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# IMPLEMENTING NEUROSCIENTIFIC PRINCIPLES IN EARLY CHILDHOOD EDUCATION: A CASE STUDY OF TKIT UMAR BIN KHATHAB KUDUS

**Uswatun Hasanah[1], Zakiyah Isnawati[2]**✉
[1]*Institut Agama Islam Negeri Kudus*
[2]*Institut Agama Islam Negeri Kudus*
✉ *Correspondence: isnazakia@iainkudus.ac.id*

***Abstract:*** *An early childhood education teacher must possess adequate knowledge and skills in early childhood pedagogy to ensure that the learning process is effective and efficient. This study aims to reveal teaching techniques that incorporate neuroscientific insights to enhance children's ability to absorb the information provided during lessons at TKIT Umar Bin Khathab Kudus. The research methodology employed is descriptive and qualitative, with data collection conducted through observation, interviews, and documentation. The study participants include a principal, two teachers, 30 students from class B, and two parents. After data collection, the study analyzes the data by relevant theories. The results indicate that the teaching at TKIT Umar Bin Khathab Kudus has adopted neuroscience principles by implementing center-based methods. Teachers' skills in initiating lessons have been observed during the pre-exposure and preparation stages. Furthermore, teachers have conducted the stages of initiation, acquisition, elaboration, and memory incubation in explaining the learning material. Finally, in concluding the learning process, teachers have applied the stages of verification, comprehension checking, celebration, and integration. The teaching skills applied are reflected in the improvement of students' learning outcomes on each indicator.*

***Keywords:*** *Early Childhood Education, Neuroscience, Teaching Skills.*

## A. Introduction

The quality of learning is influenced by the effectiveness of teaching, where the role of educators is pivotal in shaping the educational landscape. Characteristics such as mastery of the subject matter, commitment to students, effective communication, and creativity are essential for teachers, especially in early childhood education. However, in Indonesia, the quality of education continues to face challenges, partly due to the lack of competence among educators. Research has highlighted the relationship between low education quality and the lack of competent teaching practices, emphasizing the urgent need for improvement (Masnipal, 2018).

This study explores the significance of teacher skills in enhancing the learning experience, with a specific focus on early childhood education. While teachers traditionally hold a central role in delivering knowledge, their responsibilities extend beyond mere instruction. The teachers are responsible for instructing students, supporting their overall development, and helping them achieve their academic targets. This involves providing emotional and motivational support and facilitating a positive and effective learning environment tailored to the individual needs of each student. Moreover, the dynamics of contemporary teaching practices emphasize the importance of acknowledging individual differences among students, both cognitively and psychologically (Siti et al., 2021).

Fundamentally, teaching skills form the foundation for effective education, encompassing logical and systematic approaches in planning and delivering lesson materials. Additionally, teachers' influence significantly impacts students' growth and development, shaping their character and academic progress. In early childhood education, especially in Islamic institutions, character formation becomes extremely important, requiring educators' mindful and supportive approach toward their students (Imam et al., 2005).

Neuroscience is the study of the brain and nervous system. The brain regulates all body functions, controlling basic human behaviors such as eating, sleeping, and learning. The brain creates civilization, art, science, language, etc. Educators rarely address this problem (Susanto & Munfarohah, 2020). The main

task of neuroscience is to explain human behavior from the perspective of the activities that occur in the brain. For human life, the brain is like a soul that stores all records of human life. (Nasruddin & Muiz, 2020). Neuroscience in education has produced several theories in quantum learning, such as accelerated learning, quantum learning, brain-based learning, and so on (Muhimmah & Suyadi, 2020).

Building upon previous research on neuroscience-based teaching methods, this study aims to explore the potential of such approaches in enhancing teacher skills and consequently improving learning outcomes. Educators can optimize students' cognitive development and foster a deeper understanding of the subject by creating an engaging learning environment and integrating experiential learning. Moreover, neuroscience-based methodologies enable teachers to identify and address individual interests and talents, promoting a more personalized and practical learning experience (Saifurrahman, 2019).

Neuroscience-based learning plays a significant role in developing the brain's ability to carry out several actions or efforts to improve memory, awareness, and sensitivity. Learning is adjusted to how the brain processes information, and children learn naturally without coercion, tension, fear, etc. Brain-based learning is intended to return learning activities to their essence, especially learning by brain function, to get ideal results. so that the results are optimal. The primary strategy in implementing neuroscience-based learning is to create a challenging learning environment that is not boring and makes learning activities active and memorable for students.

Many educators do not look at children's brain abilities and thinking power. Children are considered miniature adults who know everything. However, the ability of a child's brain to absorb information requires special techniques so that children can understand information more easily and quickly. When educators do not know about neuroscience, the designed learning does not consider how children's brains work. Initially, at TKIT, Umar Bin Khatab Bakalan Purwosari Kudus often held story-telling activities, but 17 out of 30 children could not grasp the story's content when asked again about it. When examined more deeply, educators' teaching techniques do not suit the child's thinking

power, such as using story books that are not appropriate for the child's age, using language that is not appropriate for the child's age, such as the words "decompose", "recycle," "residue" when talking about waste. This made TKIT Umar Bin Khatab Bakalan Purwosari Kudus create neuroscience-based learning activities. Researchers want to look more deeply into learning techniques with neuroscientific insights.

Teachers' expertise in implementing innovative and evidence-based teaching strategies is key to improving the quality of education. By honing their teaching skills, educators can empower students to explore their full potential and cultivate a lifelong love for learning. This study aims to contribute to the ongoing discussion on education enhancement by highlighting the crucial role of teacher competency in shaping the future of education in Indonesia.

## B. Method

This research adopts a descriptive qualitative approach, focusing on neuroscience-based teaching skills in Early Childhood Education Institution, TKIT Umar Bin Khatab Bakalan Purwosari Kudus (Anggito et al., 2018). This approach allows researchers to gain a deep understanding of the observed phenomena and to describe the actual conditions in the field. The research takes place at TKIT Umar Bin Khatab Bakalan Purwosari Kudus. The selection of TKIT Umar Bin Khatab as the research setting is based on several considerations, including the absence of previous research related to neuroscience-based teaching skills, the strategic location of the school, and the differences in teaching methods applied (Nugrahani, 2014). The subjects of the research participants consist of a school principal, two teachers, 30 students in class B, and two parents at TKIT Umar Bin Khatab Bakalan Purwosari Kudus. Involving these research subjects allows the researchers to gain in-depth insights into neuroscience-based teaching skills from their perspectives (Mubarok et al., 2021).

Primary data is obtained through interviews with the school principal and classroom teachers, while secondary data is obtained from documents related to learning at TKIT Umar Bin Khatab (Nugrahani, 2014). Data collection techniques include

observation, interviews, and documentation (Gainau, 2016). Observation is conducted to observe the learning conditions directly, interviews are used to gather in-depth information from research subjects, and documentation is utilized to collect written data related to the research (Siyoto et al., 2015). Data analysis is conducted through data reduction, presentation, and conclusion (Nugrahani, 2014). Data reduction is conducted to narrow the focus and organize the data, data presentation is used to illustrate the information found, and conclusions are drawn to connect the findings with the research objectives (Nugrahani, 2014).

## C. Result and Discussion

The research results show that new teaching techniques based on neuroscientific insights make learning more colorful and interactive and make children think more critically. This is because attention is paid to children's brains, and they like attractive, fun, and interactive activities. Implementation of neuroscience-based learning includes activities from opening to closing in learning. These activities include opening, central, and closing activities. Opening activity is carried out to prepare children mentally and physically to participate in learning activities. This activity is connected to discussions on the themes and topics that will be carried out.

Activities that can be carried out include marching, saying hello, praying, memorizing short surahs, memorizing hadiths, and telling stories or sharing experiences according to the topic to be discussed. Core activities can shape children's judgment, skills, and social, psychological, and emotional abilities. This activity can be achieved by providing opportunities for children to investigate and analyze. As a result, they can improve their ideas and imagination, and activities can improve understanding and concentration and develop habits of doing activities well. Closing activity: This activity is the final activity that can be carried out by understanding the story, recalling, conveying the next day's activities, providing knowledge of awareness, and singing and praying.

Learning activities at TKIT Umar Bin Khatab Bakalan Purwosari Kudus based on neuroscience insights begin with an opening

activity. In this opening activity, educators carry out a routine, starting with greetings, prayer, and attendance and continuing with an introduction to the theme and topic that will be presented. The theme and topic at that time were "I Love the Earth," with the topic "caring for the surrounding fruit plants." The educator explains by giving an apperception about fruit plants. Educators ask children to tell stories about fruit plants that children know about to arouse children's curiosity. Educators prepare various fruit plants in pots placed in the schoolyard. Children are asked to leave the classroom to see, touch, and differentiate one plant from another.

This data shows that children's enthusiasm when given learning activities during apperception makes them critical in naming the fruit plants around them along with their differences. During core activities, educators choose play activities according to children's interests. The main activities of the day were divided into three: the first was the activity of mixing soil, husks, and fertilizer according to the measurements, the second was the activity of decorating pots, and the third was the activity of children preparing planting seeds, taking water and starting to plant them.

From the core activities, children are invited to carry out actual activities to stimulate their brains, from abstract thinking about plants to the stage of concrete thinking with fun activities. In the closing activity, children were invited to evaluate which activities were easy to do and who succeeded in planting and giving awards to those who completed all stages of the learning process. In the closing activity, the educator recalls the planting activities and how to care for the plants and asks about the children's feelings when carrying out the activity.

The closing activity ends with a prayer, alert messages, and greetings. The lesson plan is the process of preparing activities that will be carried out to achieve the expected goals. Planning plays an important role in determining implementation and evaluation steps. The results of the interview with Educator 1 stated that when planning activities by paying attention to knowledge about neuroscience, children absorb information more quickly. This increase is felt gradually from 10-15 percent to the increase in children absorbing information in learning.

So, it is easier for educators to identify techniques that should be used in teaching children. Using teaching techniques with neuroscientific insight makes learning easier for children to understand. That is what raises children's enthusiasm to participate in the learning process.

In this technique, teachers can carry out experimental activities that can increase children's curiosity besides making children think about solving problems. As continued by Educator 2, it was stated that learning that pays attention to how the child's brain works can influence the child's critical abilities. This happens when a hand-washing tap leaks; children complete it according to their ideas, providing a new experience. Some children fix leaking water taps by wrapping them in plastic food wrap; some take masking tape to stop the leak. The way children fix the water tap is what makes educators successful in providing learning that facilitates children to think about solving simple problems.

This research investigates the implementation of neuroscience-based teaching skills among TKIT Umar Bin Khathab Bakalan Purwosari Kudus teachers, focusing on lessons' opening, explanation, and closure stages. The results reveal a significant improvement in student achievement before and after implementing neuroscience-based teaching methods. Here is a discussion of these findings in the context of each teaching stage:

Opening the Lesson:

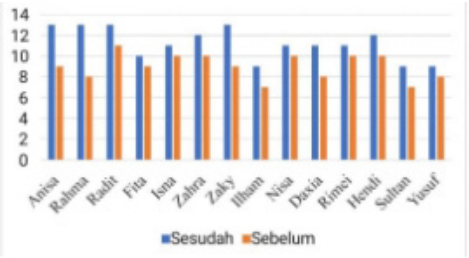


**Figure 1**. Comparison of Student Achievement Before and After Implementing Neuroscience-Based Learning Opening Activities at TKIT Umar Bin Khathab

In Figure 1, it is explained that teachers demonstrate expertise in preparing students for learning by guiding

readiness, motivation, and overall preparedness. Teachers prepare educational game tools about fruit plants. It can be seen from the opening activity that educators provide apperception in the form of knowledge of various types of fruit plants in pots, almost all of them can reveal the characteristics of each fruit plant, not only that, children can ask how plants can grow, what's the difference if plants are planted in pots? pots and in the ground, and other questions. This activity succeeded in making children think concretely.

Children can tell stories about the fruit plants planted around their house. Some talk about having mango trees and banana trees, and some talk about their chili trees. Apart from planting media, educators also explain through video media the process of plant growth, starting from the roots until the plant bears fruit. After carrying out the apperception activity, the teacher invites them to sing a song with the title fruit. With fun songs, children memorize the fruit songs they are introduced to more quickly. This action aligns with the pre-exposure phase and teaching preparation steps. It is noted that student achievement increases after neuroscience-based learning opening activities are conducted.

Such preparations include physical activities like gymnastics, movement, songs, greetings, and listening to children's stories. Teachers' teaching preparations align with early childhood brain development principles, which emphasize the more active lower brainstem (Suyadi, 2017). A study found that children in a group that was tough with educational game tools outperformed those that were tough without (Diningrat et al., 2022).

In the pre-exposure stage, teachers should also be able to stimulate children's emotions to prepare them for learning. Learning enjoyable for children will be well-received by the brain (Martha Kaufeldt, 2009). Furthermore, learning that begins with joy will activate the neurotransmitter dopamine, which contributes to creating learning motivation and focus of attention (Siregar et al., 2018).

Explanation of the Lesson:

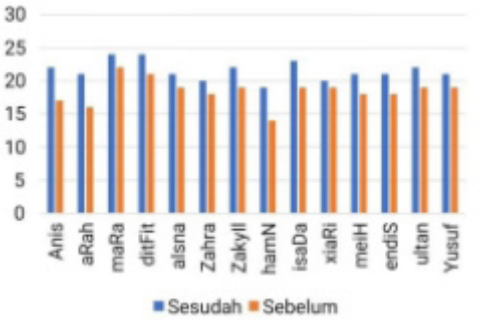


**Figure 2.** Comparison of Student Achievement Before and After the Implementation of Neuroscience-Based Learning Explanation Activities at TKIT Umar Bin Khathab

In Figure 2, it is explained that during this phase, teachers effectively deliver lesson content using language that is easily understood and engages students in the learning process. Children can measure the proportional ratio of the amount of soil, husks, and fertilizer; children also enjoy exploring their ideas when decorating pots in the school garden; apart from that, all children work together in fetching water and preparing grain. Tubers to tree trunks that the children will plant. After that, the children and their parents plant fruit plants together that are chosen according to the children's interests. Parents stated that actual learning activities carried out by children made them feel more directly about planting trees. The selection of appropriate teaching media and reinforcement is also noted. These actions align with the initiation and acquisition stage, elaboration, and memory incorporation in teaching. There is an increase in the level of student achievement after the teacher explains neuroscience-based lessons.

The parts of the brain that play a role in the initiation, acquisition, and elaboration stages are the temporal lobe, parietal lobe, and occipital lobe, which facilitate perception, encoding, and retrieval of knowledge. The hippocampus also plays a role in recording data on learning outcomes (Tyng et al., 2017). The incubation stage, conducted by the teacher, involves providing rest time and repetition for the children. This way, the learning outcomes will be retained longer in the hippocampus.

Anatomically, the hippocampus is adjacent to the amygdala, which plays a role in emotions. Emotions greatly influence the memory process (Dr. Amir Zuhdi, 2020).

Lesson Closure:

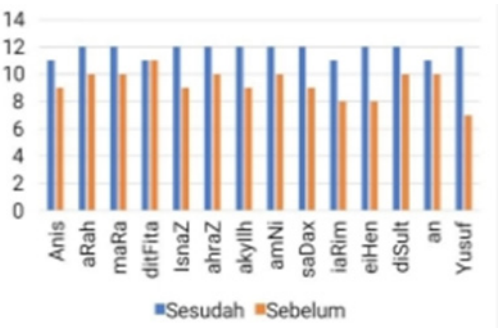


**Figure 3.** Comparison of Student Achievement Before and After the Implementation of Neuroscience-Based Learning Closure Activities at TKIT Umar Bin Khathab

In Figure 3, it is explained that teachers demonstrate expertise in summarizing the material and evaluating student learning outcomes during the lesson closure phase. The children successfully answered educators' questions regarding various types of fruit plants and differentiated their characteristics. Educators evaluate who has succeeded in planting fruit from their chosen seeds. This includes verification, belief checking, celebration, and integration stages. Student achievement shows improvement after a neuroscience-based lesson closure is conducted.

In the verification stage, teachers assist children in summarizing the newly learned material to strengthen memory. Children's brains can develop through interactions with peers and teachers. Teacher guidance can help children improve their skills in acquiring knowledge (Boeree, 2007). The celebration stage is conducted during lesson closure. Teachers create a fun atmosphere by engaging in interactive recollection, singing together, motivating children, praising them with verbal rewards, and informing them about the preparation for the next lesson. This aligns with Jensen's opinion that learning reaffirmed with fun will be easier for children to remember (Jensen, 2011).

According to neuroscience, the early childhood period, from 0 to 6 years, emphasizes the importance of movement stimulation as a primary foundation for creating healthy emotions. Before starting the learning process, providing physical stimulation to children or preparing their bodies for learning is crucial. According to neuroscience research, physical activity opens the door to cognitive brain functions, which play a significant role in learning. Movement stimulation affects emotions and triggers the release of serotonin and other happy hormones, which support a positive mood.

Therefore, movement should be an integral part of early childhood learning processes. An approach that emphasizes outdoor activities for about 70 percent and indoor activities for rest and other activities for about 30 percent is more suitable for children's needs. Continuous indoor learning can reduce its effectiveness, causing children to become restless and less able to manage their emotions, leading to aimless behavior, such as taking toys from peers or fighting (Siegel et al., 2011).

However, Daniel Goleman, in his work "Emotional Intelligence," considers emotional intelligence a far more vital intelligence factor than mere intellectual intelligence. Emotional intelligence was introduced in 1990 by Peter Salovey of Yale University and John Meyer of the University of New Hampshire to explain traits crucial to success (Daniel Goleman, 2002).

A child is an individual who, at a certain point in time and stage of development, has the potential to develop intelligence. He also believes that emotions are essentially unique feelings and thoughts, representing biological and psychological conditions and a set of tendencies to act. Emotions can be classified into various types, including anger, sadness, fear, love, surprise, and frustration (Wade, 2007).

As for boys, the need for movement is often greater, as reflected in the larger size of the hypothalamus compared to females. Boys also tend to feel hungry more quickly, disrupting their focus during learning. Therefore, to ensure effective learning, children need to be happy and comfortable, as this allows the information learned to enter long-term memory. The importance of positive emotions in learning is also emphasized at the conclusion stage of learning. Directing children towards a good mood helps them

to recall what they have learned and increases their motivation to return to school enthusiastically the next day. In conclusion, the learning approach for early childhood should acknowledge the significant role of movement in optimizing children's potential.

The brain principles in learning presented by Amir Zuhdi highlight the necessity of a comfortable environment, the utilization of all senses, and active engagement in the learning process. Alongside this, understanding the parts of the brain that play a role in learning enables teachers to design more effective teaching strategies. By comprehending and applying these principles, brain-based learning can become more effective and beneficial for children's development (Amir Zuhdi, 2020).

In addition to Amir Zuhdi's brain principles, Zulfaini Sesmiarni uses a brain-friendly learning model. This model closely correlates with insights from neuroscience learning because both emphasize applying neuroscience principles in the context of learning. They both discuss neuroscience principles such as brain plasticity, the use of emotions in learning, and multisensory stimulation, which can be applied in designing more effective learning experiences. Additionally, neuroscience learning insights also delve into how the human brain learns and processes information, emphasizing the importance of considering the role of emotions in the learning process by emphasizing optimizing the learning environment to support brain development, utilizing technology as a learning aid, and developing engaging learning strategies that trigger active student involvement (Zulfaini Sesmiarni, 2014).

The stages of learning that can be correlated include information delivery, information processing, and concept mastery. Firstly, in the information delivery stage, both emphasize the importance of using brain-stimulating teaching methods, such as storytelling or strong visualization, to enhance students' comprehension. Thus, information can be presented in a more engaging and easily understandable manner for students' brains. Then, in the information processing stage, the books might discuss strategies to strengthen neuron connections and facilitate long-term memory formation.

This could include using active learning methods that encourage students to think critically, collaborate, and participate directly

in the learning process. Neuroscience insights will also provide insights into how the brain effectively processes information, allowing educators to design learning experiences that align with the brain's workings. Lastly, in the concept mastery stage, both sources can assist in designing learning experiences that enable students to link new information with existing knowledge in their memories. This can be done by leveraging neuroscience principles emphasizing the importance of repetition, using variations in teaching, and providing constructive feedback. Thus, students can deeply understand and master the concepts learned (Zulfaini Sesmiarni, 2014).

This research emphasizes the importance of implementing neuroscience-based teaching strategies in early childhood education settings such as TKIT Umar Bin Khathab Bakalan Purwosari Kudus, highlighting their positive impact on student learning outcomes. Furthermore, the recommendations aim to facilitate continuous improvement in teaching practices and enhance the overall educational experience for young learners.

## D. Conclusion

The effectiveness of teaching practices significantly influences the quality of learning in early childhood education, and educators' roles are crucial. Mastery of subject matter, commitment to students, effective communication, and creativity are essential for teachers, particularly in early childhood education. In Indonesia, however, the quality of education faces challenges, partly due to a lack of competence among educators. This study highlights the relationship between low education quality and insufficient teaching practices, underscoring the need for improvements.

Exploring teacher skills in enhancing the learning experience, especially in early childhood education, reveals that teachers' responsibilities extend beyond instruction. They must support students' overall development and academic goals by providing emotional and motivational support and creating a positive learning environment tailored to individual needs. Contemporary teaching practices emphasize acknowledging individual cognitive and psychological differences among students.

Teaching skills form the foundation for effective education, involving logical and systematic approaches to planning and delivering lesson materials. Teachers' influence impacts students' growth and development, shaping their character and academic progress. This is especially crucial in early childhood education, where character formation requires a mindful and supportive approach from educators.

Neuroscience-based teaching methods have shown promise in enhancing teacher skills and improving learning outcomes. Educators can optimize cognitive development and foster deeper understanding by creating engaging learning environments and integrating experiential learning. Neuroscience-based methodologies also enable personalized learning experiences by identifying and addressing individual interests and talents.

Neuroscience-based learning plays a vital role in developing the brain's ability to improve memory, awareness, and sensitivity. This approach adjusts to how the brain processes information, allowing children to learn naturally without coercion or fear. Implementing brain-based learning aims to return learning activities to their essence, optimizing results by creating challenging, engaging, and active learning environments.

The study at TKIT Umar Bin Khatab Bakalan Purwosari Kudus illustrates the effectiveness of neuroscience-based teaching techniques. These methods have transformed learning into a more interactive, critical thinking-driven process by focusing on how children's brains work. The findings demonstrate significant improvements in student achievement before and after implementing neuroscience-based teaching methods, underscoring the importance of teacher competency in shaping the future of education in Indonesia.

Educators can empower students to explore their full potential and cultivate a lifelong love for learning by honing their teaching skills and adopting innovative, evidence-based strategies. This study contributes to the ongoing discussion on education enhancement, emphasizing the crucial role of teacher competency in improving educational outcomes.

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