Improving Critical Thinking Skills Based on Neuroscience in Islamic Education Learning

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Abstract

Students' critical thinking has been a significant concern within education development efforts, and this needs to be addressed and promoted by teachers. However, most teachers barely promote this skill, especially related to Islamic education, which leads to more challenges for students in learning Islam. Therefore, encouraging innovation and strategies to develop students' critical thinking in learning Islam is necessary. This research aims to analyze the implementation of the neuroscientific approach and how it can develop students' critical thinking skills. This research used a Quasi-Experimental method with a pretest-posttest design. Eighth-grade students at SMPN 1 Talangpadang Tanggamus were the population of this research. Only two classes, Class VIII.1 (experimental class) and Class VIII.3 (control class) were used as the research sample chosen using simple random sampling. The result of the research showed that the neuroscientific approach has a significant influence on improving students' critical thinking skills. However, the degree of the influence was varied across the data. Moreover, this research also showed that the implementation of the neuroscientific approach in learning should be explored and expanded to promote students' critical thinking skills.

Keywords: Critical Thinking, Islamic Education, Neuroscience.

Abstrak

Students' critical thinking has been a significant concern within education development efforts, and this needs to be addressed and promoted by teachers. However, most teachers barely promote this skill, especially related to Islamic education, which leads to more challenges for students in learning Islam. Therefore, encouraging innovation and strategies to develop students' critical thinking in learning Islam is necessary. This research aims to analyze the implementation of the neuroscientific approach and how it can develop students' critical thinking skills. This research used a Quasi-Experimental method with a pretest-posttest design. Eighth-grade students at SMPN 1 Talangpadang Tanggamus were the population of this research. Only two classes, Class VIII.1 (experimental class) and Class VIII.3 (control class) were used as the research sample chosen using simple random sampling. The result of the research showed that the neuroscientific approach has a significant influence on improving students' critical thinking skills. However, the degree of the influence was varied across the data. Moreover, this research also showed that the implementation of the neuroscientific approach in learning should be explored and expanded to promote students' critical thinking skills.

Introduction

As an integral part of the character building and intelligence of the Muslim community, Islamic education has faced many challenges with the demands of the rapid development times. This challenge extends from the classic problem of the tendency of conservatism and exclusivism in religious education in the global era (Abdullah, 2017), curriculum (Baharuddin et al., 2024; El-Mubarak & Hassan, 2021); new media including mental injuries, addiction, and sexual deviation of virtual space, weakening of family relationship, cultural anomalies, and illegitimate communication (Dalimunthe et al., 2023); integrating technology and 21st skills in learning (Fauziah et al., 2023); and management aspect (Mansir et al., 2023).

In facing these challenges, the education sector should prioritize developing critical thinking skills for students' daily lives and society (Trinova et al., 2020). Therefore, teachers should promote practical approaches to developing critical thinking skills while improving the students' cognitive abilities for their knowledge and better future. In this case, Islamic education aims to uphold the dignity and nobility of intelligence and knowledge and the vision of culture and values that require higher-order thinking (Dahari et al., 2019).

In some literature and previous research, various problems still indicate that critical thinking skills have not been a primary focus of development strategy, including learning Islam (Payam, 2015). These problems are mainly about the evaluation systems in Islamic education that only focus on rote learning and information reproduction rather than analysis and evaluation of Islamic concepts, which can hamper the development of critical thinking. Students seem to prefer to understand concepts without being able to apply, analyze, or evaluate them (Hasanah & Fadilah, 2021).

Moreover, the inability to utilize technology and interactive resources in teaching Islamic studies can reduce student engagement and involvement. Using up-to-date technology can promote a more dynamic learning experience, stimulate critical thinking, and make learning relevant to daily life (Gökçearslan et al., 2017). The other issue is the lack of innovation in teaching methods, often leading to boredom and insufficient mental stimulation for students. Passive teaching methods, where students receive information without stimulating critical thought, can significantly hinder the development of critical thinking skills (Sari & Wardhani, 2020).

Student involvement in discussion can be a significant concern in improving students' critical thinking skills. The lack of opportunities to participate in discussions, such as involving analysis and synthesis of religious concepts, can limit students' ability to develop their critical thinking skills. Well-structured and motivational discussions stimulate critical thinking (Fuad, 2020). One of the solutions to improve critical thinking skills, according to Milto's research, is interactive learning (Milto et al., 2020).

Based on these issues, it is important to address the urgency of critical thinking skills for students who need a more holistic and focused approach. In this case, one effective strategy is integrating neuroscience findings into learning. Neuroscience offers a profound understanding of how the human brain develops and learns, providing a solid scientific basis for designing more effective learning strategies. Most previous research has not focused on studying the use of a neuroscience approach in Islamic religious education learning. However, there are specific efforts to integrate it with the development of the character education curriculum (Pambayun et al., 2022). This study is still not specific to aspects of Islamic religious education but rather to the broad context of Islamic kindergartens. Therefore, this research aims to describe the effectiveness of the neuroscience approach in improving students' critical thinking skills in Islamic religious education.

From the researcher's observation of the preliminary research at SMPN 1 Talangpadang Tanggamus, many lazy students still learn Islamic religious education because they assume it is boring. That is because the teacher only uses the lecture and assignment methods. Related to the teaching and learning activities, students feel passive because they mostly just sit still and listen. Students rarely ask questions or give opinions; even if the teacher asks questions, students cannot answer them. Therefore, students critical thinking skills are still in the low category, affecting learning outcomes (Hasanah, 2023).

The causes of student's inability to be active in a class are mostly about fear of being wrong and lack of confidence or lack of knowledge about Islamic religious education. This issue is primarily related to the learning activities in Islamic religious education subjects, which can be considered as having low critical thinking skills. It is also proved by the results of observations with several students in class VIII SMPN 1 Talangpadang Tanggamus, as the majority of students expressed that their main difficulty was not only understanding the material well but also being unable to solve problems and not accustomed to thinking critically (8th Grade Students, personal communication, 2023).

Based on interview data, student learning outcomes reaching 70 KKM were only 42%, while the other 58% were still below the KKM. Based on this data, one alternative that can be improved is using the Neuroscience approach. This strategy can be applied in learning to achieve maximum competence. Therefore, this research aims to describe the effectiveness of the neuroscience approach in improving students' critical thinking skills in Islamic religious education.

Methods

In this study, the researcher used a quantitative experimental research method with a quasi-experimental research design and a "Pretest-posttest control group" design. This research design was carried out on two sample groups. In these two groups, one was proposed as an experimental group (given treatment), and the other was assigned as a control group (not given treatment). The experimental and control groups were given pretest and post-tests to see the effect of experimental and control treatments.

This research was conducted at SMPN 1 Talangpadang Tanggamus in class VIII in the first semester of the 2022/2023 academic year. The population in this study were all students of VIII grade at SMPN 1 Talangpadang Tanggamus in the 2022/2023 academic year, including class VIII 1, class VIII 2, class VIII 3, class VIII 4, class VIII 5, class VIII 6, class VIII 7 and class VIII 8. The samples used as research subjects were taken using a purposive sampling technique, which was used to select 2 classes out of 8 existing classes. The chosen classes were based on the teacher's consideration, resulting in classes VIII 1 and VIII 3 being selected as the research sample. The data collection methods were tests, documentation, and interviews. The validity and reliability tests were tested and showed high scores, while the hypothesis was analyzed using a *T-test*.

Results and Discussion

Before discussing the test results, the relevant theories and frameworks will be covered to strengthen the discussion and findings. That will also provide more transparent direction and context for the reader. The first topic will be the relationship between the neuroscience approach and Islamic Education. The second topic will be how Islamic Education views students' critical thinking skills. These discussions will give the research a more specific context, highlighting its relevance and importance. They will also help to

clarify how the research findings can be applied in educational settings and inform future studies.

The Neuroscience Approach and Its Relation to Islamic Education

Neuroscience is considered part of studies specializing in the nervous system, neurons, or nerve cells, as viewed from various disciplines of studies and approaches. Neuroscience can also be considered a field of knowledge focusing on studying the nervous system. Neuroscience studies the brain and spinal nerves and their functions (Dewi et al., 2018). Neuroscience is a part of biology science, further expanding and collaborating with other studies such as biochemistry, physiology, psychology, and other scientific disciplines. Psychology, which is mostly about mental processes, can be considered a branch of neuroscience. In this case, some scholars from mind-body experts disagree on this matter. The reason is that psychology analyzes the mental processes that can be controlled scientifically, such as in traditional behavioral and cognitive psychology's perspective on how the process of neural works, while neuroscience can explain human behavior patterns by analyzing the brain, its waves, and any activities inside it (Muhimmah & Suyadi, 2020).

The primary purpose of neuroscience is to understand the pattern of human behavior by looking at the responses and activities happening inside the brain. Some advanced neuroscience research proved the connection between the human brain and behavior. Some technological innovations, such as Positron Emission Tomography (PET), show that the brain system has some correlations and is even integrated as the result of human behavior (Ahmad, 2019).

While many other disciplines can be integrated or correlated toward neuroscience, the potential of integrating neuroscience and Islamic education can be optimized from various aspects. In Islamic religious education, the physical body is a human physique, one part of which is the brain. The brain is divided into 3 parts: the left, right and middle. The brain's work is called intelligence (*aql*). The development of *aql* or intelligence leads to many forms, such as IQ, EQ, and SQ-MaQ. In psychological terms, IQ, EQ, and SQ-MaQ are called cognitive, affective, and psychomotor. In Islamic education, various terms that become elements of *insan kamil* are understood partially and remarkably, so they are often jumbled. That is due to Islamic thought, which tends to be dichotomous or black and white (*halal/haram*; sin/reward; heaven/hell) (Muhimmah & Suyadi, 2020).

The main goal of Islamic education is also about optimizing human potential. In this case, most of the human potential relies on the brain. Therefore, it is crucial to analyze neuroscience further for human development (Suyadi & Widodo, 2019). Interpreting the *'Aql* concept (reason) from the neuroscience perspective can serve as a solid normative theological foundation in developing critical, creative, and innovative thinking in Islamic education. Educators can design more effective learning strategies by understanding *'Aql* not only as an abstract mental faculty but also as a manifestation of complex brain functions (Meliani et al., 2023). This approach integrates scientific understanding of brain function with Islamic values and principles, creating a comprehensive framework for improving students' higher-order thinking skills. Consequently, Islamic education can be more responsive to the demands of modern times while remaining rooted in the fundamental teachings of the religion. Furthermore, it encourages students to develop a deeper and more critical understanding of Islamic teachings and the ability to apply them innovatively in various life contexts (Rofdli & Suyadi, 2020).

Neuroscience can be traced from the Islamic perspective, while Islamic education can also be interpreted from a neuroscience point of view. Therefore, Islamic education can be integrated and connected with neuroscience. Through interpretive methods in intellectual intertextuality with emphasis on the meaning of creativity, the integration of Islamic education and neuroscience can be formulated, leading to neuroscience Islamic Education (Wijaya, 2018).

In improving neuroscience-based critical thinking skills in Islamic religious education learning, understanding the role of neurotransmitters such as dopamine is very important. Dopamine, often referred to as the "happy hormone," plays a crucial role in learning and critical thinking. Neuroscience shows that dopamine release occurs when the brain receives a positive stimulus, including when students successfully solve problems or understand new concepts in Islamic Religious Education learning (Miftakhurrohman & Suyadi, 2020). Therefore, integrating this understanding into Islamic religious education teaching methods can improve learning effectiveness and develop critical thinking skills. An Islamic education approach that ignores or rejects this understanding of neuroscience can be detrimental to students, as it does not utilize the brain's natural potential in the learning process. On the contrary, by integrating neuroscience principles into Islamic religious education learning, educators can create a learning environment more conducive to developing critical thinking while maintaining Islamic teachings' integrity.

Integrating Islamic education and neuroscience to optimize students' critical thinking skills is an innovative approach combining traditional Islamic wisdom with a modern understanding of brain function. This approach aims to create more effective and holistic learning methods by utilizing neuroscience insights to design teaching strategies that align with how the brain works while maintaining the integrity of Islamic values. Through this integration, educators can develop a curriculum that not only strengthens the scientific foundations of Islam but also stimulates areas of the brain related to critical thinking. The most relevant learning experience for students is increasing their engagement in learning and maximizing their cognitive potential (Miftachurrozaq & Suyadi, 2023; Suyadi, 2019).

This approach also helps bridge the gap between traditional Islamic education and the demands of the modern world, preparing students to face the complexities of contemporary society with a strong understanding of Islam and sharpened critical thinking skills. Thus, this hybridization optimizes critical thinking skills and enriches Islamic education with a more robust scientific dimension, creating a generation of Muslims who can think critically while still adhering to their religious teachings.

Critical Thinking in Islamic Religious Education Learning

Critical thinking is students' ability to think logically and reason logically with high curiosity about the clarity and accuracy of information. Critical thinking contains questions, experiments, and beliefs about the knowledge obtained, the ability to solve problems rationally according to logical stages, and the provision of more efficient problem-solving results. According to Ennis, critical thinking is essential for students to solve problems and make good and correct decisions. By developing critical thinking skills, students will be able to explore the information and seek the facts while being open to new ideas and alternatives, be more able to think systematically, and use their curiosity to solve their problems (Arsanti et al., 2021).

There are two phases in the critical thinking process. The first phase is when students build their thoughts in the form of basic ideas, principles, and theories inherent in the content. This phase is called internalization. The second phase occurs when students effectively use these ideas, principles, or theories in life as a form of application. Critical thinking plays an essential role in Islamic Education, offering a pathway for students to engage with the teachings and principles of Islam profoundly and analytically. In Islamic Education, critical

thinking involves assessing, analyzing, and evaluating religious concepts, texts, and beliefs with a discerning mind (Mulyani, 2022).

One of the primary goals of incorporating critical thinking in Islamic Education is to empower students to go beyond memorization and embrace a more thoughtful and reflective approach to understanding their faith. It involves questioning, interpreting, and applying religious knowledge to real-world scenarios, fostering a deeper connection between theoretical teachings and practical life (Rahardhian, 2022). Moreover, critical thinking encourages students to explore different perspectives within Islam, promoting tolerance, open-mindedness, and a nuanced understanding of the diverse interpretations within the Islamic tradition. It goes beyond the surface-level understanding of religious texts, encouraging students to delve into the historical, cultural, and social contexts that shape Islamic teachings (Dahari et al., 2019).

In essence, integrating critical thinking into Islamic religious education enhances intellectual abilities. It nurtures a more informed, compassionate, and well-rounded individual who can navigate the complexities of the modern world while staying rooted in the principles of Islam. Neuroscience-based Islamic education enhances critical thinking in the millennial generation (Putra & Suyadi, 2022). This approach aligns with the broader objectives of Islamic education, aiming to produce individuals who not only possess religious knowledge but can also apply it judiciously in various aspects of their lives.

The teachers are crucial in improving critical thinking skills in Islamic religious education learning. Teachers play a crucial role in developing critical thinking skills. That is closely related to the effectiveness of the nervous system in implementing the cognitive, affective, and psychomotor aspects for each student. By understanding the realm of assessment and educational goals based on the principles of neuroscience, the Islamic Education learning process can become more measurable and focused. The neuroscience approach enables teachers to identify and prioritize areas that need improvement in students' critical thinking skills regarding Islamic religious education materials. It allows teachers to design appropriate interventions to address these shortcomings. As a result, there can be a more comprehensive development of critical thinking skills in Islamic religious education learning while still upholding Islamic values and principles (Huda & Widodo, 2022).

In addition, integrating neuroscience into Islamic religious education learning can assist teachers in designing teaching strategies that stimulate various areas of the brain associated with critical thinking. For instance, activities can involve analyzing Islamic texts,

discussing contemporary issues from an Islamic perspective, or solving problems based on Islamic values. This approach enhances students' understanding of Islamic teachings and cultivates their ability to think critically and analytically within a religious framework.

Improving Critical Thinking Skills Based on Neuroscience in Islamic Education Learning

SMPN 1 Talang Padang Tanggamus was chosen as the research site, with the research samples divided into two groups. Class VIII 1 functioned as the experimental group, receiving a neuroscientific approach in the teaching model. At the same time, Class VIII 3 served as the control group, receiving conventional teaching using a question-and-answer method. After the treatment was administered to each group and research data (pretest and post-test) were obtained, the next step involved the computation and analysis of these data. There was a significant difference between the neuroscientific and conventional approaches regarding students' critical thinking skills.

Statistical hypothesis: a. Ho: $\mu_1 = \mu_2$: (There is no difference in improving critical thinking skills between the experimental and control classes). b. Ha: $\mu_1 \neq \mu_2$: (There is a difference in enhancing critical thinking skills between the experimental and control classes). The experimental results data is elaborated as follows:

Table 1. T-test

Paired Samples Statistics

		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	Pre-Test	60,40	30	11,970	2,185
	Post-Test	78,70	30	7,447	1,360

Paired Samples Test

		Paired Differences							
					,05% Confidence Interval of the Difference				
		Mean	Std. Deviation	Std. Error Mean	Lower	Upper	t	df	Sig. (2-tailed)
Pair 1	Pretest - Pos Test	-18,300	14,123	2,578	-18,302	-18,298	-7,097	29	,000

Based on the output of Pair 1, it obtained a sig value (2-tailed) 0,000 < 0,05. Therefore, it can be concluded that there is a difference in students' critical thinking between the pretest and post-test in the experimental class (neuroscience approach). Based on the

output, Pair 2 obtained a Sig Value. (2 tailed) 0,000 < 0,05 Therefore, it can be concluded that there is a difference in students' critical thinking between the pretest and post-test in the control class (conventional method). The results of the effect size test calculation are as follows:

$$d = \frac{m_A - m_B}{\left[\frac{(sd_A^2 + sd_B^2)}{2}\right]^{1/2}}$$

$$d = \frac{78,7 - 68,16}{\left[\frac{7,44705 + 11,1141}{2}\right]^{1/2}}$$

$$d = \frac{6,7373}{6,50205}$$

$$d = 1,03618089 \, (High \, category > 0,8)$$

The effect size test determines the Neuroscientific Approach's effectiveness in improving students' critical thinking skills. In this study, the Hake formula is utilized to calculate the efficacy. This effectiveness calculation can be performed by comparing the scale of post-test values among students.

The researcher utilizes Excel software, and an effect size of d=1.036 is obtained, which falls into the category of "high" (> 0.8). Consequently, it can be concluded that the learning process utilizing the neuroscientific approach effectively enhances the critical thinking skills of eighth-grade students at SMPN 1 Talangpadang Tanggamus.

This research proved that using Neuroscience in teaching Islam to students is quite effective. Therefore, teachers can design their teaching instruction based on active and problem-based learning to promote students' critical thinking skills and provide a better understanding of Islamic teaching. Moreover, the neuroscience approach can also help improve the students' memorization and apply the teachings of Al Quran and Hadits. That is because when the emphasis is placed on understanding the brain's function and optimizing learning processes, students can more effectively engage with and retain Islamic teachings.

Improving critical thinking skills through the neuroscience approach aligns with Islamic education's goals to optimize human potential, especially brain potential. Neuroscience contributes to developing *'aql* (reason) in Islamic education (Jailani et al., 2023). So, the neuroscience approach allows students to be more active in learning, explore information, and solve problems systematically. It encourages students to not only understand the concepts in Islamic education but also to be able to analyze, evaluate, and apply them in everyday life.

The results of this study also confirm the importance of innovation in Islamic education teaching methods. Furthermore, thw Islamic education curriculum has integrated neuroscience for student character development (Arif et al., 2022). The neuroscience approach can solve problems such as student boredom, lack of mental stimulation, and limitations in developing critical thinking skills. By integrating an understanding of how the brain works into the learning process, educators can design more effective teaching strategies to improve student's critical thinking skills in the context of Islamic education.

Conclusion

Based on the data analysis and discussion above, the researcher can conclude that the neuroscientific approach effectively improves the critical thinking skills of eighth-grade students at SMPN 1 Talangpadang Tanggamus. It is evident in the proof from the effect size test, which yielded a value of $d=1.036 > 0.8$, categorizing it as "high." Therefore, it can be concluded that utilizing the neuroscientific approach effectively enhances critical thinking skills. The effectiveness of the neuroscientific approach is further supported by the average N-Gain values, where in Class VIII.1 (experimental class), it is more significant than in Class VIII.3 (control class), with a value of $0.39 > 0.21$.

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