Exploring Nature's Classroom: “Fostering Science Literacy And Critical Thinking In 21st-Century Education"

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ABSTRACT
This research explores the effectiveness of incorporating environmental exploration activities to enhance students' science knowledge and logical thinking skills in the 21st century. Recognizing the demand for diverse skills, especially in the evolving technological landscape, the study underscores the importance of cultivating both soft and hard skills from early childhood through higher education. The emphasis is on introducing scientific literacy early on and building a connection with nature to stimulate critical thinking. The research employs a qualitative approach, Classroom Action Research (CAR), following Kemmis and McTaggart's formula. Pre-research observations reveal low science knowledge among children, leading to the integration of environmental exploration activities into the learning process. Results demonstrate a significant improvement in students' science knowledge through cycles, affirming the effectiveness of exploration methods. The study concludes by highlighting the transformative impact on the learning experience, shifting from limited interest to active engagement and environmental responsibility. Overall, exploration methods successfully create an environment where children actively engage with and appreciate the natural world, aligning with the objectives of early childhood science activities.

KEYWORDS
Environmental exploration,
scientific literacy,

DOI : doi.org/10.35316/ris.v3i1.547
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Introduction

The 21st century necessitates societal engagement with advancing knowledge and technology, urging individuals to acquire numerous skills previously nonexistent. Amidst the challenges and opportunities, potential issues may arise if not addressed with the appropriate foresight, strategy, and knowledge.

Children are naturally curious and explorative beings, seeking to understand the world around them. Their inherent sense of wonder is a foundation for learning, especially when interacting with their environment. While children possess some innate knowledge and skills related to survival, they also acquire scientific knowledge and skills through the guidance of more knowledgeable adults. The skills of observing, exploring, and discovering are highlighted as crucial in early childhood science education. The statement argues that effective science education during the preschool period not only encourages children's curiosity and enjoyment in exploring their surroundings but also

establishes a solid foundation for future science education in primary and secondary levels (Cihad, 2017).

Looking ahead, the younger generation must cultivate both soft and hard skills from early childhood through higher education. The demands of this era compel individuals to learn and excel in various areas, extending beyond cognitive knowledge to encompass novel skills. The continually evolving technological landscape serves as a conduit for acquiring new knowledge and skills, even for individuals in early childhood. Scientific literacy introduction is advocated to commence at an early age (Rodger W. Bybee, 2008). Children, with their existing knowledge base, acquire scientific knowledge such as food preservation for survival and related skills like drying and curing through guidance from more knowledgeable adults (Richard E. Mayer, 2004).

The imperative to emphasize science in early childhood education arises from various factors impacting the early childhood community. Central to this is the evolving understanding of the significant influence of children's early thinking and learning. Current research and practice indicate that children possess a greater learning potential than previously believed, necessitating enriched and more stimulating early childhood environments. In these settings, guided by adept teachers, children's experiences during the early years can profoundly shape their subsequent learning. Moreover, science holds particular importance in early childhood education, not only for establishing the foundation for future scientific comprehension but also for cultivating crucial skills and attitudes conducive to learning (Worth, 2010).

A defining characteristic of the 21st century is the escalating prominence of science, an integral aspect of societal advancement. Future endeavors involve striving for mastery in science as part of civilization development. Science, as a discipline, presents both opportunities and challenges in children's education. The introduction of science to children is deemed essential, irrespective of their developmental stage. It is imperative to make this introduction accessible, employing methods such as engaging children in experiments and broadening their insights, fostering a willingness to explore (Dwiyani Marsetyaningrum). The National Science Foundation emphasizes the innate scientific inclination of children in the book "Helping Children Learn at Home" (1997), stating that "Children are natural mathematicians and scientists."

Developing a connection with nature and exposing children to new experiences and discoveries in their natural environment stimulates critical thinking and problem-solving, fostering a broader knowledge base (National Research Council [NRC], 2012). Through their five senses, children can observe and comprehend natural phenomena.

Scientific literacy, a term derived from the Latin "literatus" and English "scientia," encapsulates knowledge or a system of knowledge concerning the physical world and its phenomena (Toharudin, 2011). Science encompasses a body of knowledge reflecting our understanding of natural systems and the dynamic process of continually extending, refining, and revising that knowledge. Understanding both aspects is crucial for scientific progress and learning (Duschl, Richard A.; Schweingruber, Heidi A.; & Shouse, 2007).

PISA (Programmed for International Student Assessment) defines scientific literacy as the ability to apply scientific knowledge, pose questions, and draw logical conclusions in the process of understanding and decision-making.

Play is an integral aspect of early childhood, serving as a natural means for children to engage in their formative years and develop their potential. Irawati (Nuraini, 2014). emphasizes that "play is a necessity for all children, particularly those aged 3-6 years." During this critical period, it is crucial for children to enjoy well-directed playtime, as it can stimulate various aspects of their development. Play offers ample chances for children to learn science, exploring concepts like life diversity, force, motion, and matter structure (Hamlin, 2021).

(Omar, J., Turiman, P., Daud, A.M., & Osman, 2012). identify four key skill domains essential for the 21st century: literacy, inventive thinking, effective communication, and high productivity. Science, defined as knowledge about nature and natural phenomena, is seen as a means to encourage children to grasp simple scientific concepts applicable to their daily lives (Bundu, 2006).

The National Association for the Education of Young Children (NAEYC) sets the age range for early childhood as 0-8 years, while in Indonesia, it specifically focuses on children aged 0-6 years (National Association for the Education of Young Children [NAEYC], 2013). The variance is attributed to the formal education system in Indonesia, where elementary schools (7-12 years) adopt a similar approach to education for ages 4-6 years (Aisyah, S., 2011). Early childhood marks a unique stage of growth and development.

Introduction to science activities can be seamlessly integrated into play, fostering exploration abilities, nurturing curiosity, and developing fundamental science process skills, including knowledge about various objects in terms of structure and function (Dewi, K. R., I Ketut Gading, & Magta, 2019).

Exploring the surrounding environment emerges as an effective method for introducing science concepts to children. Drawing on Tylor's perspective, exploration activities enable direct investigations through spontaneous steps, facilitating decision-making processes (Masitoh, 2007).

Engaging in scientific play provides children with ample opportunities to explore, enhancing their comprehension of concepts and foundational knowledge (Heldanita, 2018). Mulyasa defines exploration as a playful activity involving the exploration or visitation of a place to learn specific things while seeking enjoyment or entertainment (Mulyasa, 2012).

Initiating science education through exploratory activities begins with interactions with the natural surroundings, tapping into children's potential to develop knowledge through simple observations (Masitoh, 2007).

Methodology

This study employs a qualitative approach, specifically Classroom Action Research (CAR), with the aim of assessing the effectiveness of implementing environmental exploration activities in enhancing students' knowledge in the field of science and cultivating fundamental skills in logical thinking.

The Classroom Action Research follows the steps formulated by Kemmis and McTaggart, encompassing multiple cycles. Each cycle comprises four components: planning, acting, observing, and reflecting. Wina Sanjaya (2009) underscores that Classroom Action Research (PTK) aims to investigate educational target objects that influence learning outcomes in a class. The primary objective is to examine educational target objects that impact classroom learning outcomes (Muliawar, 2010).

Pre-research observations were conducted on November 13, 2023. The data from pre-cycle observations revealed a student population of 9 males and 8 females. Teacher-provided data on learning outcomes indicated that, on average, students exhibited low proficiency, particularly in understanding the natural environment and logic. Specifically, 14 out of 17 children fell into the low category in terms of their grasp of science concepts.

Interviews with teachers yielded insights into the causes of students' limited knowledge in science. The primary factors identified were teaching methods that did not align with children's developmental stages, including a lack of concrete examples in lessons and

an overreliance on abstract explanations, forcing children to imagine concepts without adequate support.

Given these observations, the research endeavors to enhance students' knowledge in science and their foundational scientific thinking skills by incorporating environmental exploration activities into the learning process.

Results and Discussion

Exploratory activities in the surrounding environment during both Cycle I and Cycle II began with the teacher instructing children to line up in the school's front yard. Subsequently, the children were grouped into three, each accompanied by a teacher. Following this, each teacher communicated the guidelines and materials for the activity, emphasizing rules such as the need for patience while waiting for turns and the prohibition of fighting or disturbing friends during the process.

Afterward, the children were encouraged to observe their surroundings. The teacher then distributed flowers to be planted, providing a demonstration on proper planting techniques and explaining how to care for the plants. This structured approach ensures that the children not only engage in the exploration activity but also comprehend and follow essential rules and procedures throughout the process.

Following that, children are granted the opportunity to delve into nature by attempting to independently plant their own flowers based on the teacher's instructions and demonstration. Subsequent to planting, the children water the flowers they have planted, serving as a conclusive step in the activity, signifying the completion of the task. The continuation of this activity involves the ongoing care of the planted flowers, contributing to the flourishing growth of the plants and serving as a manifestation of the children's commitment to nurturing the environment post-planting.

This exploration activity within the surrounding environment extends beyond the initial planting phase. It involves the daily observation of plant growth and the ongoing care of plants, fostering the enhancement of the children's scientific knowledge through systematic exploration methods. The application of exploration methods at RA Miftahun Najah Banyuputih is designed to augment children's scientific knowledge, facilitating the acquisition of practical knowledge and experiences. Engaging in environmental exploration enables children to refine their understanding of science, focusing on the exploration of plant characteristics through observation and research.

The essence of exploration, as defined by Tylor and quoted by Masitoh et al., lies in enabling children to conduct direct investigations through spontaneous steps. This approach empowers them to make decisions about what, how, and when to explore (Masitoh, 2007). In the implementation of this exploration activity, it goes beyond mere planting and caring; it establishes social bonds between the teacher and students and among the children themselves. The teacher cultivates positive and engaging communication, offering children the opportunity to express themselves, ask questions, and share their thoughts.

According to Musfiroh, children with scientific knowledge often exhibit a fondness for animals and plants, as evidenced by their interest in activities such as watering flowers or caring for plants and animals. Cultivating a love for nature from an early age becomes crucial for instilling concepts of nature conservation, environmental balance, and appreciation for the natural world in children. The exploration method serves the dual purpose of expanding scientific knowledge while fostering a sense of belonging and affection for nature, animals, and plants (Masitoh, 2007). During observations, children are encouraged to express gratitude for the blessings of living creatures, plants, and the natural surroundings through the phrase "hamdalah."

Data Analysis

The researcher's observations before initiating the classroom action research process using exploration methods in the surrounding environment revealed the scientific knowledge attainment of children in class B during the pre-cycle. The total score for the 17 children was 69, with an average of 4.05 and a percentage of 41.17%. Subsequently, during the implementation of action research in cycle I with exploration methods, there was a noticeable increase in children's science knowledge, resulting in an overall score of 90, an average score of 5.29, and a percentage of 58.82%.

While the results in cycle I demonstrated positive development compared to pre-cycle values, they did not meet the targeted completion criteria, preventing a definitive success classification. Consequently, the study progressed to cycle II, where a significant improvement was achieved. In this phase, the overall score reached 122, with an average score of 7.17 and a percentage of 88.23%.

Analyzing the values across the pre-cycle, cycle I, and cycle II, it is evident that there was a substantial percentage increase in the science knowledge of class B children. The recapitulation table illustrates the gradual enhancement in children's science knowledge from cycle I to cycle II.

In conclusion, the efforts to augment children's science knowledge through exploration methods in the surrounding environment at RA Miftahun Najah Banyuputih for the 2023/2024 academic year can be deemed successful. The incremental increase in children's science knowledge, as evidenced in the recapitulation table, reflects the effectiveness of the implemented exploration methods over the course of the study. recapitulation of increasing science knowledge in class B from cycle I to cycle II as follows:

Table 1. Recapitulation of Increasing Knowledge

	Siklus I	Siklus II
Jumlah	90	122
Rata-rata	5,29	7,17
Persentase	58,82%	88,23%

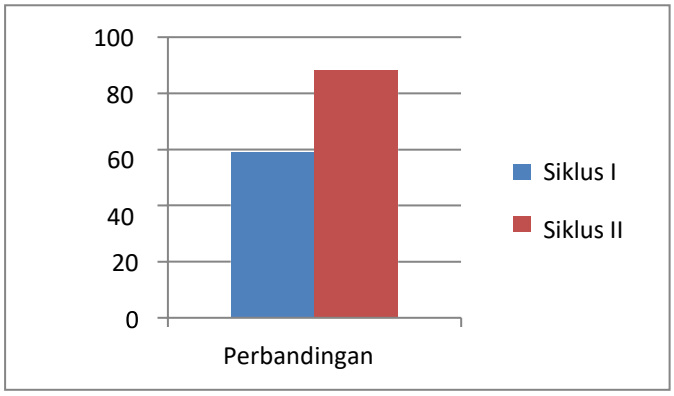

Figure 1. Graph of Percentage of Achievement from Cycle I and Cycle II

Certainly, the comparison of increasing science knowledge through environmental exploration methods for Class B children at RA Miftahun Najah Banyuputih during the academic year 2023/2024 is summarized in Table 2:

Table 2. Comparison of Increasing Science Knowledge Through Environmental Exploration Methods for Class B Children at RA Miftahun Najah Banyuputih Academic Year 2023/2024 in Cycle I and Cycle II.

No.	Hasil	Siklus I	Siklus II	Perubahan
1	Classical value	58,82%	88,23%	29,41%
2	Average value	5,29	7,17	1,88%

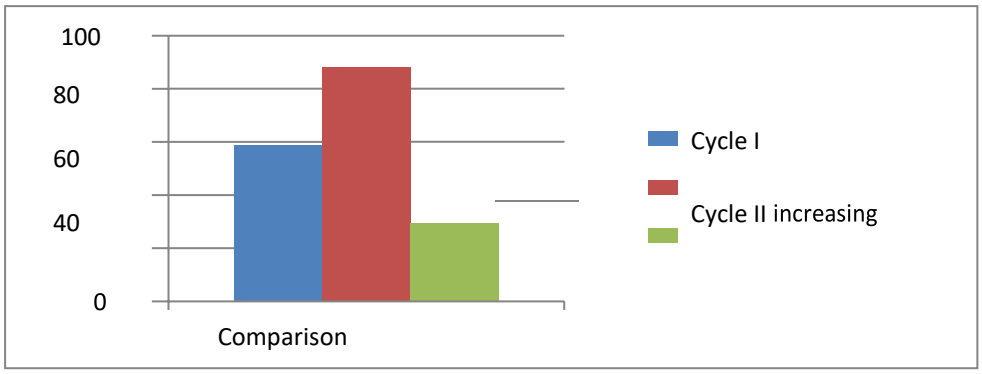

Figure 2. Comparative Graph of Recapitulation of Cycle I and Cycle II

The table outlines the success rate and average scores for Class B children in cycles I and II. The success rate indicates a substantial improvement, rising from 58.82% in cycle I to 88.23% in cycle II, reflecting an impressive increase of 29.41%. Similarly, the average score demonstrates enhancement, progressing from 5.29 in cycle I to 7.17 in cycle II, showcasing a positive change of 1.88%.

The provided table summarizes the research results, showcasing success rates and average scores in two study cycles. In Cycle I, the success rate was 58.82%, increasing significantly to 88.23% in Cycle II, indicating a notable positive change of 29.41%. The average score also improved from 5.29 in Cycle I to 7.17 in Cycle II, reflecting a positive change of 1.88%. These results underscore the efficacy of incorporating environmental exploration activities to enhance students' science knowledge and logical thinking skills, as evidenced by the substantial improvements in success rates and average scores between the two study cycles.

The table provides a clear overview of the improvement in children's science knowledge from pre-cycle to cycle II. In the pre-cycle, the total score for the development of children's science knowledge reached 69, with an average of 4.05 and a percentage of 41.17%. This initial state indicated a need for improvement. After the implementation of action research in the first cycle, there was a significant increase, with a total score of 90, an average of 5.29, and a percentage of 58.82%. This positive trend continued in cycle II, where children's science knowledge further increased, reaching a total score of 122, an average score of 7.17, and a remarkable percentage of 88.23%.

These results affirm the effectiveness of the environmental exploration methods in advancing the scientific knowledge of Class B children at RA Miftahun Najah Banyuputih during the specified academic year.

The identified challenges before the action research reflected that children's science knowledge was not progressing well. Issues such as destructive behavior in gardens, stepping on flowers, and littering were observed. Additionally, children exhibited a lack of confidence when expressing themselves, minimal knowledge about plants and natural events, and a disinterest in flora, fauna, and other natural occurrences due to their limited scientific knowledge.

The root causes of these challenges were attributed to monotonous learning methods, a lack of teacher creativity in enhancing science knowledge, large class sizes impacting the learning environment negatively, and the use of traditional teaching methods leading to boredom among children. The teacher's reliance on lecture methods and minimal engaging media further contributed to the lack of interest in the learning process.

It's emphasized that science games in kindergarten, as highlighted by Yuliani Nurani Sujono, aim to encourage children to actively seek information about their surroundings, fostering a more engaging and participatory learning experience (Yuliani, 2009). The positive shift observed in the table demonstrates the success of the implemented action research in overcoming these challenges and progressively enhancing children's scientific knowledge at RA Miftahun Najah Banyuputih.

The implementation of cycle I has brought about noticeable changes in improving children's science knowledge. The outdoor activities have made the learning environment more enjoyable, resulting in increased enthusiasm and active participation from the children. The exploration activities, which involve direct contact with the natural surroundings, have created a different and engaging atmosphere for learning. Through question and answer activities integrated with exploration, children have the opportunity to learn while playing, fostering confidence in asking questions, telling stories, and expressing their opinions. The freedom granted to children to explore the natural surroundings under teacher supervision contributes to a more interactive learning experience.

As stated by Mulyasa, exploration is a type of game activity conducted to learn certain things while seeking fun or entertainment (Mulyasa, 2012). This approach aligns with the positive outcomes observed in cycle I, indicating an improvement in the children's engagement and interest in learning.

Moving to cycle II, there is a further increase in children's science knowledge. Previously disinterested in plants and the environment, children now exhibit curiosity and interest in participating in activities. Notably, they have begun to take responsibility for the cleanliness of their surroundings by disposing of rubbish properly and assisting teachers in cleaning the school environment. The children's enthusiasm and confidence in asking questions and recounting activities have also grown.

During the implementation of exploration activities in cycle II, children's interest and curiosity in trying new things have increased. This has led to a boost in their scientific knowledge, making it easier for them to meet the criteria for completion.

In early childhood, science activities are designed to stimulate curiosity, encourage problem-solving through observation, categorization, and conceptual connections. These activities are seen as a process to nurture talents and interests rather than focusing solely on end products. The emphasis is on practicing skills through simple and enjoyable activities within a playful framework. The primary goal of introductory science activities is not just knowledge acquisition but, more importantly, the

development of children's thinking abilities regarding the surrounding environment and the cultivation of basic logical thinking skills. Young children benefit from diverse opportunities that facilitate science exploration and discovery. Their learning is enhanced when provided with such opportunities to explore and experience science. (Bosse, S., Jacobs, G., & Anderson, 2013).

The potential of young children to engage in scientific practices and develop conceptual understanding. The role of adults is crucial in facilitating children's science learning by asking questions, providing explanations, supporting exploration, and adjusting the difficulty levels of information. It highlights the importance of offering various opportunities for children to explore and experience science, both in formal (school) and informal (home) settings. The developmental process of acquiring science skills and knowledge in young children is recognized, indicating that it may take time for them to understand natural events. Engaging children in experimental learning settings, curated by adults, is emphasized as a valuable approach. This setting allows children to ask questions, explore new information, and build upon their existing knowledge, fostering the development of science skills and knowledge over time (National Science Teachers Association (NSTA), 2002).

Conclusion

The implementation of exploration methods in cycles I and II at RA Miftahun Najah Banyuputih has proven successful in fostering a significant enhancement in children's science knowledge. The transition from a pre-cycle state, marked by limited interest and engagement, to the active participation, increased curiosity, and heightened environmental responsibility observed in cycles I and II, indicates the positive impact of the applied approach. The dynamic and hands-on nature of exploration activities has not only elevated children's enthusiasm but also bolstered their confidence in questioning, storytelling, and expressing opinions. Furthermore, the progressive increase in science knowledge aligns with the objectives of early childhood science activities, emphasizing skill development and logical thinking rather than mere knowledge acquisition. Overall, the exploration methods have effectively transformed the learning experience, creating an environment where children actively engage with and appreciate the natural world around them.

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