

Analysis of the Role of Educational Games Ball Relay Puzzles in Improving the Cognitive Abilities of Early Childhood Children

Ilham Marito Setiaji¹, Amin Yusuf²

Corresponding author, email: maritoilham@students.unnes.ac.id

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Abstract

Background – Study early childhood education plays a crucial role in shaping children’s future development, as early childhood is considered a *golden period* for cognitive growth. Learning at this stage must be designed to actively stimulate children’s thinking abilities through meaningful and enjoyable experiences. One effective approach is play-based learning using educational toys that integrate learning and play.

Focus Study - This study focuses on describing the role of educational toys, specifically ball relay puzzle games, in developing the cognitive abilities of early childhood learners at Alam Jungle School Kindergarten.

Research Urgency - Cognitive development is a fundamental foundation for children’s future learning. However, early childhood learning practices often remain limited to conventional methods that reduce children’s active engagement. Therefore, this study is important to highlight educational toys as an alternative strategy to optimize cognitive development through play-based learning.

Research Objectives - This study aims to describe the implementation of ball relay puzzle games, their role in supporting children’s cognitive development, and the supporting and inhibiting factors in the learning process.

Research Method - This research employed a descriptive qualitative approach. Data were collected through interviews, observations, and documentation. Data validity was ensured through technique and source triangulation, while data analysis followed the Miles and Huberman model: data reduction, data presentation, and conclusion drawing.

Research Findings - The findings show that ball relay puzzle games effectively support children’s cognitive development, particularly in problem-solving, logical thinking, and concentration. Learning becomes more engaging and interactive. However, challenges include limited availability of educational tools and varying levels of children’s enthusiasm.

Conclusion - Educational ball relay puzzle games play an important role in enhancing learning effectiveness and cognitive development in early childhood.

Research Novelty/Contribution - This study contributes practical insights into the implementation of play-based learning using educational toys and highlights real classroom challenges that can inform early childhood education practices.

Keywords: games ball, early childhood, educational toys

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INTRODUCTION

Education is one of the most decisive factors in building a better future for the nation (Waluyo E, 2024). Early childhood education is essentially an effort and action undertaken by educators and parents regarding the process of care, nurturing, and education by creating an environment where children can freely explore themselves through experiences gained to discover and understand learning obtained from the environment through a process of observing, imitating, and experimenting that takes place repeatedly and involves all of the child's potential and intelligence (Fitriana, 2022).

Early childhood is a crucial period; therefore, stimulation is necessary, one of which is through education. However, a phenomenon that is still often encountered is that students quickly become bored and lack enthusiasm during learning. The causes include children not being actively involved, not being given freedom to learn, and learning media that is not diverse enough (Ratna et al., 2023). Early childhood is significant as a unique period in which patterns of growth and development in cognitive, social-emotional, creative, and linguistic aspects develop specifically in accordance with each stage of development (Widayati et al., 2020). Every human being, from childhood to adulthood, always has a desire to play, even though the games played at each age level differ. Every parent can guide their children to fulfil their developmental needs during childhood through playing activities. The problem faced by playgroups today is the need for educators to create learning opportunities that stimulate students' cognitive, psychomotor, and affective abilities for their daily activities at home and at school (Loretha et al., 2023).

Play is considered an important aspect of Early Childhood Education. However, the relationship between play and learning is often underestimated in both research and practice (Pramling Samuelsson & Björklund, 2023). According to Moeslichatoen, 'children learn by playing while learning.' However, in the learning process, it is necessary to pay attention to the conducive environment, the children's activity, and the presentation of interesting and informative material so that children can learn and practice in a pleasant atmosphere without losing sight of the learning objectives and so that children can develop their various potentials optimally (Shunhaji & Fadiyah, 2020). Play is a medium that can help children express their inner world, fears, anxieties, desires, fantasies and dreams (Pérez Carmuega & Álvarez Martínez, 2025). Play encourages exploration of the world and problem solving. In addition, play facilitates children to develop executive functions naturally and enjoyably (Rodríguez-Ferrer et al., 2023).

Educational toys are toys that can optimize a child's development. Educational toys are tailored to the child's age and developmental level, with the aim of promoting physical, linguistic, cognitive and social development (Urnia, 2020). Educational toys can unknowingly develop children's cognitive abilities, for example through puzzle games, building blocks, alphabet wheels, and so on. This is because in these games, children use their minds to solve problems in order to achieve developmental tasks in early childhood (Fitriana, 2019).

Cognitive development is the internal process of the nervous system when thinking. These cognitive abilities develop gradually in line with physical and neurological development (Baharun & Saleha, 2021). Educational toys greatly assist in the growth and physical development of children, as well as all aspects of their development, such as moral and religious, linguistic, cognitive, and socio emotional. Educational toys can encourage quality play activities that are useful for bringing out children's talents. Educators must have the knowledge to determine the appropriate

educational toys according to the age and development of children, so that the function of these educational toys can be in line with their purpose in terms of child development. Early childhood education aims to nurture and develop the full potential of children optimally, so that they form behaviors and basic skills that are harmonious, coherent, and balanced through their developmental stages, thereby preparing them to enter further education (Trisnawati et al., 2021).

Alam Jungle School Playgroup is one of the playgroups located in Sekaran, Gunung Pati District, Semarang City. Based on the latest data obtained, there are two teachers at Alam Jungle School Kindergarten, which has four classrooms and outdoor play facilities. Alam Jungle School has a variety of educational toys, but over time, many of these toys have been damaged or lost. The educational ball relay puzzle game is a durable educational toy because it uses PowerPoint. The educational game to be learned is the ball relay puzzle game. This educational game works by passing the ball from one student to another while singing, and when the teacher says 'stop', the last student holding the ball is asked to answer questions presented through interactive PowerPoint, where examples of questions include answering the number of fruits in the picture and imitating animal sounds. This educational game tool is beneficial for the development of gross and fine motor skills in childhood.

The study Astuti et al. (2024) entitled Analysis of Educational Games in Supporting Development focuses on the role of games in developing children's cognitive abilities and formulating optimal implementation strategies. However, this study specifically analyses ball relay puzzle games that combine physical activity (relay) with cognitive problem solving through digital media (PowerPoint), a combination that has rarely been studied in the context of Nature-Based Early Childhood Education.

METHODS

The research approach applied is the qualitative research method. This research includes data collection, data recording, data analysis, and detailed reporting. Qualitative research is research that understands behavior, motivation and actions comprehensively presented in words using scientific methods. This qualitative research was conducted continuously at the research site, recording events and observing behavior and incidents as data to be collected and later analyzed for the preparation of a detailed report. Qualitative research is a research method conducted by obtaining data directly, interpreting and analyzing it, with the aim of providing peace of mind regarding various problems experienced (Sugiyono, 2020). This research will use qualitative methods to obtain in-depth information about the role of educational ball relay puzzle games in improving the cognitive abilities of early childhood at Alam Jungle School Kindergarten.

The data sources in this study used two types of data sources, namely primary and secondary data. Primary data was obtained from key informants and supporting informants. The key informants were the headmaster and one educator at KB Alam Jungle School. The supporting informants were representatives of parents of students at KB Alam Jungle School. The criteria for selection were that this one educator dealt directly with students at the kindergarten level, and that there was only one representative parent who could be used as a source. The secondary data sources in this study were obtained directly from documents, scientific publications, and various books.

Data collection was conducted through direct observation, interviews with informants, and direct documentation of the learning process at KB Alam Jungle School for one month, with the

main points of research being the role of learning using educational toys in developing the cognitive abilities of children at KB Alam Jungle School. Data analysis used in this study includes data collection, data reduction, data presentation, and conclusion drawing (Miles & Huberman, 2014). Data was collected through observation, interviews, and documentation. Once the data was collected, it was summarized by selecting important topics and focusing on the research objectives.

The results of data reduction were then presented descriptively. In this study, technique and source triangulation were used to test the validity of the data. Technique triangulation aims to test data by comparing interview data from different sources. Meanwhile, source triangulation aims to test data by checking data obtained from various data sources such as observation, interviews, and activity documentation

RESULTS AND DISCUSSION

Alam Jungle School kindergarten is one of the playgroups located in Sekaran, Gunung Pati District, Semarang City. Based on the latest data obtained, there are two teaching staff members at the Alam Jungle School Kindergarten has four classrooms and outdoor play facilities. Learning media not only has benefits in the learning process but also serves as a means of game-based learning that creates a fun and engaging learning environment. Games, in the context of learning, are transformative teaching tools that can improve language and speaking skills, strategic skills, and logical skills in various educational settings (Raj et al., 2022).

Based on the results of research conducted at Alam Jungle School Kindergarten through observation, interviews, and documentation. The interview stage involved the head of the kindergarten, educators, and parents, while the observation stage involved observing the learning process. Based on interviews with parents, they said, "In my opinion, the educational games taught by educators at Alam Jungle School Kindergarten are appropriate for my child's age, so my child's cognitive development is maximized." This study focused on the use of educational relay ball puzzles to improve the cognitive abilities of children at Alam Jungle School Kindergarten.

This study aims to describe the role of educational relay ball puzzle games in improving the cognitive abilities of early childhood students at Alam Jungle School through the stages of planning, process, role, type, as well as supporting and inhibiting factors of learning through educational games. Based on observations and interviews regarding learning using educational toys, children are much more enthusiastic about learning because of their curiosity, but there are also children who get bored quickly. As stated by the head of the kindergarten, "With educational toys such as relay ball puzzles, children are curious and enthusiastic, but again, children will inevitably want to play on their own." Therefore, educators need to redesign or update educational games, especially educational relay ball puzzles, so that children do not get bored and their cognitive development improves significantly.

Learning Planning

Learning planning is an important part of the learning process, and includes understanding the objectives, functions, and models of learning. Learning planning can be defined as the preparation of a process using approaches, learning methods, techniques and tactics to achieve learning that is in line with the objectives or expectations (Afifah & Shofwan, 2023). Learning planning also involves learning outcome assessment, which can measure students' ability to apply the learning they have

acquired. Learning outcome assessment is designed to ensure alignment between educational objectives and learning needs (Shofwan et al., 2021).

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The implementation of learning with lesson planning can adjust the learning concepts to be implemented so that the learning objectives will be in line with the desired outcomes. Teaching methods are the ways used by educators to deliver learning to students in order to achieve planned learning objectives (Yusuf F et al., 2025). Learning media through games or gamification is not only used as a medium for basic education but can also be used in secondary and higher education, by adjusting it to the learning material needs that will be used and applied (Saputra et al., 2024).

The results of this study indicate that lesson planning at Alam Jungle School Kindergarten is well organized, with educational games tailored to the developmental stages of the children, enabling their cognitive abilities to develop as expected. Based on interviews with the head and educators of the kindergarten, lesson planning using educational toys has been planned in accordance with predetermined themes and the children's ages, so that their cognitive development will be in line with their developmental stages.

Most educators have used learning media in various forms. At the higher education level, around 60% of lecturers stated that learning media can improve learning efficiency (Rizal et al., 2020). Educators must also be able to master the learning material to be delivered, especially material on game-based learning that uses educational games. Game-based learning allows children to be directly involved in the learning process, combining challenges and fun, so that information is presented in an engaging way (Liu et al., 2020).

Learning Process

The implementation of learning is a continuation of learning planning that has been designed in a structured and systematic manner to achieve the desired learning objectives. Through structured learning implementation, educators facilitate learners in mastering knowledge, skills, and attitudes with educational objectives (Babussalam et al., 2025). The results of this study indicate that before teaching using educational games, educators will check and prepare the educational games to be used so that there are no obstacles during use, and the learning process will run smoothly.

Based on interviews conducted with the head of Alam Jungle School Kindergarten, it was explained that in the process of implementing educational games, particularly the Ball Relay Puzzle, educators will usually prepare and ensure beforehand whether the game is truly ready for use during the lesson. When it is time for the lesson to begin, prayers are usually said first, followed by physical motor activities such as gymnastics. Next, the educator will immediately explain and demonstrate the lesson using the educational game tools that will be used. Interviews with parents also revealed that they feel that learning using educational game tools is very helpful in developing their children's abilities, because they find it very interesting.

The learning process uses an educational ball relay puzzle game by preparing an interactive PowerPoint presentation filled with questions about types of animals, fruits and numbers. The application of interactive strategies will provide a deep understanding and an active role in learning (Musyafak & Subhi, 2023). To play this ball relay puzzle game, form a large circle and have the children sing a song while passing the ball around, which has been prepared by the teacher. When the teacher asks them to stop singing, the child who is holding the ball will have the opportunity to answer the questions on the PowerPoint presentation. Learning with this educational game can develop children's gross motor skills when passing the ball and their cognitive abilities when answering questions on the PowerPoint presentation.

Based on the results of this study, the learning process at Alam Jungle School Kindergarten also includes outdoor learning, where lessons are held in houses built in the children's play area. This learning concept is based on learning from nature, and the learning process is carried out in groups, with each house having its own group name. This learning aims to introduce children to nature and to train cooperation among students in group learning. This learning outside the classroom also aims to prevent children from becoming bored due to learning in the classroom too often.

The Role of Educational toys

Educational toys stimulate children to explore and experiment with the world around them to build their own knowledge (Mukhtar, 2020). The results of this study indicate that by learning using educational toys, children are much more enthusiastic about learning because of their curiosity, but there are also children who get bored quickly. In interviews with kindergarten principals and educators, it was explained that before carrying out learning activities, educators need to understand the concepts of the learning that will be carried out so that when teaching children, the material can be conveyed easily and clearly, thereby ensuring that children's cognitive development progresses as expected.

Based on research conducted by Midred Parten on the play activities of children aged 2-5 years in terms of their social behavior, six categories of play were identified, namely: a.) Unoccupied play, where children observe and look at things that attract their attention and make free movements in the form of uncontrolled behavior, b.) Solitary Play, in which a group of children play alone with various toys, so there is no communication or interaction between them; c.) Onlooker Play, in which children watch and observe other children playing, talk to others and ask questions; d.) Parallel Play, in which children play with the same toys but do not communicate with each other; e.) Associative play, children play together and borrow games from each other, but the games do not have a common goal, there is no division of roles or sharing of play equipment, f.) Cooperative play, children play in an organized group, with constructive activities and create something real where each child has their own role (Khobir, 2021).

Through play, all of a child's senses are actively engaged. All information is captured by the child's senses and transmitted to the brain as stimuli, causing brain cells to become active and develop. Therefore, children's play activities need to be facilitated by parents or educators at school to support children in becoming active and creative (Wahyunita et al., 2025). In learning using educational games such as ball relay puzzles, several cognitive developments in children can be observed, such as logic, understanding of material, problem solving, and attention to the learning process. Thus, the role of learning with educational games at kindergarten age is very important for developing the cognitive abilities of early childhood.

Types of Educational Toys

Both digital and more traditional games, such as board games or word games, offer opportunities to learn through experience, helping children explore various scenarios, make decisions, and observe the consequences of their actions in a safe and controlled environment (Patil et al., 2024). There are two types of educational toys: traditional toys and modern toys. Traditional toys are children's toys made from simple materials that reflect cultural aspects of community life. Traditional toys also encourage teamwork, thereby teaching children to socialize and communicate with their environment (Hasanah, 2020).

One type of traditional educational toy is stacking blocks and *dakon* or *congklak*. Traditional toys such as *congklak* can stimulate several aspects of child development, such as motor skills, cognitive skills, social-emotional skills, and sportsmanship. Meanwhile, modern toys include video games and computers. These games are very interesting educational games, and children can easily operate them by simply pressing the buttons in the game. However, modern games tend to result in children having less socialization with their environment. Modern educational toys will be more effective if the games are accompanied by educators. Based on interviews with the head and educators of Alam Jungle School Kindergarten, it was explained that Alam Jungle School Kindergarten has many types of educational toys, but after use, many are damaged or lost, such as small wooden blocks. However, the educational toy 'Teka-teki Estafet Bola' (Ball Relay Puzzle) is durable because it uses interactive PowerPoint, so it can be used for learning in the following year.

Criteria for Educational Toys

The use of educational toys in early childhood education has evolved over time, driven by advances in technology, educational research, and changes in pedagogical approaches (Alotaibi, 2024). Criteria for selecting educational toys for learning at Alam Jungle School Kindergarten by determining educational toys that are appropriate for the child's developmental stage and age. Based on the results of an interview with the head of Alam Jungle School Kindergarten, he explained that in choosing the right educational toys, we consult with educators to group them according to the child's developmental age, so that we can choose educational toys that are suitable for children. The interview with one of the educators at Alam Jungle School Kindergarten also explained that the criterion for selecting the right educational toys is to adjust them to the age of early childhood, so that children's cognitive development can be maximized.

The criteria for selecting educational toys used in learning at Alam Jungle School Kindergarten have been planned in advance with the head of kindergarten and other educators, so that they can determine educational toys that are appropriate for the cognitive development stage of the child and appropriate for the child's age. The results of an interview with one of the parents regarding the suitability of the educational toys taught at Alam Jungle School Kindergarten explained that the educational toys taught by educators at Alam Jungle School Kindergarten are appropriate for my child's age, allowing for maximum cognitive development.

Supporting Factors

Supporting factors include infrastructure and teacher competence (Ansori et al., 2025). The results of this study indicate that the factors supporting the smooth running of learning using educational games are the availability of good educational games and the enthusiasm of children in participating in the learning process. Alam Jungle School Kindergarten has a variety of educational

games that serve to develop children's cognitive abilities in accordance with their age levels. Based on interviews with the head of Alam Jungle School Kindergarten, the supporting factors include the knowledge and experience of educators in teaching, the suitability of media and space for learning, and the activeness of students in the learning process. The results of interviews with educators at Alam Jungle School Kindergarten also explained that the supporting factors for learning using Educational Toys are the availability and suitability of learning media and the enthusiasm of students in receiving learning.

Inhibiting Factors

Students today are more exposed to various distractions from digital media that can reduce their focus and concentration in learning. In addition, the lack of variety in learning methods and limited educational facilities are also significant obstacles (Mesra et al., 2024). Barriers to learning using educational toys include the availability of educational toys and children's participation or enthusiasm in learning, such as children being busy playing on their own and feeling bored. Therefore, innovation or renewal of educational toys is necessary. Based on interviews with the headmaster and educators at Alam Jungle School Kindergarten, the inhibiting factors include a lack of enthusiasm among children in participating in learning, such as boredom or playing alone, as well as the availability of educational toys.

The way to overcome these obstacles is to pay special attention to children who are not focused on learning and to encourage them, as well as to replace educational toys that are broken or worn out so that children do not get bored easily. The results of an interview with the head of Alam Jungle School regarding how to overcome these obstacles revealed that educators overcome obstacles such as children being preoccupied with playing by diverting their attention from a game so that they can be conducive to learning and follow the lessons being taught. The results of an interview with educators at Alam Jungle School also explained that the way to overcome this is by interspersing.

CONCLUSION

This study successfully describes the role of the educational game Ball Relay Puzzles in developing the cognitive abilities of early childhood students at KB Alam Jungle School, including lesson planning, the learning process, the role of educational games, and supporting and inhibiting factors in the learning process. This educational game has been proven to play an important role in the effectiveness of learning and is capable of developing the cognitive abilities of children at KB Alam Jungle School. Based on interviews and observations, it can be concluded that children at KB Alam Jungle School are able to learn the educational games provided by educators. This shows that the learning process at KB Alam Jungle School is successful, thereby facilitating children's memory development. Educators at KB Alam Jungle need to overcome obstacles in learning using educational games by developing or updating and innovating types of educational games, one of which is the ball relay puzzle educational game, so that children do not get bored with the same questions or displays, thereby enabling their cognitive abilities to develop more effectively.

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