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Strategy for Introducing Basic Mathematics Based on Jumping Geometry Game for Early Childhood

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Abstract
Learning to read, write, and count becomes very difficult if the concepts have not been mastered. Mathematical skills in understanding basic mathematical concepts can be trained first in recognizing geometric shapes before recognizing number symbols. This can be done through geometry lombat games that are played directly by the child. The purpose of this study is that educators can use innovative strategies in the introduction of basic math for children, which can be done through games that are fun and meaningful for children. The research method used descriptive qualitative with 8 subjects conducted at Pertiwi Nglebak Ngawi Kindergarten. The research technique used observation, interview and documentation techniques. The findings of this study indicate a new innovation in recognizing geometric shapes through various shapes with different colors, with the implementation of fun games through activities of jumping over geometric shapes that have been determined by educators. These activities can be used as an initial strategy in introducing geometry to 4-5 year old children who have just entered kindergarten.
Keywords: Basic Math, Jumping Geometry Game, Early Childhood

Introduction
The introduction of mathematical concepts is important to introduce to children from an early age to prepare the golden generation of 2045 in accordance with the vision and mission of the Indonesian state. Mathematics is introduced with scary learning at every level of education, this also applies at the preschool level. Children's basic math skills begin with the introduction of geometric shapes in mathematical concepts. This ability can be done through geometry jumping games that are applied to children. Early childhood is unique with abilities that vary from one anotherhus. The abilities that children must master according to their development consist of six aspects, one of which is the cognitive aspect (Mallawaarachchi et al. 2024).

Early childhood cognitive development is a gradual process related to a child's ability to think, understand, remember, solve problems, and make decisions from birth to around six years of age (Prime et al. 2023). During this period, children are in the early stages of rapid brain development, so learning experiences, social interactions, and environmental stimulation have a huge impact on the formation of their cognitive structures. Cognitive development encompasses how children process the information they receive, how they connect one experience to another, and how they construct basic concepts about the world around them (Rakesh et al. 2024). Thus, cognitive development is not only related to academic abilities such

as counting or recognizing letters, but also involves a wider range of mental processes such as attention, memory, reasoning, creativity, and problem-solving skills.

Cognitive development in early childhood includes the introduction of basic math concepts that are taught in accordance with the characteristics of child development (Maharani and Watini 2022), mathematics is taught in a concrete, active, fun and contextual way. The Minister of Education and Culture in the education policy evaluation coordination meeting delivered by Abdul Mu'ti emphasized that mathematics at the kindergarten level does not contain complicated counting material because it will emphasize the principle of playing while learning. It was emphasized that in early childhood education the introduction of mathematics is carried out in fun ways without any high achievements because children's understanding will be strengthened when they enter elementary school.

Based on observations found at Pertiwi Nglebak Ngawi Kindergarten, in stimulating basic math skills in children is carried out as in the elementary school level. Educators use old methods with classical classes through writing on the board numbers from 1 to 5 then children are told to copy them in the notebook. In addition, educators still often use magazine books for children when teaching. These methods make children lazy to learn and think that learning math is a difficult thing to do and understand.

Educators who are still guided by it will be left behind in the development of learning that is more innovative and interesting for children. In accordance with the curriculum which is a reference for educators that early childhood education is implemented through meaningful play activities that are beneficial and fun for children (Ngaisah and Aulia 2023). So that children's basic math skills do not directly practice writing numbers but rather understand concepts and geometric shapes. Shape recognition can be done through fun play activities such as geometry jumping games that educators innovate as a learning medium in stimulating children to recognize basic math.

Previous research presented by Safira and Maini Sitepu (2025) in the application of geometry concepts in developing mathematical intelligence in early childhood is done through the introduction of geometric shapes by means of educators explaining and mentioning the types of names, concepts and geometric shapes then children repeat backhi. In addition, children are also trained in classifying geometric shapes by showing concrete objects around. And after understanding the concept of geometry, children are trained to characterize geometry with several examples such as mentioning the characteristics of triangles and squares. The introduction of geometric shapes is not implemented by writing or drawing shapes, but children see geometric shapes directly through objects or images and are implemented directly with objects around them. Harris (2023) explains that basic mathematical skills greatly influence a child's intellectual potential, which has a long-term impact.

Nita Rahmawati et al strengthened her explanation that in occupying early childhood in introducing basic math skills can use interesting media (Rahmawati, Zaenullloh, and Fauzi 2025). With media that every child plays becomes a real experience for children so that children will easily remember and understand it. Media and games in the form of geometry become

interactive and enjoyable media so as to support the holistic development of children and be able to prepare them to achieve academic success at every level (Demir 2022).

Based on previous research findings and issues related to learning strategies that are still conventional and not yet innovative, the researcher was interested in conducting research entitled, "Strategy for Introducing Basic Mathematics Based on Jumping Geometry Game for Early Childhood." The purpose of this study was to introduce children to basic mathematics in recognizing geometric shapes through the implications of geometric jumping games that stimulate children to move actively. This also encourages educators to develop new innovations in creating learning media that are interesting and enjoyable for children through meaningful play activities that are in line with the characteristics and curriculum applicable in early childhood education units. Basic mathematical skills are very important for children's daily lives because mathematical abilities have the potential to influence children's intelligence in the long term, so they must be introduced early so that children can understand mathematical concepts fully in accordance with their age development.

Literature Review

Cognitive development in early childhood is the main foundation for their ability to understand basic mathematical concepts. Between the ages of 0 and 6, children's thinking capacity develops gradually through sensory-motor processes, early mental representation, and the ability to construct simple symbolic understanding (Mix 2019). Mathematics at this stage is not understood as formal calculation, but as early logical abilities that are formed through play, observation, social interaction, and exploration of the environment. Cognitive development theories provide a strong basis for explaining how young children construct ideas of numbers, patterns, geometry, measurement, and spatial relationships.

The basic concept of mathematics in PAUD is that children understand several things such as numbers, algebra, classification, comparison, arrangement, patterns, geometry, measurement, analysis and probability (James-Brabham et al. 2025). The importance of children's cognitive development in basic or beginning mathematics, one of which is the branch of geometry (Schenck and Nathan 2024). Geometry is a branch of mathematics that deals with shape, size, relative position of figures, and the nature of space (Lewis Presser, Braham, and Vidiksis 2025). The introduction of geometric shapes for children includes triangles, squares and circles. Within this scope there are several aspects including the concept of shape, color and size.

One of the most influential theories in understanding mathematical cognitive development is Jean Piaget's constructivist theory. Peaget explained that early childhood is in the preoperational stage (Kusuma, Sukmono, and Tanto 2022), which is characterized by understanding concepts through real activities or concrete experiences compared to verbal instructions or abstract symbols. This implies that the introduction of basic mathematics is done through real and contextual activities through play activities that are fun and meaningful for

children. Play is one form of concrete learning experience that is effectively implemented in PAUD (Husaini et al. 2025).

The geometry jumping game is very relevant to the learning principles in the curriculum and national standards of PAUD which emphasize the importance of fun, participatory, and holistic learning. This proves that the strategy of using geometry jumping games as an introduction to basic math is an innovative solution that suits the needs and characteristics of early childhood. This is evidenced by previous studies that examined game-based mathematics learning strategies as explained in the table.

Table 1. Game-based learning strategies

No.	Research Title	Method	Year	Findings
1.	Implementation The Concept of Geometry in Developing Mathematical Logic in Melati Kindergarten, West Pasaman Regency in 2018 (Citrawati 2019)	Study This use studies descriptive with approach qualitative, namely study studies case	2018	Implementation draft geometry can develop intelligence logic mathematics child age early, weakness from study This that learning Not yet implemented through game that is only with method memorize forms geometry. The advantages is theory in study previously. The same with research conducted by the author careful.
2	Effectiveness Use of Geometry Puzzle Educational Tools in Improving Cognitive Age 5-6 Years in Asma Nadia Kindergarten (Rahmawati et al. 2025)	Approach qualitative with method studies case	2025	Study This describe How tool props educational, especially geometry puzzles, can increase development cognitive child age early in Asma Nadia Kindergarten. Weaknesses study previously that puzzle game already often used in develop cognitive child so that child need innovation game new that makes child can move active with fun game.
3	Efforts to Improve Ability Know Geometry Shapes Through Play Geometry Jump In Children Group B Diponegoro Kindergarten 109	Classroom Action Research (CAR) Techniques	2022	Ability child know form geometry through game jump geometry. In precycle ability child know form geometry only 20%, on cycle I ability child know form geometry increase to 50 % and on cycle II ability children get to

Pageraji (Komariyah 2023)	know form geometry increase to 85 %.

Methods

This study uses qualitative research by describing the strategies applied by educators in introducing basic mathematics through geometric jumping games to children aged 4-5 years. This study was conducted at Pertiwi Nglebak Ngawi Kindergarten with 8 subjects. Subject selection was carried out using purposive sampling, which is a technique for determining subjects based on research objectives (purposive). The subjects consisted of eight 4-5 year old children who were students in a class that used geometric jumping games as a medium for early mathematics learning. The criteria for selecting subjects included: (1) children aged 4-5 years in accordance with early childhood development standards; (2) children actively involved in motor and cognitive learning activities; and (3) children who participated in learning activities on a regular basis to facilitate the continuous observation process. In addition to the children, the classroom teacher was also used as a key informant because of their in-depth understanding of teaching strategies and the daily development of children (Sugiyono 2017).

Observations were first made to find out the problems in the field related to the basic math skills of children aged 4-5 years. Then interviews were conducted with the class teacher to obtain more in-depth data and continued with documentation. After that, qualitative data analysis techniques developed by Miller and Huberman were carried out in data reduction. Presentation of reduced data is organized according to information and made into conclusions by going through the data analysis process (Sugiyono 2011). In qualitative research, data analysis is an important part that takes place continuously from the beginning of data collection to the end of the research. This study uses the Miles and Huberman data analysis model, which includes three stages: data reduction, data presentation, and verification or conclusion drawing. In the data reduction stage, researchers select and focus on raw data from observations, interviews, and documentation. Data that is not relevant to the focus of basic mathematics recognition through geometric jumping games is eliminated, while relevant data is coded thematically. Examples include notes on children's motor responses, children's understanding of geometric shapes, or teachers' strategies in giving game instructions.

The next stage is data presentation, which involves organizing the reduced data into narratives, tables, flowcharts, or thematic matrices to make it easier for researchers to understand the relationships between data. This presentation of data allows researchers to see patterns in children's behavior, the effectiveness of the game stages, and the influence of teacher instructions on the understanding of geometric concepts. For example, researchers can present findings on how children recognize triangles, circles, and squares through jumping activities on certain patterns. The final stage is verification or drawing conclusions. At this stage, researchers interpret the data that has been presented and draw conclusions related to basic mathematics recognition strategies. Conclusions are preliminary at first, but become more solid after being retested with additional data or through a process of discussion and triangulation.

This study applied source triangulation and technique triangulation. Source triangulation was conducted by comparing information from children, teachers, and learning documents. Meanwhile, technique triangulation was conducted by comparing the results of observations, interviews, and documentation. In addition, the researcher conducted member checks with classroom teachers to ensure that the interpretation of data did not deviate from the actual conditions in the field. This technique helps to improve the credibility and accuracy of the findings.

Result/Findings

The results of research conducted at Pertiwi Nglebak Kindergarten for children aged 4-5 years in the introduction of basic math through geometry jumping show that children contribute to following activities from start to finish with fun. Educators stated that the strategy of using geometry jumping games really helped students in recognizing basic math concepts. The introduction of basic mathematics begins with three stages, namely the introduction stage, the analysis stage and the sequencing stage.

Tabel 2. Results of Observation and Interviews in Introducing Basic Mathematics to 4–5 Year Old Children at Pertiwi Nglebak Kindergarten

No.	Stage Activity	Educator Strategy	Observation Results	Findings Interview
1.	Introduction	Preparing the build media flat from paper fold shaped square, triangle, circle, and rectangle long with color different	The child shows interest to colors and shapes, paying attention to media, naming colors and shapes in a way spontaneous	Educator state that use color and shape concrete make it easier child recognize differences and similarities get up geometry
		Building a structure geometry in several lines with order random	Children observe pattern, ask about difference arrangement, and try remember order form	Educator evaluate that arrangement random practice Power remember and concentrate child
2	Stage Analysis	Give example method play jump geometry	Children imitate movement educators, trying understand rule game	Educator convey that giving examples are very important for children No

				confused and feeling believe self
		Give instructions oral about the form that must be jumped over	Children listen instructions, matching form with command, then jump to build accordingly	Educator state that instructions oral practice understanding Language at a time draft mathematics
		Give chance child repeat If do error	The child does not show fear failed, still enthusiastic For try return	Educator emphasize that repetition make child more fast understand draft without pressure
3	Stage Sequencing	Request child finish game to the last line	Children are able jump in a way sequentially from the first line until end	Educator state that child seen the more skilled after played several times
		Direct child grouping and connecting get up geometry based on color	Children can pointing and naming wake up that has color The same	Educator evaluate that activity This strengthen ability classification
		Conditioning the game to take place orderly and pleasant	Children are able wait turn, follow rules, and work The same	Educator convey that game help manage class with more conducive

Based on the results of interviews and observations, educators use geometry jumping activity strategies to stimulate basic math skills in early childhood. The strategies given are as follows:

First, educators prepare folding paper media that are cut out according to geometric shapes, namely squares, triangles, circles, and rectangles. Then each shape has a different color with the aim that students easily memorize it. Like a red square, green triangle, yellow circle, and blue rectangle. Each row consists of 4 different shapes and colors and is followed by the next row which is randomized each geometry shape of each row but not with the same shape. Second, after the media preparation and learning environment are ready. Learners queue to play the geometry jumping game by way of educators modeling first. After that, students who have queued up to play geometry jumping are followed. Educators give instructions on various geometric shapes and learners jump to the appropriate shape according to the educator's

instructions. If the learners are wrong in jumping and not according to the educator's instructions then the game is considered lost, and if the learners can complete until the final row then considered successful and win. The game is given as a strategy in learning the introduction of geometry so if learners fail then it will take turns again or given the opportunity to repeat it until it succeeds in the last row.

Third, the success of students in following the geometry lombat game is also marked by students who are able to sort geometric shapes and connect geometric shapes based on the color that educators have determined. In addition, students can also follow the instructions of educators well and the game can be done in an orderly and fun way. The strategy used in the introduction of basic mathematics in the form of geometry is done by recognizing geometric shapes and various colors that make it easier for students to remember. Of the three stages above is an important process to be given the right stimulation so that the learning ability of students in recognizing geometric shapes and can develop optimally in accordance with the stages of development.

Discussion

Educators in implementing learning activities are required to have high creativity and innovation to achieve success in the teaching and learning process (Fauziah and Sahlani 2023). Teaching in PAUD tends to be done with fun media and concepts so that children are interested in following it(Ilma and Pudjawan 2021). Learning that is fun and meaningful for children is learning through play. This makes educators create games that can educate and stimulate children's development.

The geometry jumping game is also one of the ideas of educators in introducing children's basic math concepts in recognizing geometric shapes in the surrounding environment. Learning geometric shapes becomes the initial foundation for children to interpret, classify, and represent various objects in the daily environment (Rahmawati et al. 2025). The application of basic mathematics skills in the introduction of geometric shapes based on indicators is divided into three stages, namely the introduction stage, the analysis stage and the sequencing stage where children are able to recognize or understand geometric shapes and can connect geometric shapes (Rahmawati, Widayati, and Widayanti 2023).

This is reinforced by the findings (Citrawati 2019) This is reinforced by the findings (Citrawati 2019) that the application of geometry concepts in developing early childhood mathematical logic is carried out through three stages, namely: First, the introduction of geometric shapes is done through shapes in the surrounding environment. Geometric shapes consist of a square, triangle, circle and rectangle. Geometric shapes are implemented with objects around such as circles like balls, rectangles like cabinets, triangles like the roof of the house and squares like books. With that, the introduction of geometric shapes is needed from an early age to introduce children to the shapes of objects. Children's activities in learning to recognize geometric shapes help children understand, describe and describe objects that are around them more easily.

Second, the grouping of geometric shapes is done by children individually or in groups. Grouping geometric shapes to introduce basic mathematics for children is done by grouping objects according to their size from smallest to largest or vice versa. And third, distinguishing the characteristics of geometry by embedding the concept of geometry. Such as calculating some angles in geometry and others. This helps each child in solving problems through observing shapes in the surrounding environment then implemented through symbols and notations that are spoken verbally.

Geometry in PAUD teaches related to understanding objects and the relationship between these objects, including the recognition of shapes and patterns (Afni, Mulyana, and Rahman 2021). Early childhood can recognize, classify and name the names of flat and spatial shapes with a variety of different sizes or shapes (Zariṇa et al. 2024). Meanwhile, basic mathematical abilities in early childhood are in the preoperational phase which is characterized by the ability to think symbolically. The basic ability of geometry is developed through the introduction of children to the ability to recognize the shape of objects and the location of the object. This can be assessed when children imagine the objects around them. Learning through geometry jumping play activities can help children understand, describe and describe the objects around them.

Conclusion

Based on the findings of this study, the implementation of the geometry race game in introducing basic mathematics proves to be an effective and developmentally appropriate strategy for early childhood learning. The learning process integrates three interrelated pedagogical strategies: the systematic introduction of basic geometric shapes (triangles, circles, squares, and rectangles), the development of children's ability to comprehend and follow educators' instructions as part of conceptual understanding, and the activity of sorting geometric shapes based on size from smallest to largest and vice versa. These strategies not only strengthen children's recognition of geometric forms but also foster essential mathematical concepts such as size comparison, color differentiation, and spatial reasoning. Moreover, the playful and competitive nature of the geometry race game enhances children's engagement, motivation, and active participation, allowing mathematical concepts to be internalized through meaningful experiences and applied in everyday contexts. Therefore, the geometry race game can be concluded as an appropriate and effective learning strategy to stimulate early childhood basic mathematical abilities holistically, encompassing cognitive, perceptual, and problem-solving skills.

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