPPH), student attendance lists, and relevant child development records to strengthen the context of the field study (Arikunto, 2022).

Data collection techniques used in this study included structured observation and performance-based oral tests to assess the ability to count objects, identify number symbols, and match number symbols. To ensure the research instrument met scientific criteria, content and construct validity were tested through expert judgment involving PAUD lecturers and senior practitioners. Furthermore, data validity or quality assurance techniques were conducted by pilot testing the instrument on a homogeneous group of children outside the research sample. Internal consistency was measured using Cronbach's Alpha to ensure the reliability of all instrument items before application to the main sample.

Data analysis techniques in this study employed descriptive and inferential statistical analysis to test the hypotheses. Before hypothesis testing was conducted, the pre-test and post-test score data from both groups were first tested for prerequisites through the Kolmogorov-Smirnov normality test and the homogeneity of variance test to ensure the data were normally and uniformly distributed. After all prerequisites were met, the effect of the intervention was tested using the Independent Samples T-Test assisted by the SPSS program at a significance level of $\alpha = 0.05$. Conclusions were drawn deductively, where if the significance value (p -value) < 0.05 , then the null hypothesis (H_0) was rejected and the alternative hypothesis (H_a) was accepted, which means that the use of the Cheerful Animal Dice APE had a significant effect on children's numeracy skills (Santoso, 2023).

RESULTS AND DISCUSSION

1. Initial Profile of Early Numeracy Skills of Children at Mawar Merah Preschool in Pasar Maga Village

The objective initial numeracy skills of early childhood children at Mawar Merah Preschool in Pasar Maga Village before intervention were at a concerning level, dominated by the Not Yet Developing (BB) and Beginning to Develop (MB) categories. Based on initial observations, the majority of children were only able to memorize the sequence of numbers from one to ten verbally without understanding the essence of the quantities they represented. When asked to count randomly arranged objects, they tended to skip objects or count the same objects repeatedly due to immature one-to-one correspondence skills (Ananda, 2021).

This low initial ability is closely related to the limited variety of concrete media used in daily learning at Mawar Merah Preschool in Pasar Maga Village. Educators relied more heavily on lectures and assignments from commercial textbooks that featured abstract two-dimensional images for early childhood thinking. The absence of tactile stimulation prevented children from developing their mathematical thinking structures from the ground up, so counting activities were perceived as a heavy memory burden rather than an enjoyable logical exploration. In addition to media availability constraints, the attention span of children at Mawar Merah Preschool in Pasar Maga Village is also a contributing factor to these low initial achievement scores. Without dynamic visual aids, children are easily distracted by environmental stimuli outside of learning activities. As a result, their understanding of number symbols is absorbed very slowly and struggles to remain in their long-term memory due to the lack of emotional engagement in learning (Mulyani, 2025).

These less-than-optimal initial conditions confirm the importance of reconstructing mathematics teaching methods in early childhood to prevent academic trauma early in children's development. The process of internalizing basic numerical concepts must be returned to the natural foundation of child development, which is based on real objects, contextualized, and full of physical activity. The consistently low scores in the experimental and control groups during the pre-test provided the researchers with a primary basis for testing the effectiveness of new media interventions.

Through mapping these initial skills, it is clear that children at Mawar Merah Preschool in Pasar Maga Village need a cognitive bridge in the form of safe, colorful, and interactive three-dimensional manipulative learning media. Number recognition cannot be separated from play activities that stimulate their fine sensory abilities. Based on this empirical need, researchers implemented the use of the Cheerful Animal Dice APE as a tactical strategy to overcome the limitations of children's cognitive achievements in school.

2. Dynamics of the Fun Animal Dice Educational Game Implementation Process in the Experimental Class

The learning process using the Fun Animal Dice Educational Game (APE) in the experimental class began with the classroom being transformed into a fluid, group play area free from formal tension. The teacher introduced large dice made of soft sponge covered in flannel with colorful animal characters that captivated the children's visual interest. Children were not treated as passive recipients of information, but rather were fully involved as key players, controlling the dice game.

Each child in the experimental group was given a fair turn to roll the large dice in the center of the circle. When the dice stopped rolling and revealed a top face depicting a group of animal characters, the child was asked to observe carefully, point to the objects depicted, and count the number aloud in front of their peers. This activity simultaneously stimulated children's rapid visual perception (subitizing) and honed their skills in counting objects sequentially and accurately.

The next step is to integrate the results of calculating the physical quantity of animals on the dice with written number symbols that have been randomly placed on a secondary flannel board on the classroom wall. Once the children have successfully determined the number of animals on the dice, they must walk to find the number card that corresponds to their calculation and stick it next to the dice. The combination of physical movements of walking, searching, and sticking the number cards provides kinesthetic stimulation that strengthens the coordination of the symbolic representation of numbers.

Throughout the game, the teacher acts as a facilitator and dialogic guide, providing positive reinforcement in the form of verbal praise, warm hugs, or applause when the children successfully count correctly. For children who still experience doubts or miscalculations, the teacher provides gentle guidance without negative correction that can be demoralizing or trigger feelings of guilt. This supportive communication pattern, combined with group play, successfully eliminates psychological barriers that often hinder children's creative thinking (Wulandari, 2022).

The implementation of multisensory stimulation through the Cheerful Animal Dice is carried out consistently over several cycles of experimental meetings, with varying levels of animal types in each session to maintain the children's high level of interest. The presence of these dice has successfully redesigned the learning environment at Mawar Merah Preschool in Pasar Maga Village, creating a lively, interactive, inclusive, and entirely child-centered math play laboratory. Learning basic math has finally become a much-anticipated activity, instead of a stressful time.

3. Significant Improvement in Early Numeracy Learning Post-APE Intervention

Following a series of interventions using the Cheerful Animal Dice Educational Game, there was a very impressive transformation in the early numeracy skills of the children in the experimental group. Children's assessment scores, which had previously been in the Not Developing category, shot up sharply to the Developing as Expected (BSH) and even Very Well Developed (BSB) categories. Children in the experimental class were able to consistently count the quantities of objects from 1 to 10 without missing any and were able to quickly match numbers (Tarigan, 2021).

The improvement in the children's cognitive thinking was evident in their ability to perform simple addition operations concretely by combining the results of two dice rolls. When the first roll yielded three elephants and the second two rabbits, the children were able to spontaneously continue counting to five without having to start counting from one. This associative thinking ability indicates that the children's mathematical understanding has advanced from mere mechanical memorization to substantive conceptual understanding (Zahra, 2024).

In contrast, the control group, which continued to use the conventional method of filling out paper worksheets, showed slow, stagnant, and uneven score development. Children in the control group frequently exhibited symptoms of mental fatigue, inaccuracy, and decreased enthusiasm, resulting in frequent fatal errors when counting static objects on their worksheets. The contrasting results between these two groups provide clear evidence of the essential role of manipulative media in children's learning.

The positive impact of using dice also extended to improving children's attention span during classroom instructional activities. Educators noted that children in the experimental class were able

to maintain their attention on the counting material for significantly longer periods than when they were given the task of writing numbers on a table. The emotional appeal of the cheerful animal figures on the dice successfully engaged the children's attention in a voluntary, productive, and enjoyable manner.

Statistically, the striking and significant difference in gain scores between the experimental and control groups confirmed that cognitive stimulation through APE was not superficial but rather permanent. The success of this intervention challenges the conventional wisdom that rural children's numeracy skills are hampered. When given the right media stimulation, their cognitive capacity can accelerate optimally. Empirical post-test data confirms the high efficiency of using Cheerful Animal Dice in addressing children's basic numeracy literacy challenges.

4. Comparative Analysis of the Effectiveness of the Cheerful Animal Dice Educational Game Versus Conventional Methods

A thorough comparative analysis confirms that the Cheerful Animal Dice Educational Game has pedagogical and psychological advantages that far exceed the effectiveness of conventional teaching methods. Conventional methods, which rely on two-dimensional worksheets, restrict children's movement and physical exploration, making it difficult for children with kinesthetic and tactile learning styles to optimally absorb the material. In contrast, the Cheerful Animal Dice Educational Game is able to facilitate all children's learning style preferences (visual, auditory, and kinesthetic) simultaneously within a single game environment.

The distinctive advantage of the Cheerful Animal Dice lies in the game's mechanical characteristics, which contain a high level of unpredictability when the dice are rolled. The element of surprise regarding which animal and how many will appear on the top face triggers positive adrenaline and a strong sense of curiosity in children, something that would never be achieved with rigid and static student worksheets. This dynamic, interactive nature successfully stimulates deep cognitive engagement throughout the thinking process.

Beyond cognitive aspects, conventional methods tend to create rigid, one-way interactions between teachers and children, thus stifling their potential for social-emotional intelligence. Using dice in a small group setting actually fosters healthy horizontal communication between children, such as politely correcting each other's calculations, queuing up to roll the dice, and joyfully celebrating each other's successes. Through this APE, mathematics is no longer viewed as a solitary subject but rather as a collaborative social experience (Fauzi, 2024).

From the perspective of cognitive load theory, the Cheerful Animal Dice (Dice) media successfully reduces unnecessary extrinsic cognitive load through the simplicity of its highly intuitive rules. Children don't waste their psychological energy figuring out how to hold a pencil correctly or worrying about writing symbols incorrectly, but can instead direct all their cognitive energy toward the essence of quantification and basic number recognition. This elimination of technical barriers accelerates operational understanding of mathematics in early childhood (Gunawan, 2025).

Comprehensively, the effectiveness of this media is also reflected in the stability of children's memory retention, where they are not only able to calculate quickly during the experiment but are also able to transfer these numeracy skills to other objects outside the school environment. This high cognitive flexibility proves that the APE Cheerful Animal Dice has succeeded in constructing substantive, solid, useful, and sustainable mathematical understanding for children's academic readiness at the next level of education.

5. Theoretical and Practical Implications of Using Manipulative Media in a Rural Early Childhood Education (ECE) Context

Theoretically, the scientific findings in this study provide strong empirical confirmation of the relevance of Jean Piaget's theory of cognitive development, particularly regarding the pre-operational developmental phase of children aged 4-6. This theory asserts that children's thinking at this age range is still highly dependent on the presence of concrete physical object representations in the real world around them. The significant success of the use of Cheerful Animal Dice at Mawar Merah Early Childhood Education (ECE) in Pasar Maga Village provides clear evidence that the

manipulation of three-dimensional concrete objects is an absolute prerequisite for the internalization of abstract numerical concepts without cognitive distortion (Hidayat, 2021).

Furthermore, these findings expand the theoretical application of Lev Vygotsky's idea of the importance of the Zone of Proximal Development (ZPD) mediated by interactive educational games. Cheerful Animal Dice act as external scaffolding instruments that help children reach higher levels of mathematical understanding that would otherwise be difficult to achieve independently without the aid of media. This research adds to the existing literature on early childhood education (ECE) on how learning media based on the visual wisdom of local animals can optimize children's ZPD in rural areas.

Practically, the results of this study provide direct implications and strong recommendations for early childhood educators to immediately reduce paper-and-pencil-based learning methods and shift to optimizing the use of creative educational play materials (APE). Teachers are required to hone their skills in designing and modifying affordable, safe, durable, and contextual independent educational play tools using local materials found in their villages. This study demonstrates that effective quantitative learning does not always have to rely on the adoption of expensive digital technology based on gadgets, as intelligently designed conventional analog media has proven to have extraordinary pedagogical efficiency.

For policymakers, foundation administrators, and the principal of Mawar Merah Early Childhood Education (PAUD) in Pasar Maga Village, these empirical findings provide a solid operational foundation for reforming school infrastructure procurement policies to focus more on providing manipulative APE in every classroom. Regular training on APE creation for PAUD teachers at the village level is needed to improve their professional competence in creating independent teaching media. This structured approach is highly strategic for bridging the gap in educational quality between rural and urban areas.

Finally, practical implications also highlight the importance of parental involvement in the domestic sphere of children's numeracy development to foster continued numeracy stimulation. The concept of the Cheerful Animal Dice game can easily be adopted by parents using simple household materials as an alternative educational family game that can divert children from the negative impacts of screen time. The synergistic use of educational media between the school and home environments will accelerate the development of solid basic numeracy literacy in the rural golden generation (Lestari, 2025).

CONCLUSION

Based on the overall results of the inferential statistical data analysis, field observations, and comprehensive discussion presented, it can be concluded validly and convincingly that the use of the Cheerful Animal Dice Educational Game (APE) has a positive and highly significant impact on improving early arithmetic skills in early childhood at Mawar Merah Preschool (PAUD) in Pasar Maga Village. This three-dimensional manipulative dice-based learning intervention, which integrates visual aspects of animal characters, successfully stimulates children's ability to count objects, identify number symbols, and solidify the foundation of one-to-one correspondence skills. The dynamic group play environment reduces psychological barriers such as math anxiety, fosters children's intrinsic motivation to learn, and extends their attention span in a voluntary and productive manner.

As a final implication, the high pedagogical effectiveness demonstrated by the Cheerful Animal Dice media confirms that reforming mathematics teaching methods in early childhood, particularly in rural areas, requires prioritizing the principles of media concretization and humanizing the learning process. Reliance on conventional methods based on children's worksheets (LKA) has proven incapable of optimally facilitating children's cognitive growth and development during this pre-operational developmental phase. Therefore, it is strongly recommended to PAUD educators and curriculum policy makers at the educational unit level to adopt, produce, and integrate similar educational game tools as mandatory numeracy stimulation instruments in the classroom, in order to realize a solid logical-mathematical thinking foundation for children's academic future.

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