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IMPROVING UNDERSTANDING OF SCIENCE CONCEPTS THROUGH INTERACTIVE VIDEOS IN STEAM ACTIVITIES IN EARLY CHILDHOOD EDUCATION (ECE)

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ABSTRACT

This study aims to analyze the effectiveness of using interactive videos in STEAM activities to enhance the understanding of science concepts in children aged 5-6 years in class B1 at TK Negeri 5 Pekanbaru. The type of research used was Classroom Action Research (CAR) with the Kemmis & Taggart model, conducted in two cycles, each consisting of two meetings. The subjects of this research were 14 children aged 5-6 years in class B1, consisting of 7 boys and 7 girls. The research data were analyzed using quantitative descriptive analysis. Data collection techniques were obtained through participatory observation and documentation. The results showed an increase in children's understanding of science concepts through interactive videos in STEAM activities in class B1 at TK Negeri 5 Pekanbaru, namely: in the pre-cycle, it was 37% with the criteria of Starting to Develop (MB), in the first cycle first meeting it increased to 48% (MB), the first cycle second meeting became 59% with the criteria of Developing According to Expectations (BSH), the second cycle first meeting became 73% (BSH), and in the second cycle second meeting it reached 83% with the criteria of Very Well Developed (BSB). The success target of this research was 75%. Thus, children's understanding of science concepts can be significantly improved through the application of interactive videos integrated into STEAM activities.

Keywords: Understanding of Science Concepts, Interactive Video, STEAM, Early Childhood

1.INTRODUCTION

Early Childhood Education (ECE) is the primary foundation in shaping character and basic abilities of a child. The 0-6 years age range, known as the golden age, becomes a critical period where appropriate stimulation will greatly influence holistic child development, including physical, cognitive, social-emotional, language, and arts aspects (Rahmawati et al., 2021). Early science introduction plays an important role because it can develop various basic skills. Essential for children, such as curiosity, observation skills, and the ability to think critically and systematically.

Science for early childhood is everything that amazes and captures their attention (Wati & Jayanti, 2022). Science learning should be carried out through enjoyable and contextual approaches, such as simple experiments, educational games, and hands-on activities involving the senses. The use of concrete media such as visual aids and physical objects has been shown to improve understanding of abstract concepts in early childhood (Setyawati, 2024). In the context

of science learning, this approach allows children to touch, manipulate, and directly observe phenomena, ultimately creating deep learning experiences.

However, field reality shows that science learning in kindergarten still faces various challenges. Based on initial observations at TK Negeri 5 Pekanbaru, it was found that science activities are still limited to conventional experiments like volcanic eruptions and color mixing. Teachers only use non-interactive videos from YouTube without special modifications for learning needs. As a result, children are less interested and quickly become bored, and children´s understanding of science concepts remains low, with an average of 37% in the Developing Start category.

The development of educational technology offers innovative solutions through interactive video. Interactive video is a learning medium that integrates visual, audio, and interactive elements into a single cohesive unit, creating an immersive learning experience where children can directly interact with the material and receive direct feedback (Rahmawati et al., 2021). Khairunnisa et al. (2024) show that interactive video designed with a simple interface and interaction elements aligned to preschool children's cognitive abilities can significantly improve engagement and memory retention.

The STEAM approach (Science, Technology, Engineering, Arts, and Mathematics) was chosen because of its ability to integrate multiple disciplines holistically and contextually. This approach can be applied from an early age by collaborating science with everyday life (Wahyuni et al., 2020). Previous research has proven the effectiveness of interactive video in improving science learning outcomes for elementary school students (Rahmawati et al., 2021) and early childhood mathematical abilities (Ayumi & Sit, 2025). However, studies specifically examining the use of integrated STEAM interactive video to enhance understanding of science concepts in kindergarten are still very limited. Based on the identified problems, this study aims to: (1) determine whether interactive video media in STEAM activities can improve children's understanding of science concepts at TK Negeri 5 Pekanbaru, and (2) determine how large the percentage improvement in children's understanding of science concepts through that media is.

2. METHODOLOGY

This study uses Classroom Action Research (PTK) with the Kemmis & Taggart model conducted in two cycles, each consisting of two meetings. This model includes four stages: planning, action implementation, observation, and reflection. The study was conducted in B1 TK Negeri 5 Pekanbaru class located at Jalan Pembina Gang Ikhlas, Kelurahan Lembah Sari, Kecamatan Rumbai Timur, Pekanbaru City, Riau Province, in the first semester of the 2025/2026 academic year. The subjects are 14 children aged 5-6 years, consisting of 7 boys and 7 girls.

Data collection techniques used are participatory observation and documentation. The research instrument is an observation sheet developed based on the scoring rubric for early childhood science concept understanding, referring to Firda & Suharni (2022), covering five main indicators: (1) observing ability, (2) questioning ability, (3) trying/exploring ability, (4) concluding ability, and (5) communicating ability. Each indicator is described in three statements with a rating scale: Not Developed Yet (BB=1), Beginning to Develop (MB=2), Developing According to Expectations (BSH=3), and Developing Very Well (BSB=4). Data analysis uses descriptive quantitative analysis with the percentage formula: $P = (F/N) \times 100\%$, where P is the

percentage, F is the total score obtained, and N is the maximum possible score. The success indicators of the study are set if ≥75% of children meet the Developing According to Expectations (BSH) or Developing Very Well (BSB) criteria, in accordance with the Kemendikbudristek (2021) standard.

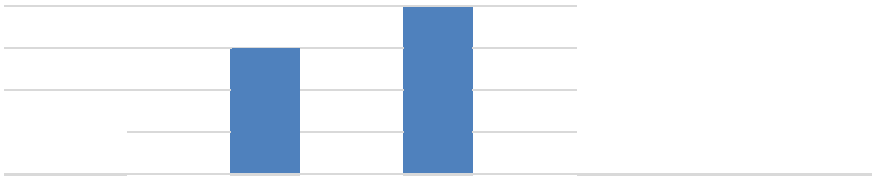
3. RESULTS

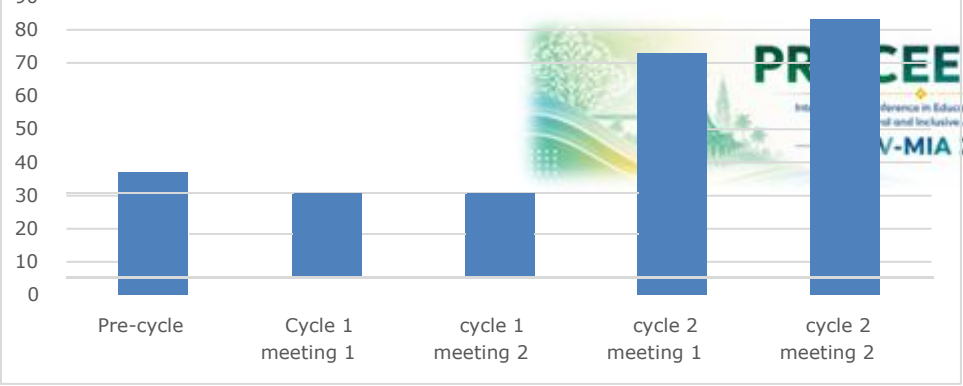
The study was conducted in two cycles, each with two meetings. Cycle I activity theme is "Understanding the Properties of Water" (water properties follow the container and flow from high to low), while Cycle II theme is "Understanding Floating and Sinking Properties" implemented through object grouping experiments and a simple boat-making project.

Table 1. Recapitulation of the Increase in Children´s Science Concept Understanding

Research Stage	Average Percentage	Criteria
Pre-Cycle	37%	Beginning to Develop (BD)
Cycle I Meeting 1	48%	Beginning to Develop (BD)
Cycle I Meeting 2	59%	Developing According to Expectations (BSH)
Cycle II Meeting 1	73%	Developing According to Expectations (BSH)
Cycle II Meeting 2	83%	Developing Very Well (BSB)

In the pre-cycle, the average understanding of children's science concepts only reached 37%. The lowest indicator was the ability to show work confidently (30%), as well as the ability to manipulate objects and make predictions (each 32%). After the action in cycle I meeting 1, the percentage increased to 48% (MB), and in cycle I meeting 2 it reached 59% (BSH). A significant increase occurred in cycle II meeting 1 (73%, BSH) and peaked in cycle II meeting 2 at 83% (BSB), surpassing the success target of 75%. Figure 1 clarifies this upward trend.





3.2 Improvement per Indicator

A more detailed analysis of the five indicators of science concept understanding shows an even improvement, as presented in Table 2.

Table 2. Score Improvement per Indicator in Cycle II

No	Indicator	Cycle II M1	Cycle II M2	Average
1. Ch	ldren respond to questions n interactive video	77%	86%	81%
2. Ch	ld uses accurate science vocabulary	71%	86%	78%
3. Ch	ld shows results work with confidence	75%	82%	79%
4. Ch	ld expresses curiosity to wonder / curious	75%	82%	78%
5. Ch	ld wants to try experiments according to theme	73%	84%	78%

The indicator with the highest increase is the children's ability to respond to questions in interactive videos, reaching 86% in cycle II meeting 2, followed by the ability to use accurate science vocabulary at 86%. This shows that video interactivity is effective in encouraging children's active participation and enriching their conceptual understanding.

4. DISCUSSION

The research results prove that the application of interactive videos in STEAM activities significantly increases early childhood understanding of science concepts. This finding is in line with the research of Rahmawati et al. (2021), which states that interactive videos successfully create an immersive learning environment and significantly improve science learning outcomes. Interactive videos combine audio, visual, and interactive elements that can be touched or clicked directly by children, thus maintaining their focus while training hand-eye coordination (Khairunnisa et al., 2024). The STEAM approach provides an ideal learning framework because it invites children to solve real-world problems through integrated exploration. In cycle I, children not only learned science about the properties of water, but also used technology (interactive videos), conducted simple engineering (experiments moving water and making miniature water flows), and developed artistic aspects through exploring water colors. In cycle II, children learned the concepts of floating and sinking, used interactive videos, designed and made boats from styrofoam (engineering), decorated boats with origami (art), and counted the number of coins the boat could hold (mathematics). This integration creates holistic and meaningful learning, in accordance with the characteristics of early childhood who are concrete and learn through direct experience (Chen & Tippett, 2022). The increase in the observing indicator is in line with the opinion that children's science process skills include observing skills as the main foundation. In the questioning indicator, children are increasingly brave in asking questions and responding to questions in interactive videos, reflecting their exploratory nature as natural scientists. The ability to try increased significantly, where children enthusiastically conducted experiments and manipulated objects, implementing the principle of learning by doing. The indicators of concluding and communicating also showed progress, where children were able to make simple predictions, present observation results, and use accurate science vocabulary, while also developing language aspects and self-confidence. Achiev. ing the success target of ≥75% in cycle II meeting 2 (83%) proves that the integration of innovative media with the right learning approach can create meaningful and effective learning experiences. This finding strengthens the research of Ayumi & Sit (2025) which shows the effectiveness of interactive videos for early mathematical abilities, as well as the research by Wati & Jayanti (2022) on the development of technology-based media for children's science understanding.

5. CONCLUSION

This study concludes that: (1) The understanding of science concepts in early childhood students in class B1 at TK Negeri 5 Pekanbaru can be improved through the use of interactive videos in STEAM activities. This approach has proven effective in stimulating curiosity, active engagement, and children's critical thinking skills in understanding simple science concepts such as the properties of water and the concept of

floating and sinking; (2) The improvement in children's understanding of science concepts is evident from the average percentage obtained at each stage: pre-cycle 37% (Starting to Develop), cycle I 59% (Developing as Expected), and cycle II 83% (Developing Very Well), exceeding the success target of 75%. For PAUD/Kindergarten teachers, it is recommended to be more creative and innovative in designing science learning by utilizing interactive video media integrated with STEAM. Schools should provide supporting facilities such as technological devices and training in the development of interactive media. Future researchers are expected to develop similar research with other variations of interactive media, larger samples, or different settings to strengthen the findings.

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