p-ISSN: 2809-7122
e-ISSN: 2809-7343
tadbiruna
Jurnal Manajemen Pendidikan Islam
Volume 5 Nomor 2 2026 http://jurnal.iuqibogor.ac.id

CURIOSITY FROM THE PERSPECTIVE OF COGNITIVE PSYCHOLOGY AND NEUROSCIENCE: EPISTEMOLOGICAL IMPLICATIONS FOR EDUCATION AND THE LEGAL SYSTEM

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ABSTRACT
Curiosity is a fundamental aspect of human cognitive development that plays a crucial role in the formation and development of knowledge. From a cognitive psychology perspective, curiosity is understood as an internal drive that arises due to an information gap. In neuroscience, this phenomenon is related to the activity of the dopamine system, hippocampus, and prefrontal cortex, which support learning, memory, and decision-making. This study aims to analyze curiosity from a cognitive psychology and neuroscience perspective and examine its epistemological implications in education and the legal system. The method used is library research with a qualitative-descriptive approach and content analysis of relevant scientific literature. The results of the study indicate that curiosity has a strong neurobiological basis and plays a key role in the exploration and learning process. Epistemologically, curiosity is the foundation for critical and reflective knowledge construction. The implication in education is the importance of implementing inquiry-based learning, while in the legal system, curiosity needs to be managed ethically to support the search for truth and justice.
Keywords: *cognitive psychology; neuroscience; epistemology; education*

INTRODUCTION

Curiosity is a fundamental characteristic inherent in humans from early development through adulthood (Ansya, Halimatussakdiah, Mandasari, Humaira, & Rahma, 2025). From a cognitive psychology perspective, curiosity is understood as an internal drive that drives individuals to seek new information, reduce uncertainty, and broaden their understanding of their surroundings. This phenomenon not only plays a role in formal learning processes but also serves as a key driver in the formation of knowledge in general. In *cognitive psychology studies,* curiosity is often associated with information gaps, which trigger exploratory activities and deeper cognitive processing (Lahmi, Dahlan, & Hakim, 2025).

From a neuroscientific perspective, curiosity has a complex biological basis involving the interaction of various brain structures and neurotransmitter systems. Activation of the dopamine system in the brain plays a crucial role in providing a sense of satisfaction when individuals discover new information, thus reinforcing knowledge-

seeking behavior (Destiyanti & Pramowardhani, 2026). Structures such as *the hippocampus* contribute to the storage of new memories, while *the prefrontal cortex* plays a role in decision-making and cognitive control. These interactions between brain regions demonstrate that curiosity is not simply a psychological phenomenon but also an organized and adaptive neurobiological process (Rois, Ariani, & Arifin, 2022).

From an epistemological perspective, curiosity plays a crucial role as a foundation for human knowledge construction. Knowledge is not formed passively, but rather through an active process of exploration, questioning, testing, and critical reflection. Curiosity is a key driver in the development of science because it enables humans to continually question, evaluate, and refine their understanding. Therefore, studying curiosity from a cognitive psychology and neuroscience perspective is crucial for understanding how the process of knowledge formation occurs more deeply and comprehensively (Afriko, Lahmi, Dahlan, & Hakim, 2025).

Research (Lahmi, Dahlan, Hakim, & Prima, 2025)confirms that *educational neuroscience* is an integration of neuroscience, cognitive psychology, and education that is able to explain how the learning process is influenced by brain activity, including the role of *curiosity* in increasing students' cognitive engagement. Research (Ansya et al., 2025)highlights that the development of cognitive neuroscience enriches the understanding of human epistemic processes, especially in *epistemic emotions* that encourage individuals to explore new knowledge. Research (Al Azhar, Muna, Yuliana, & Mahardika, 2025)shows that innovative learning environments are able to stimulate curiosity through the activation of the nervous system and students' intrinsic motivation, while (Rosyidiana et al., 2025)in *Neuropsychology of Elementary Education* explains that cognitive and emotional representations in the brain greatly influence the learning process, especially in forming critical thinking patterns.

The main problem in this study lies in the lack of an integrated understanding of curiosity as a multidimensional phenomenon involving psychological, biological, and epistemological aspects as a whole. Most previous studies still focus solely on education, particularly within the framework of *learning motivation* and *cognitive engagement,* without expanding the analysis to broader implications such as the legal system which also demands a process of seeking truth based on rationality and evidence. Furthermore, there is still a conceptual gap in understanding how neurobiological mechanisms such as the dopaminergic system, *hippocampus,* and *prefrontal cortex* contribute not only to the learning process, but also to the formation of broader epistemological thought structures. The lack of integration between the perspectives of *psychology of curiosity,* neuroscience, and philosophy of science has resulted in a partial understanding of curiosity, thus failing to comprehensively explain how this phenomenon influences the construction of knowledge in more complex social settings such as formal education and the justice system.

This study aims to analyze curiosity as a cognitive phenomenon with a neurobiological basis from the perspective of cognitive psychology and neuroscience, and examine its epistemological implications in education and the legal system. Specifically, this study aims to explain how brain mechanisms such as dopamine system activation and the interaction between *the hippocampus* and *prefrontal cortex* play a role in shaping human exploratory behavior. In addition, this study also aims to develop a theoretical

understanding of curiosity as a basis for the process of critical and reflective knowledge construction from an *epistemological perspective.* This study aims to contribute to the development of *inquiry-based learning models* in education and provide a conceptual framework for managing curiosity in the legal system so that it remains within ethical boundaries, yet remains productive in the search for truth and justice.

The urgency of this research lies in the increasing need to understand the learning process and the search for truth more deeply in the modern era marked by the rapid development of science and technology. In education, the transformation towards 21st-century learning demands an approach that emphasizes not only the transfer of knowledge but also the development of critical, creative, and reflective thinking skills that rely heavily on the stimulation of curiosity. Meanwhile, in the legal system, the complexity of modern legal cases requires law enforcement officers to have in-depth and evidence-based analytical skills, which are also influenced by the cognitive mechanisms of curiosity. With the growing study of *the neuroscience of learning* and *cognitive psychology,* it is important to integrate scientific understanding of the biological basis of curiosity with its implications in social systems. Therefore, this research is crucial to bridge the gap between basic science and practical application in two strategic fields, namely education and law.

The novelty of this research lies in the multidisciplinary integration of cognitive psychology, neuroscience, and epistemology in analyzing curiosity, not only as a psychological phenomenon, but also as the neurobiological basis of knowledge construction and its implications in two different social domains, namely education and the legal system. Unlike previous research that generally focuses on education and *the learning process,* this research broadens the scope of analysis by including the legal system as an epistemological space that is also influenced by the dynamics of human curiosity. Furthermore, this research explicitly connects neural mechanisms such as the dopaminergic system, *hippocampus,* and *prefrontal cortex* with epistemological concepts such as *critical thinking* and *truth-seeking behavior,* thus producing a new, more comprehensive conceptual framework. Thus, this research not only provides theoretical contributions in the fields of *cognitive neuroscience* and education but also offers new perspectives in understanding how curiosity can be managed ethically and productively in the modern legal system

RESEARCH METHOD

This study uses a library research method with a qualitative-descriptive approach and is interdisciplinary in nature that integrates the perspectives of cognitive psychology, neuroscience, and epistemology. Data sources are obtained from various relevant scientific literature, such as national and international journals, academic books, and previous research results that discuss the concept of curiosity, the neurobiological mechanisms of the brain, human cognitive processes, and their implications in the fields of education and the legal system. Data analysis is carried out using content analysis techniques by identifying, classifying, and interpreting key concepts related to curiosity as a cognitive and biological phenomenon. Next, the analyzed data are systematically interpreted to build a theoretical synthesis that explains the relationship between neural activity such as the dopaminergic system, hippocampus, and prefrontal cortex with the

process of knowledge formation from an epistemological perspective. This approach allows the study to produce a comprehensive understanding, not only at the theoretical level, but also on practical implications in the world of education and the modern legal system.

RESULT AND DISCUSSION

Literature Review Result

Table 1. *Literature Review Results*

No	Writer	Problems	Objective	Method	Results	Conclusion
1	(Lahmi, Dahlan, & Hakim, 2025)	The integration of *neuroscience*, cognitive psychology, and Islamic values in learning strategies still does not provide a comprehensive explanation of how the learning process occurs at the brain and spiritual levels simultaneously.	Analyzing the integration *of educational neuroscience* with Islamic values in modern learning	*Library research* with an interdisciplinary approach	It was found that brain activity, emotions, and cognition are closely related in the learning process, and can be synergized with Islamic spiritual values.	The integration of neuroscience and Islamic values produces a more holistic learning model, encompassing cognitive, emotional and spiritual aspects.
2	(Rois et al., 2022)	Learning at the elementary level still tends to be monotonous, so it is less able to raise students' motivation and cognitive involvement.	Examining the effectiveness of *ice breaking* in increasing learning motivation	Descriptive qualitative based on classroom observation	*Ice breaking* has been proven to increase attention, create a positive learning atmosphere, and activate students' cognitive structures.	Learning methods based on learning psychology and neuroscience can increase the effectiveness of the learning process.
3	(Afriko et al., 2025)	Lack of integration	Explaining the	Literature study	Emotions act as a	Integration of emotions

		between emotional, cognitive, and spiritual aspects in the modern Islamic education system	relationship between emotions and brain activity from the perspective of Islamic educational neuroscience		reinforcement of learning motivation and are directly related to neural activity in the brain.	and cognition is important for building more meaningful learning.
4	(Ivancovsky, Baror, & Bar, 2024)	The relationship between *curiosity* and creativity is still debated whether it originates from the same or different cognitive mechanisms.	Explaining the relationship between *the novelty seeking mechanism* in curiosity and creativity	Empirical review of neuroscience and behavioral science	Curiosity and creativity have the same neural basis, namely *the novelty seeking system.*	Curiosity and creativity stem from identical neurocognitive mechanisms.
5	(Modirshanechi, Kondrakiewicz, Gerstner, & Haesler, 2023)	There is no comprehensive model that explains how *curiosity-driven exploration* works in the learning process.	Developing a curiosity-based exploration model	Review of neuroscience and computational modeling	Curiosity functions as an adaptive exploration system in prediction-based learning.	Curiosity can be modeled computationally in the human cognitive system.
6	(Carruthers, 2024)	The definition of *curiosity* in cognitive neuroscience is still dominated by a meta-cognitive perspective that is not yet uniform.	Analyzing the concept of curiosity from a cognitive philosophy perspective	Philosophical studies and cognitive science	Curiosity is understood as a meta-cognitive process that involves awareness of information gaps.	Curiosity is a meta-cognitive mechanism in the search for knowledge.
7	(Forss et al., 2024)	Curiosity studies are still limited	Developing a transdisciplinary	Cross-disciplinary review	Curiosity is found in humans,	Curiosity is a universal cognitive

		to humans and have not yet covered much of the animal and artificial intelligence fields.	perspective of curiosity	(neuroscience, AI, developmental psychology)	animals, and AI systems as an exploration mechanism.	phenomenon across biological and artificial systems.
8	(Kenett, Humphries, & Chatterjee, 2023)	The relationship between memory, reward, and curiosity systems has not been fully integrated.	Explaining the neural relationship of curiosity to the reward system and memory	Neuroscience review	Curiosity is closely related to the activation of the dopamine system and memory formation.	Curiosity is driven by a reward system that reinforces learning.
9	(Poli, O'Reilly, Mars, & Hunnius, 2024)	The optimal mechanisms in *curiosity-driven exploration* are not fully understood.	Analyzing the dynamics of curiosity-based exploration	Cognitive neuroscience approach	Curiosity follows *the predictive brain principle* in decision making.	Curiosity helps the brain optimize prediction-based learning.
10	(Singh & Murayama, 2024)	Creativity and curiosity are often considered different even though they have similar mechanisms.	Testing the relationship between *novelty seeking mechanisms*	Experimental neuroscience reviews	Curiosity and creativity come from the same neural system.	Both concepts have an identical neurobiological basis.
11	(Li, Emin, Zhou, Zhang, & Hu, 2023)	The relationship between *epistemic curiosity* and creativity in education has not been studied in depth.	Analyzing the relationship between curiosity and creativity in education	Educational literature review	*Epistemic curiosity* improves students' creative thinking skills	Curiosity plays an important role in the development of academic creativity.
12	(Le Cunff, 2024)	There is no systematic framework for	Developing a curiosity framework for *human*	Conceptual review	Curiosity is multidimensional and can be	Systematic curiosity can enhance human

		understanding *systematic curiosity* in human development.	*flourishing*		consciously trained.	cognitive development.
13	JPH Seiler, O. Dan (2024)	The relationship between boredom and curiosity has not been consistently explained.	Analyzing the relationship between boredom and curiosity	Experimental psychology studies	Boredom encourages the emergence of curiosity as an information seeking mechanism.	Boredom and curiosity are cognitive need regulation systems.
14	(Ten, Oudeyer, & Moulin-Frier, 2022)	*Curiosity-driven exploration* mechanism still not integrated into modern learning theory	Examining the function of curiosity in cognitive exploration	Neuroscience & cognitive psychology studies	Curiosity enables learning without external instructions	Curiosity is an adaptive mechanism in human learning.
15	(Wilson, 2024)	Studies on curiosity and *information-seeking behavior* are still separate across disciplines.	Examining psychological literature on curiosity	Literature review	Curiosity is the basis of information seeking behavior.	Curiosity is the main foundation of human information exploration behavior.

Curiosity as a Phenomenon of Cognitive Psychology and Neuroscience in Knowledge Formation

Curiosity is understood as a fundamental mechanism that drives individuals to seek, process, and evaluate new information when there is a knowledge gap or cognitive uncertainty. In various *cognitive psychology studies,* this phenomenon is often explained through the concept of *information gap theory,* which is a condition when individuals realize there is a difference between what is already known and what they want to know. This gap creates cognitive tension that triggers an exploratory drive to seek additional information. Curiosity is not merely a simple motivation, but a complex cognitive regulatory system that directs attention, increases focus, and deepens information processing. This is in line with Wilson's (2024) findings, which emphasize that *curiosity* is

the main foundation of *information-seeking behavior,* namely basic human behavior in building knowledge through active exploration of the environment.

From a neuroscientific perspective, curiosity has a highly complex biological basis and involves the interaction of various brain structures and neurotransmitter systems. One key component is the dopaminergic system, which plays a role in the brain's *reward system.* Dopamine activation not only provides a sense of pleasure when someone discovers new information but also strengthens the motivation to continue seeking knowledge in the future. This is supported by the findings of Kenett et al. (2023), who showed that curiosity is closely related to the reward system and memory formation. The *hippocampus* plays a crucial role in encoding and consolidating new memories, while *the prefrontal cortex* is responsible for executive functions such as decision-making, planning, and cognitive control. The interaction between these two structures enables individuals to not only gather information but also evaluate and integrate it into more complex knowledge structures. Thus, curiosity can be understood as an organized, adaptive, and interconnected neurocognitive process based on biological systems.

Furthermore, research in the *neuroscience of curiosity* shows that curiosity is closely related to the concept of *the predictive brain,* namely the brain's ability to predict unknown information and minimize uncertainty. Poli et al. (2024) explain that the process of *curiosity-driven exploration* follows the principles of the predictive brain, where individuals actively seek information to reduce the gap between prediction and reality. Curiosity is not only reactive, but also proactive in shaping how the brain organizes experiences. Singh and Murayama (2024) even emphasize that curiosity and creativity originate from the same mechanism, namely *the novelty-seeking system,* which functions to seek new experiences as part of human cognitive adaptation. This shows that curiosity is not just an emotion or a simple psychological drive, but a fundamental mechanism that connects cognition, emotion, and neurobiology in one integrated system.

According to Carruthers (2024), curiosity, from a *cognitive neuroscience perspective,* has a metacognitive dimension, namely an individual's awareness of what they don't know. This awareness forms an important basis for the process of reflection and self-evaluation, which then encourages individuals to explore further. Thus, curiosity can be understood as a mechanism that functions not only to obtain information but also to regulate human epistemic awareness of the limitations of their own knowledge. This reinforces the view that curiosity is a crucial element in the process of knowledge formation that is dynamic, reflective, and continuously evolving.

2.3. Epistemological Implications of Curiosity in Education and the Legal System

From an epistemological perspective, curiosity plays a central role as the primary foundation in the process of constructing human knowledge. Knowledge is not formed passively through the reception of information, but through an active process of questioning, exploration, testing, and critical reflection. Curiosity becomes an epistemic motor that drives individuals to continuously question the truth, evaluate the validity of information, and build a deeper understanding. Le Cunff (2024) emphasizes that *systematic curiosity* can be an important instrument in holistic human development (*human flourishing)*, because it allows individuals to direct their curiosity in a conscious,

structured, and productive manner. Curiosity is not only spontaneous but can also be developed as a trainable epistemic competency.

In education, curiosity has significant implications for modern learning design. Exploration-based learning approaches such as *inquiry-based* and *problem-based learning directly rely on activating* students' curiosity. Research by Modirshanechi et al. (2023) shows that *curiosity-driven exploration* functions as an adaptive learning system, enabling individuals to learn without strict external instructions. This means the learning process becomes more independent, active, and experience-based. Furthermore, research by Rois et al. (2022) shows that cognitive stimulation such as *icebreakers* can increase student engagement by activating attention and cognitive structures. This demonstrates that curiosity can be enhanced through appropriate learning design, which creates a fun and intellectually challenging learning environment.

Furthermore, Afriko et al. (2025) emphasize the importance of integrating emotion and cognition in education, where curiosity is one of the emotional-cognitive aspects that strengthens learning motivation. This is reinforced by Li et al. (2023) who show that *epistemic curiosity* has a direct relationship with academic creativity. This means that the higher a person's curiosity, the greater the potential for developing creative and critical thinking skills. Thus, education functions not only as a transfer of knowledge but also as a space for developing individual epistemic structures through the continuous stimulation of curiosity.

The implications of curiosity become more complex because they relate to the search for truth and justice within a normative and ethical framework. The legal system fundamentally demands an in-depth, objective, and evidence-based investigative process. In this regard, curiosity serves as an epistemic driving force for law enforcement officers in uncovering facts and comprehensively understanding an event. Curiosity in law must also be tempered by ethical boundaries and legal regulations to prevent it from becoming a violation of privacy or an abuse of authority.

Forss et al. (2024) provide an important perspective that curiosity is a universal cognitive phenomenon not only found in humans but also in other systems such as animals and artificial intelligence. This demonstrates that information exploration mechanisms are fundamental to various cognitive systems. Curiosity has a more complex normative dimension as it is linked to moral values, ethics, and social responsibility. Therefore, in the legal system, curiosity must be directed into *truth-seeking behavior* that remains within the law and professional ethics.

Wilson (2024) also emphasized that information-seeking behavior is the foundation of all human exploratory activity. This means that the processes of investigation, inquiry, and evidence collection rely heavily on the cognitive ability to systematically manage curiosity. Therefore, curiosity plays a role not only in education as a driving force for learning, but also in the legal system as an epistemological instrument for achieving justice.

The integration of cognitive psychology, neuroscience, and epistemology demonstrates that curiosity is a multidimensional phenomenon with broad implications for human life. In education, curiosity forms the basis for developing active and creative learning, while in the legal system, curiosity serves as a truth-seeking mechanism that must be ethically regulated. Thus, a comprehensive understanding of curiosity can make a

significant contribution to the development of more adaptive, reflective, and knowledge-based educational and legal systems.

CONCLUSION

Curiosity is a multidimensional phenomenon that can be understood not only as a simple psychological drive, but also as a complex neurocognitive mechanism involving the interaction of the dopaminergic system, hippocampus, and prefrontal cortex in the process of forming, processing, and strengthening human knowledge. From a cognitive psychology perspective, curiosity acts as a primary driver that arises due to the information gap, thus encouraging individuals to explore, search, and evaluate information actively and continuously. Meanwhile, from a neuroscience perspective, curiosity has been proven to have a strong biological basis through the activation of the brain's reward system, which provides a sense of satisfaction when individuals succeed in acquiring new knowledge, while also strengthening long-term learning processes through memory mechanisms and predictive brain. Epistemologically, curiosity is an important foundation in the construction of knowledge because it allows humans to not only receive information passively, but also build understanding through a continuously evolving reflective, critical, and dynamic process. The implications of these findings suggest that in the field of education, curiosity needs to be developed through exploration-based learning approaches such as inquiry-based learning that can increase students' cognitive engagement, creativity, and critical thinking skills. Meanwhile, in the legal system, curiosity plays a strategic role as an epistemic driver in the search for truth and justice, but it must be managed ethically to avoid violating legal norms and privacy. Thus, the integration of cognitive psychology, neuroscience, and epistemology provides a more comprehensive understanding that curiosity is not merely an individual phenomenon but also a crucial foundation for developing a broader, adaptive, and truth-oriented knowledge system across various aspects of human life.

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