



## Children's Critical Thinking Development Through Educational Toys with the Theme of Eruption Mountains in Children Aged 4-5 Years

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### Abstract

The development of critical thinking skills in early childhood is a crucial aspect that must be stimulated and nurtured through appropriate approaches. This study aims to enhance children's critical thinking abilities through the use of an educational play tool themed volcanic eruption at RA Bustanul Ulum Badean Bangsalsari Jember. A descriptive qualitative method was employed, utilizing observation, interviews, and documentation to obtain an in-depth picture of the learning process in the field. The findings indicate that the volcanic eruption educational play tool serves as an effective learning strategy for fostering children's critical thinking skills. This is evident in the active involvement of children during exploratory activities, from constructing to practicing with the tool, which encourages them to observe, ask questions, and draw conclusions independently. Through this process, children develop reasoning abilities that form the fundamental basis of critical thinking.

**Keywords:** Critical Thinking, Educational Toys, Mountain Erup

### Introduction

Early childhood education is the process of providing stimulus to children aged 0 to 6 years. Where this stimulus is given to promote early childhood growth and development (Nirva & Mesiono, 2016:6). It is said that this period is called the golden age period because it is a time when all children's abilities develop very rapidly, so education is needed that is appropriate for their ages so that they can be maximum and on target, besides that this age is also mentioned as a critical period for children. So the learning delivered to early childhood cannot be done carelessly.

Learning is an activity of delivering material to students that has previously been listed in the institution's curriculum. For early childhood education, learning can be conveyed, one of which is through learning media. Just as the concept of learning for early childhood is play, because play is a necessity for early childhood in addition to having fun, play is a child's learning process (Ratno & Asy'ari, 2023:1). Therefore, the role of learning media for early childhood can be said to be mandatory when the early childhood learning process is an intermediary or liaison tool in conveying knowledge to early childhood, one of which can be through educational game tools.

Educational game tools are visual learning media for early childhood that have educational value and can certainly provide stimulation for early childhood development

(Nurfadilah et al., 2022:7). Educational game tools can be used as tools for early childhood play, so that when using this educational game tool children not only play but can also increase children's growth and development, because not all can be categorized as educational game tools as all tools can be used as tools for play, but not all tools that can be used to play children have educational value or educational value.

Currently, the development of science is so rapid, that we as early childhood education teachers need to equip students with skills and abilities that can be competitive (Anggun et al, 2024). One way that teachers can do to develop students' scientific abilities is to use educational game tools such as those applied at RA Bustanul Ulum Badean Bangsalsari Jember. The application of the eruption mountain game tool applied in RA is a learning activity that introduces children to the eruption volcano disaster such as knowing what a volcano is, what happens when it erupts, what to do if there is a siren sound or information from the teacher in a fun, not scary, and adjusted way to children's ability to reason so that children are able to think critically.

Critical thinking is a cognitive activity related to the use of reasoning (Rohita et al., 2023). One of the stimuli for early childhood to think critically is through science experiments such as those carried out by RA Bustanul Ulum Badean Bangsalsari Jember. Science such as the simulation of mountain APE eruptions in this case refers to a system for gaining knowledge through an approach that uses observation and experimentation to describe and explain phenomena that occur in nature (Tri Ayu, 2022). Through this activity, children are invited to observe, predict, and conclude, which is a key aspect in the development of critical thinking.

The development of the times and parents' understanding of the importance of early childhood education will certainly require educators to be more innovative and creative in designing learning resources for their students. How educators are able to design and create game tools that can develop aspects of child development, through these educational game tools can be more effective materials and learning media for early childhood because they are in the form of attractive visuals and children can make and play them directly with the guidance of their teachers (Riyas, Rahmawati, 2022:2). So that children's learning becomes fun and happy.

The author is interested in conducting research at RA Bustanul Ulum Badean Bangsalsari Jember because the teachers at RA Bustanul Ulum Badean Bangsalsari are creative. They not only use Educational Game Tools obtained from buying, but also the work of teachers and teachers. Teachers of RA Bustanul Ulum Badean Bangsalsari Jember often take part in related trainings on educational game tools, so that the learning media used is innovative and not monotonous. And of course, it adjusts to the development of what is to be achieved each time the learning process, because teachers' proficiency in using teaching materials is the substance of competence that teachers should teach to students (Ismail Thaib, 2021:30).

The purpose of this study is to explore how educational toys with the theme of erupting mountains can stimulate and enhance the development of **critical thinking skills in children aged 4–5 years**. Early childhood is a sensitive period for building foundational cognitive processes such as reasoning, problem-solving, and scientific curiosity. Educational toys that integrate natural phenomena, such as volcanic eruptions, provide a rich sensory and experiential

context that encourages children to ask questions, predict outcomes, and explore causal relationships through play-based learning. As noted by Fisher, Godwin, and Seltman (2014), playful exploration enhances executive function and higher-order thinking by allowing children to test hypotheses in a safe, imaginative setting. Similarly, Zosh et al. (2018) argue that play acts as a bridge between concrete experience and abstract reasoning, making it an effective tool for early science-based critical thinking. In the context of STEM-oriented early learning, Herodotou (2018) emphasizes that inquiry-based play with real-world themes helps children to build early scientific literacy and reflective thought processes.

Furthermore, this study aims to design and evaluate a model of learning using volcano-themed educational media that supports children's cognitive and creative engagement. The eruption mountain toy is expected to serve as a stimulating tool for guiding children to observe, compare, and infer through hands-on experimentation. As Hidayati and Rahmawati (2021) found, educational games that involve cause-and-effect exploration significantly improve analytical and reflective skills in preschoolers. Moreover, Puspitasari, Suyadi, and Mulyani (2022) revealed that contextual play materials based on natural science themes strengthen children's logical reasoning and curiosity. In addition, Nicolopoulou (2015) noted that integrating play narratives with scientific exploration enables children to internalize complex cognitive patterns while maintaining emotional engagement. Finally, research by Weisberg, Hirsh-Pasek, Golinkoff, Kittredge, and Klahr (2016) reinforces that guided play, when structured around meaningful contexts, produces measurable gains in early problem-solving and reasoning abilities. Therefore, this study seeks to contribute a pedagogical framework that combines educational play, thematic exploration, and cognitive development to support critical thinking in early childhood education.

## Literature Review

The development of critical thinking skills in early childhood is a vital aspect of education, emphasizing analytical ability, problem-solving, and reflective decision-making. Children who develop critical thinking early are better prepared to face future learning challenges and build essential 21st-century life skills (Suyadi et al, 2023). One effective approach to fostering this ability is through the use of Educational Play Materials (EPMs) as contextual, enjoyable, and cognitively stimulating learning tools. Educational Play Materials are not only tools for play but also pedagogical instruments that stimulate children's cognitive development. Research by Yuliani Nurani Sujiono (2017) explains that EPMs designed systematically and aligned with developmental stages can encourage children to explore, compare, categorize, and connect information core components of critical thinking. For instance, block building, logic puzzles, and cause-effect toys allow children to formulate hypotheses and evaluate the outcomes of their own experiments.

Furthermore, Gunarti, Arifin, and Sudrajat (2020) argue that EPMs containing cognitive challenges and promoting divergent thinking enhance children's ability to understand concepts,

distinguish between relevant and irrelevant information, and develop alternative solutions. Active and collaborative play processes also help children practice listening to others' ideas, expressing their opinions, and making democratic decisions. Another study by Fitriani, Hasan, and Komalasari (2022) found that integrating EPMs with a problem-based learning approach for children aged 5–6 in kindergarten significantly improved critical thinking indicators such as the ability to ask questions, make predictions, and identify logical fallacies. This suggests that play is not merely recreational but also serves as a reflective tool for cultivating higher-order thinking skills.

In the context of the Merdeka Curriculum (Indonesian Independent Curriculum), the use of EPMs aligns with the principles of differentiated learning and the reinforcement of the Pancasila Student Profile. Children are encouraged to become independent learners, critical thinkers, and creative individuals through meaningful interactions with their learning environment. Therefore, developing EPMs based on local wisdom and culture is also crucial, as it not only fosters critical thinking but also cultivates children's understanding of identity and noble national values.

Educational game tools are very important for the early childhood learning process as research has been conducted by Atin and Lusi in 2022. In the study, it was explained that educational game tools have the purpose of creating children's motivation in creativity (Atin & Lusi, 2022). The same research was also conducted by Iis and Choiriyah in 2025 entitled *The Influence of Educational Game Tools (APE) Happy Boards on Early Childhood Critical Thinking Skills*. In the study, it was described that by using educational game tools for early childhood, the positive impact is that the process of children receiving material can be received very easily and fun (Iis & Choiriyah, 2025).

The development of thinking skills for early childhood can be done through the stimulus of educational game tools as the same research was conducted by Mimpira Haryono in 2023 with the title of research on improving critical thinking skills in group B children through the use of image media (Mimpira, 2023). In the study, it is explained that to stimulate children to think critically, media that can stimulate children's minds and the media must be real and practicable. From several studies related to how the role of educational toys in children's critical thinking, we can conclude together how important educational toys are in early childhood learning poses that can stimulate children's cognition.

Educational toys are a means of play and learning to develop children's development, such as research conducted by Anis Kumala Fasha and Hibana in 2023 with the research title *Teachers' Understanding of the Use of Educational Game Tools in the Early Childhood Learning Process*. In the study, it was explained that educational game tools are specifically used as learning media and a means of play and early childhood learning which can make it easier for teachers to convey material because educational game tools are visual game tools that children can directly use. And of course, through this educational game tool, it is able to develop children's abilities and development optimally.

Through the literature review above, the author makes it a reference for this research. This research focuses on the use of educational game tools of erupting mountains to develop children's critical thinking skills. The author chose the RA Bustanul Ulum Badean Bangsalsari Jember institution because he was interested in the use of educational game tools used as learning materials by teachers. Not all teachers in early childhood education units are willing to use the eruption mountain educational game because it is a little difficult to make and the process of using it uses high imagination, for that reason this educational game is able to develop critical thinking skills in early childhood.

The use of educational play tools themed "volcanic eruption" is an effective medium for developing critical thinking skills in early childhood. Through a simple eruption simulation using basic materials such as baking soda and vinegar, children are invited to observe cause-and-effect relationships, make predictions, and analyze the changes that occur. This activity stimulates curiosity and questioning skills, which are foundational to critical thinking (Selvi, 2022). Children do not engage in passive play but actively participate in designing simple experiments, forming hypotheses, and evaluating the outcomes based on direct observation.

In addition, the volcano eruption play activity provides opportunities for children to collaborate, engage in discussions, and express their opinions with peers and teachers. This process nurtures social and communication skills that are essential for collective decision-making and problem-solving. Children also gain a concrete understanding of natural concepts and basic geography, fostering scientific thinking in a contextual and developmentally appropriate way. Therefore, educational play tools such as volcanic eruptions are not only visually engaging but also rich in educational value, supporting the holistic development of children's critical and scientific thinking from an early age.

## Methods

This study employs a qualitative descriptive research method, aimed at providing an in-depth depiction of the phenomena occurring in the field. According to Syafrida (2022), qualitative research is a method that focuses on deep perception of a phenomenon by examining it in detail on a case-by-case basis. Each situation or problem may differ in its characteristics, allowing the researcher to obtain richer and more comprehensive insights. In this context, the study aims to explore how critical thinking skills in early childhood are developed through the use of an educational play tool themed "volcanic eruption" at RA Bustanul Ulum Badean Bangsalsari, Jember.

To obtain valid and comprehensive data, the researcher collected both primary and secondary data. Primary data were gathered through direct observation of the learning activities using educational play tools, while secondary data were obtained from documentation and interviews with key informants. The observation technique was used to capture real classroom situations, such as teacher-child interactions, spontaneous child responses, and the actual play process. Meanwhile, interviews were conducted with Class A teachers, all students in Group A

(ages 4–5), and the school principal to gain deeper and verified information regarding the implementation of the method.

Once the data were collected, the researcher conducted a qualitative data analysis following systematic stages as outlined by Hardani et al. (2020). The first stage was data reduction, where relevant information from observation, interviews, and documentation was selected and filtered. Irrelevant data were excluded to maintain the research focus. The next stage was data display, where the reduced information was organized systematically to facilitate interpretation and analysis. The final stage was drawing conclusions, where the researcher synthesized the findings to explain how educational play tools influence the development of children's critical thinking skills.

In the core activity, Group A children were actively involved in creating and playing with the volcano eruption educational tool. The activity began with the teacher giving a simple explanation of volcanoes, followed by an experiment using baking soda, vinegar, and food coloring to create an eruption effect. Children helped prepare the materials, observed the eruption process, and responded to the teacher's questions. This activity was designed to promote active cognitive engagement through observation, inquiry, and simple discussion.

Observations showed that this game effectively stimulated the children's critical thinking skills. The children were actively asking questions such as, "Why does it erupt?", "What happens if we add more water?", or "Can we change the color?" These responses indicated logical thinking processes and high curiosity. Teachers acted as facilitators by encouraging children to think instead of directly providing answers. Through this approach, the children not only enjoyed the play activity but also learned to form hypotheses, evaluate results, and reflect on their experiences establishing an early foundation for critical thinking development.

## **Result/Findings**

From the results of observations and interviews conducted by researchers at RA Bustanul Ulum Badean Bangsalsari Jember, researchers can identify that the experiment of educational tools for educational games of erupting mountains applied at RA Bustanul Ulum Badean Bangsalsari Jember plays a very important role in influencing children's critical thinking skills. This game tool is applied to group A students, namely children aged 4-5 years. The use of materials uses recycled materials that are around us and are easy to get, there are also some materials obtained from buying.

The educational game tool for the erupting mountain at RA Bustanul Ulum Badean Bangsalsari Jember was made by teachers with the help of students. Students are tasked with cutting cardboard boxes and used items needed and then assembled by the teacher to shape them into a mountain. From the very beginning, children have been trained to use their sensory devices to work actively because children are not only commanded to pay attention but also to

experiment. In the experiment, children were encouraged to ask questions about the process that took place both when starting to assemble the erupting mountain APE and when using the educational game tool.

The researcher saw that the simulation of an erupting volcano applied at RA Bustanul Ulum Badean Bangsalsari Jember made a very significant contribution to developing children's critical thinking skills. Through this educational game tool the eruption mountain can scientifically make children gain insight into many things. First, regarding the process and impact of volcanic eruptions, here children can ask many things about mountain eruptions starting from how the volcanic process can erupt, why it can erupt, what happens when the mountain erupts and other impacts. Children can also learn what can be done when a mountain erupts. Exploratory activities in the eruption volcano experiment at RA Bustanul Ulum Badean Bangsalsari Jember reinforce the finding that active learning that directly involves students helps children build critical thinking habits. Because the achievement of critical thinking requires demonstration and or guidance to make a concept of knowledge. Because thinking must be stimulated with educational game tools or the right media and of course that can stimulate children to think and do so that children can learn directly, think directly and evaluate directly.

Based on direct observation and interviews conducted by the researcher at RA Bustanul Ulum Badean Bangsalsari Jember, it was identified that the volcanic eruption educational play experiment played a significant role in influencing the development of critical thinking in young children. This play activity was not merely recreational, but it incorporated simple scientific concepts in a fun and developmentally appropriate way for children aged four to five years. The children were not passive participants in the learning process. Instead, they were actively involved from the beginning, from creating the materials to conducting the experiment. This active involvement fostered a sense of ownership and increased engagement in the learning process.

The process began with collecting materials, most of which were recycled items found around the children's environment, such as used cardboard, plastic bottles, paper, and glue. The teacher worked together with the children to prepare these items, allowing them to participate in hands-on tasks like cutting, shaping, and assembling materials into a volcano model. This phase allowed the children to strengthen their fine motor skills and social interactions, while also introducing them to practical problem-solving and collaboration. Despite their young age, many of the children showed early signs of initiative and curiosity as they contributed ideas and participated in building the model.

This educational play experience created opportunities for children to express curiosity and develop inquiry-based thinking. As they observed the volcano erupting from the combination of baking soda and vinegar, the children responded with enthusiasm and spontaneous questions. They asked things like "Why is it erupting?", "What happens if we add more water?", or "Can we change the color?" These responses reflect their growing ability to

observe, question, compare, and test their own ideas through direct experiences. The activity encouraged not only sensory involvement but also intellectual engagement, as children tried to make sense of what they saw.



**Figure 1.** Educational Toy Application with Volcano Eruption Theme

In the picture, a preschool teacher is seen guiding a group of 4–5-year-old children as they play with an educational tool themed around a volcanic eruption. The children appear enthusiastic as they watch a mixture of baking soda and vinegar being poured into a miniature volcano made from cardboard and recycled materials, creating a foaming reaction that resembles flowing lava. The teacher sits close to the children, explaining in simple terms the process of a volcanic eruption. The children are actively asking questions, pointing, and laughing as the “lava” flows from the top of the homemade volcano. This activity illustrates a joyful educational interaction, where the children are not only playing but also learning through hands-on experience that stimulates their curiosity and critical thinking skills.

Another key aspect observed was the role of the teacher as a facilitator rather than a lecturer. The teacher encouraged the children to explore, to guess what might happen, to try, to fail, and to reflect on their observations. This approach created a dynamic and interactive learning environment, where knowledge was built through experience rather than passive reception. The children learned because they engaged with the process, not because they were given fixed answers. This form of learning is essential for fostering early critical thinking skills and helps build children’s confidence to speak up, ask questions, and make predictions based on observation.

Overall, the volcanic eruption play experiment showed great potential as an integrated tool to stimulate cognitive, emotional, social, and physical development in children. It allowed children to engage in scientific exploration, understand cause and effect, and reflect on their learning process. The repetition of such play-based experiments, combined with guided questioning from teachers, can gradually shape the habit of critical thinking. It helps children move beyond memorization and into thoughtful reflection, problem solving, and reasoning. This activity is a strong example of how scientific ideas can be introduced through meaningful, enjoyable, and developmentally suitable learning experiences in early childhood education.



## Discussion

The development of critical thinking is very important because this skill helps them in reasoning and the child is able to use their cognitive abilities well. One of the effective methods to train critical thinking skills is through educational games that contain scientific elements, such as educational game tools such as erupting mountain educational games. In these experimental activities, children are not allowed to be just observers but to reason and practice directly the phenomena that occur. By doing this, children will use their logic to think Paradita & Nugraha explained that children's critical thinking skills will only develop when they see the relationships around them with science (Paradita & Nugraha, 2023).

From the results of the research that the author has conducted at RA Bustanul Ulum, Badean Bangsalsari, Jember, teachers improve children's critical thinking so that children are used to reasoning about what is happening around them. For this reason, RA Bustanul Ulum Badean Bangsalsari Jember uses educational game tools to erupt mountains because through this game tool many times children are required to think and reason. Starting from the process of making to using it. As according to Ms. Noni et al., teachers or kindergarten managers in order to be able to choose the appropriate play equipment, they must be able to understand the developmental characteristics of their students (Ms. Noni et al., 2024:30).

When teachers understand the characteristics of their students' development, then teachers can create a suitable and adaptive learning environment. The learning process that suits the needs of students and the learning materials used can also be adjusted, in this case in accordance with the research conducted by the author at RA Bustanul Ulum Badean Bangsalsari Jember. Teachers can adjust learning materials, namely educational game tools, erupting mountains to improve children's critical thinking, this can illustrate that through the use of educational game tools can provide the right stimulus and help students to understand the material provided by the teacher (Raudhatun & Hery, 2024:4).

According to Linda & Eka In addition to making arguments, critical thinking is important in education (Linda & Eka, 2019). Critical thinking which is part of the cognitive realm with a focus on the scope of cognitive development, the standards for achieving child development regulated in Permendikbud No. 137 of 2014, Article 10 seem to have an agreement between the ages of 5 and 6 years. There are three outcomes that need to be improved: learning and problem solving, logical thinking and symbolic thinking (Ministry of National Education, 2014). So this is something that must be considered by teachers when carrying out the teaching and learning process, namely how to develop students' critical thinking skills.

One of the effective activities to develop critical thinking skills in early childhood is the experiment of educational game tools such as those carried out by teachers of RA Bustanul Ulum Badean Bangsalsari Jember. The eruption experiment used by RA Bustanul Ulum Badean Bangsalsari Jember is a simple educational activity that helps children get to know natural phenomena in an active and fun way. The materials used are safe and easy to obtain, such as baking soda, vinegar, liquid soap, as well as food coloring and also used items such as cardboard, drink bottles and others. Some of these materials are bought and some are brought directly by students, so that children can also think about how to get the materials requested by the teacher.

As teachers have the main role, namely as a planner, as an implementer and also as an assessor (Reja Pahlevi, 2021:17). So teachers must be innovative and creative, teachers must always learn in order to get something new during the teaching and learning process. Teachers can be said to be creative if they have high creativity, so that teachers not only think about how children understand what is conveyed but how children can understand what is conveyed by teachers well. Teachers must be able to see the problems that occur to their students, and provide the right learning to maximize it.

## Conclusion

The experiment of educational game tools of erupting mountains is an effective learning strategy in developing children's critical thinking by providing exploratory experiences through activities of making educational toys for erupting mountains and practicing educational toys for erupting mountains, children not only observe but can also practice directly. Through educational play tools, erupted mountains can create their reasoning, which is the main foundation of critical thinking. Experiments with educational toys showed that there were significant differences in children's critical thinking skills before and after the stimulation of the eruption of the mountain. The results of the study showed that children's critical thinking skills improved after receiving stimulation of erupted mountains and children were better able to analyze and solve problems after receiving stimulation.

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