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WHERE IS THE MATHEMATICS? A Critical Reflection on Mathematics Education Research in Indonesia from the Perspective of Jinfa Cai

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Abstract

This article aims to critically reflect on the position of mathematics within mathematics education research in Indonesia by employing JinfaCai's perspective as a conceptual lens. The article is motivated by the growing tendency of mathematics education research to focus predominantly on general pedagogical aspects, such as the effectiveness of instructional models, the use of media, and the integration of technology, while providing relatively limited attention to mathematical thinking, mathematical structures, and students' processes of mathematical reasoning. Using a reflective-philosophical approach grounded in literature review, this article analyzesJinfaCai's ideas concerning the importance of positioning students' mathematical learning at the center of mathematics education research. The reflection reveals that many mathematics education studies in Indonesia still tend to position mathematics merely as a context for instruction rather than as the epistemological core of inquiry. Such a condition potentially causes mathematics education to lose its disciplinary distinctiveness as a field rooted in human mathematical activity. This article emphasizes the importance of reconstructing the direction of mathematics education research in Indonesia by placing mathematical thinking, problem posing, mathematical reasoning, mathematical creativity, and epistemic judgment as primary research concerns. Furthermore, the integration of technology and artificial intelligence in mathematics education should be directed reflectively so that these technologies do not replace students' mathematical thinking but instead strengthen it. This article is expected to contribute to the development of mathematics education research in Indonesia that is mathematically more substantive, philosophically more reflective, and more relevant to the challenges of education in the digital era.

Keywords: *mathematics education, mathematical thinking, JinfaCai, philosophy of mathematics education, problem posing, artificial intelligence.*

INTRODUCTION

Mathematics education research fundamentally aims to understand, explain, and improve students' learning of mathematics through inquiries grounded in the distinctive nature of mathematics itself. However, recent developments indicate a growing tendency for many mathematics education studies to focus more heavily on general pedagogical aspects than on the mathematical substance learned by students. Research attention is frequently directed toward the effectiveness of instructional models, the use of digital media, learning motivation, or the implementation of technology, while students' mathematical thinking structures, reasoning processes, conceptual formation, and the nature of mathematical activity often receive less in-depth attention (Cai, 2025; Ernest, 1991). Consequently, in a number of mathematics education studies, mathematics appears merely as an instructional context rather than as the epistemic core of the research itself.

This condition has become an important concern in international mathematics education discourse. JinfaCai emphasizes that mathematics education research should place students' learning of mathematics at the center of inquiry rather than treating mathematics merely as an administrative background for general educational studies (Cai, 2025). Cai argues that mathematics education research must seriously attend to how students think mathematically, construct mathematical relationships, solve problems, pose problems, and develop mathematical dispositions. Cai's critique becomes particularly relevant when mathematics education research begins to lose its mathematical specificity and becomes increasingly difficult to distinguish from research in general education. In this context, mathematics should not merely be understood as a school subject, but as a form of human intellectual activity possessing its own epistemological characteristics (Ernest, 1991; Skovsmose, 1994).

Within the Indonesian context, similar tendencies can be observed in many mathematics education studies conducted in

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recent years. Numerous studies focus predominantly on testing the effectiveness of particular instructional models rather than exploring how students develop deep conceptual understanding of mathematics. In addition, many studies emphasize learning outcomes in the form of test scores without seriously investigating how students' mathematical thinking evolves throughout the learning process. Even in technology-based and artificial intelligence-based research, attention to mathematical reasoning, epistemic judgment, and mathematical structures often remains limited. Several studies in Indonesia indicate that mathematics education research continues to be dominated by implementation-oriented and evaluative approaches rather than epistemological explorations of students' mathematical activity (Asyari, 2024; Suryadi, 2019). Yet the abilities to reason, generalize, and construct mathematical arguments constitute the very essence of mathematical literacy emphasized in international studies, including the Programme for International Student Assessment (PISA) (OECD, 2023).

This phenomenon demonstrates the need for an epistemological reflection on the direction of mathematics education research in Indonesia. Such reflection is crucial to ensure that mathematics education research does not lose its disciplinary identity as a field rooted in human mathematical activity. From the perspective of the philosophy of mathematics education, losing focus on mathematics may cause mathematics education research to drift toward general pedagogical studies that merely employ mathematics as a disciplinary label (Ernest, 1998). Several Indonesian scholars have also highlighted the importance of reconstructing the epistemology of mathematics education so that research not only produces methodological innovations but also deepens understanding of the nature of students' mathematical thinking (Hudojo, 2005; Suryadi, 2019). Therefore, a fundamental question must be raised: *Where is the mathematics in mathematics education research in Indonesia?* This question is important because the quality of mathematics education research is determined not only by methodological sophistication but also by the depth of reflection on the nature of mathematics and students' mathematical thinking processes.

This article aims to critically reflect on the position of mathematics in mathematics education research in Indonesia using JinfaCai's perspective as a conceptual analytical lens. This article is not intended to reject the importance of pedagogical aspects, technology, or instructional innovation. Rather, it seeks to reaffirm that mathematics education research should continue to place mathematical thinking at the center of its concerns. Through this reflection, the article is expected to contribute to reconstructing the orientation of mathematics education research in Indonesia so that it becomes mathematically more substantive, philosophically more reflective, and more meaningful for the development of mathematics learning in the digital and artificial intelligence era.

A. Mathematics in Mathematics Education Research: The Perspective of JinfaCai

For JinfaCai, students' learning of mathematics constitutes the central focus of mathematics education research. This perspective is grounded in the belief that the fundamental purpose of mathematics education research is not merely to improve instructional effectiveness in general, but to understand how students learn mathematics as a form of knowledge possessing distinctive epistemological characteristics (Cai, 2025). Consequently, mathematics education research must focus on students' mathematical thinking activities, including how students construct concepts, reason, solve problems, pose problems, and develop dispositions toward mathematics. Within this perspective, mathematics is understood not merely as a collection of procedures or algorithms, but as a human intellectual activity involving meaning construction, generalization, and logical reflection (Ernest, 1991). Such a perspective is also consistent with Hudojo's (2005) view that learning mathematics is not simply a matter of memorizing rules, but rather a process of constructing logical and systematic thinking structures.

This perspective becomes evident in the conceptual framework developed by Cai when discussing the relationships among curriculum, instruction, instructional tasks, teacher beliefs, and student learning outcomes. Within this framework, students' mathematical learning is positioned at the center, while other factors are viewed as elements influencing the development of mathematical learning (Cai, 2025). Thus, the primary focus of research does not lie in the instructional model itself, but in how such a model influences the quality of students' mathematical activity. This perspective demonstrates that mathematics is not merely a medium for measuring pedagogical success; rather, it constitutes the core of the entire process of mathematics education research. Such a position aligns with Schoenfeld's (1992) argument that mathematics learning must be understood through analyses of how students think, make decisions, and employ mathematical strategies when confronting problems. Within the Indonesian context, Suryadi (2019) likewise emphasizes that mathematics education research should attend to students' thinking processes rather than merely focusing on final learning outcomes.

One of Cai's most important contributions is his critique of the growing tendency for mathematics education research to lose its mathematical specificity. Cai argues that the mathematical orientation of a mathematics education study should be questioned when the word "mathematics" in the study can simply be replaced with "science" or "reading" without fundamentally altering the structure of the research (Cai, 2025). This critique reflects a profoundly epistemological concern. According to Cai, mathematics education research must maintain particular attention to the nature of mathematics as a discipline, including structures of thinking, deductive reasoning, abstraction, generalization, and the activities of problem solving and problem posing. In other

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words, mathematics education research must possess a *mathematical specificity* that distinguishes it from educational research in other disciplines. Similar criticisms have also emerged within Indonesia, where a number of mathematics education studies focus primarily on implementing instructional models without deeply exploring the mathematical concepts and structures learned by students (Turmudi, 2008).

From Cai's perspective, mathematical thinking is a central element that cannot be separated from mathematics education research. Mathematical thinking is not limited to the ability to obtain correct answers; it also includes the ability to construct mathematical relationships, recognize patterns, make generalizations, examine the validity of arguments, and reflect on one's own thinking processes (Mason et al., 2010). Therefore, mathematics education research that focuses excessively on improving test scores without investigating students' mathematical thinking processes risks losing its substantive core. This perspective is also aligned with the OECD framework of mathematical literacy, which emphasizes the importance of formulating, employing, and interpreting mathematics in a variety of real-life contexts (OECD, 2023). In Indonesia, the importance of mathematical thinking has likewise been emphasized by Sumarmo (2013), who positions higher-order mathematical thinking as the essence of modern mathematics learning.

In addition to emphasizing mathematical thinking, Cai also places considerable importance on *problem posing* as a fundamental mathematical activity. According to Cai, students should not merely be trained to solve mathematical problems; they should also be given opportunities to construct and pose mathematical problems themselves (Cai& Hwang, 2020). From this perspective emerged the concept of *Problem-Posing-Based Learning* (P-PBL), an instructional model that positions problem posing as the core activity of mathematics learning. Within this model, students are viewed as active intellectual agents who construct mathematical structures rather than passive recipients of solution procedures. Such a perspective suggests that learning mathematics is fundamentally a creative process of constructing mathematical relationships and possibilities. Within the Indonesian context, approaches that provide opportunities for exploratory and reflective activities are also considered essential for developing students' mathematical creativity (Siswono, 2018).

The problem-posing perspective developed by Cai carries important philosophical implications. Mathematics is understood not as a collection of mechanistic procedures, but as a creative human activity for constructing mathematical relationships and meanings. Accordingly, mathematics education research should not merely assess whether students are able to follow particular procedures, but should also investigate how students generate new mathematical ideas, formulate conjectures, and develop flexible ways of mathematical thinking (Silver, 1994). In this sense, problem posing is not only an instructional strategy but also a means of understanding students' epistemic development in learning mathematics. This perspective is consistent with social constructivism, which views mathematical knowledge as a human construction developed through interaction and reflection (Ernest, 1998).

Beyond cognitive aspects, Cai also emphasizes the importance of noncognitive dimensions in mathematics learning. Attitudes toward mathematics, mathematical dispositions, perseverance, self-confidence, and students' beliefs about mathematics are considered to have significant influences on learning success (Cai&Merlino, 2011). In several of his studies, Cai employs metaphors to understand how students interpret mathematics. Such an approach demonstrates that experiences in learning mathematics shape not only students' intellectual abilities but also their emotional relationships and identities with respect to mathematics. This perspective reveals that mathematics education possesses a humanistic dimension that cannot be reduced merely to academic achievement scores. In Indonesia, mathematical disposition is likewise regarded as important because it influences students' perseverance and willingness to confront mathematical challenges (Sumarmo, 2013).

Cai's work also illustrates the close relationship between theory and instructional practice. He rejects the notion that theory and practice constitute separate domains. According to Cai, theory should inform teaching, while instructional practice should also serve as a source for theoretical development (Cai et al., 2023). This perspective demonstrates that mathematics education research must be grounded in the realities of classroom learning while simultaneously contributing to the development of mathematics education theory. Thus, research should not stop at describing phenomena, but should move toward reconstructing instructional practices that are mathematically more meaningful. Such a perspective is highly relevant to Freire's (1970) conception of reflective education, which views praxis as the unity of reflection and action. Within Indonesia, reflective approaches of this kind have also begun to develop through didactical design research, which positions analyses of students' thinking processes as an essential component of mathematics learning theory development (Suryadi, 2019).

Through these ideas, Cai essentially reminds researchers that mathematics education research must preserve its epistemological identity as a field centered on mathematics and the learning of mathematics. This perspective is highly relevant for reflecting upon the direction of mathematics education research in Indonesia, particularly when many studies appear more focused on general pedagogical innovations than on deeply developing students' mathematical thinking. Consequently, JinfaCai's thought can serve as an important conceptual foundation for reconstructing the orientation of mathematics education research so that it becomes more substantive, reflective, and rooted in the nature of human mathematical activity.

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B. Trends in Mathematics Education Research in Indonesia

Over the past several decades, mathematics education research in Indonesia has experienced substantial growth. The increasing number of scholarly publications, the expansion of mathematics education programs, and the broadening range of research themes indicate that the field has developed dynamically in response to global educational changes. Various instructional innovations have continuously emerged, ranging from cooperative learning models, problem-based learning, and discovery learning to the integration of digital technology and artificial intelligence in mathematics classrooms. In addition, developments in national educational policy, such as the implementation of the *Merdeka Curriculum* and the growing emphasis on numeracy literacy, have also influenced the direction of mathematics education research in Indonesia (Kemendikbudristek, 2024; 2025). These developments demonstrate that mathematics education research in Indonesia has shown strong concern for improving the quality of school mathematics learning, particularly in addressing the challenges of twenty-first-century competencies and digital educational transformation.

Nevertheless, such quantitative growth has not always been accompanied by deeper engagement with mathematical substance. Many mathematics education studies place greater emphasis on testing the effectiveness of instructional models than on exploring students' mathematical thinking structures. In numerous research articles, the primary focus lies in comparing learning outcomes between experimental and control groups, while the processes through which students construct mathematical understanding are discussed only superficially. As a result, mathematics frequently appears merely as instructional content used to test the success of particular pedagogical strategies. This phenomenon suggests that the orientation of mathematics education research tends to move toward *pedagogical effectiveness* rather than *mathematical understanding*. Criticism of this tendency has also begun to emerge within Indonesian mathematics education discourse, where scholars emphasize the need for more in-depth investigations into students' mathematical thinking processes (Suryadi, 2019; Turmudi, 2008).

This tendency can be observed clearly in the dominance of studies examining improvements in learning outcomes through the implementation of particular instructional models. Many studies measure instructional success primarily through increases in posttest scores or gain scores without conducting deeper analyses of how students understand mathematical concepts. In such situations, mathematical reasoning, abstraction, conjecturing, and proving often do not become central objects of investigation. Research frequently concludes that a particular instructional model is "effective" in improving learning outcomes without explaining the transformations in students' mathematical thinking that occur during the learning process. Yet from the perspective of contemporary mathematics education, understanding students' mathematical thinking processes constitutes one of the most essential dimensions of mathematics learning (Schoenfeld, 1992). Within Indonesia, Sumarmo (2013) similarly emphasizes that higher-order mathematical thinking should become the primary goal of mathematics learning rather than mere procedural achievement and test performance.

A similar phenomenon can also be observed in technology-based and media-based mathematics education research. The integration of technology into mathematics learning is indeed important and highly relevant to developments in the digital era. Various studies indicate that digital media can enhance students' motivation and engagement in learning mathematics (NCTM, 2014). However, in many Indonesian studies, technology is positioned primarily as a tool for increasing students' interest in learning rather than as a means for deepening students' mathematical activity. In fact, the use of technology in mathematics education should not merely focus on visualization or instructional efficiency, but also on developing higher-order mathematical thinking abilities such as pattern exploration, generalization, and mathematical argumentation. In this regard, Asyari (2024) argues that the use of technology in mathematics learning must continue to consider the ontological and epistemological dimensions of mathematics so that mathematics is not reduced to a merely procedural digital object.

Within the context of artificial intelligence (AI), this tendency becomes even more significant to reflect upon. Many studies concerning AI in mathematics education focus primarily on the effectiveness of chatbots, adaptive applications, or AI-based media in improving students' learning outcomes. However, attention to how students evaluate the mathematical validity of AI-generated responses, identify mathematical errors produced by AI, or construct *epistemic judgment* toward mathematically generated information remains relatively limited. Consequently, AI is often understood merely as an instructional innovation rather than as an epistemological challenge concerning how students understand mathematics. In this context, mathematics education research in Indonesia still requires stronger philosophical reflection on the relationship among human beings, mathematics, and artificial intelligence. Such reflection is crucial because AI has the potential to reshape how students construct mathematical knowledge when learning is not directed in a reflective and critical manner.

In addition to the dominance of pedagogical orientations, mathematics education research in Indonesia also tends to provide limited attention to *problem posing* as a fundamental mathematical activity. Most studies continue to focus primarily on *problem solving* in the sense of solving already-existing mathematical problems. Students are trained to find correct answers according to predetermined procedures but are rarely given opportunities to construct, modify, or reformulate mathematical problems themselves. Yet the ability to pose problems constitutes an important indicator of students' mathematical creativity and mathematical agency (Silver, 1994). From the perspective of Cai and Hwang (2020), problem posing enables students to construct more flexible mathematical relationships and reveals the depth of their conceptual understanding. Within Indonesia, Siswono

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(2018) likewise emphasizes that problem-posing activities can help students develop mathematical creativity and divergent thinking abilities.

The limited attention given to mathematical structures can also be observed in the scarcity of studies exploring students' mathematical abstraction processes. Many studies employ the term "conceptual understanding" without explaining in detail how mathematical concepts are formed within students' minds. Even terms such as *mathematical structure*, *mathematical object*, *abstraction*, and *formal reasoning* remain relatively uncommon as primary focuses of mathematics education research in Indonesia. This situation indicates that mathematics education research often remains closer to general pedagogical studies than to investigations into the nature of mathematical thinking itself. From Ernest's (1991) perspective, such conditions may cause mathematics education to lose its connection with the philosophy of mathematics and the nature of human mathematical activity. Similar critiques are also found in Hudojo's (2005) work, where mathematics is emphasized as a structure of thinking rather than merely a collection of formulas taught mechanistically.

From JinfaCai's perspective, these conditions indicate the necessity for deeper reflection on the epistemological direction of mathematics education research in Indonesia. Cai's critique becomes highly relevant because a number of studies appear transferable to other educational disciplines without substantial changes other than replacing the name of the subject matter. This situation suggests that mathematics has not yet fully become the central object of analysis in mathematics education research. Yet the primary identity of this field lies precisely in its capacity to explain how human beings think, learn, and construct mathematical meaning. Within the Indonesian context, such epistemological reflection is important to ensure that mathematics education research does not lose its philosophical depth amid increasingly pragmatic demands for instructional innovation.

Nevertheless, this critical reflection on trends in mathematics education research in Indonesia should not be interpreted as rejecting the importance of pedagogical innovation, technology, or modern instructional approaches. On the contrary, such innovations should be directed toward strengthening students' mathematical thinking. In this way, mathematics education research will not merely produce instructional models that are administratively effective, but will also deepen understanding of how human beings think and learn mathematics. It is precisely at this point that reconstructing the orientation of mathematics education research becomes essential so that mathematics once again becomes the epistemological core of research rather than merely a context for pedagogical implementation.

C. Where Is the Mathematics?

The question *"Where is the mathematics?"* is not merely a rhetorical question, but an epistemological inquiry that touches the foundational identity of mathematics education research. This question invites researchers to reflect critically on whether mathematics truly constitutes the core of their inquiry or merely functions as an administrative context within broader educational studies. From JinfaCai's perspective (2025), mathematics education research should maintain particular concern for the nature of students' mathematical activity, including how students construct concepts, reason, generalize, solve problems, and pose mathematical problems. Consequently, mathematics education research is not sufficient if it merely evaluates instructional effectiveness in general terms; rather, it must also explain how mathematical activity develops within students. This perspective demonstrates that mathematics is not simply an object of instruction, but the epistemological core that distinguishes mathematics education from other educational fields.

In many mathematics education studies conducted in Indonesia, mathematics is often reduced to a collection of instructional topics used to test the effectiveness of particular teaching strategies. Research attention is directed more toward improving learning outcomes, motivation, or classroom activity, while the characteristics of students' mathematical thinking that emerge during instruction are rarely analyzed in depth. As a consequence, mathematics loses its position as a discipline possessing distinctive epistemological structures. This phenomenon reveals that instructional success is frequently measured administratively through numerical scores and statistical indicators rather than through the quality of students' reasoning and the depth of their mathematical understanding. In such contexts, mathematical thinking tends to be positioned merely as an additional outcome rather than as the central purpose of mathematics learning itself. Critiques of such tendencies also appear in Turmudi's (2008) work, which argues that mathematics education must not become trapped in proceduralism because the essence of mathematics lies in logical and abstract structures of thinking.

This condition becomes particularly evident in studies that evaluate instructional success solely through final test scores. Increased scores are frequently regarded as the primary indicator of successful mathematics learning without sufficient attention to how students achieved such understanding. Yet within mathematics learning, the process of thinking is often more important than the final answer itself. Two students may arrive at the same answer while employing entirely different reasoning structures. If research focuses exclusively on final outcomes, the dimension of mathematical reasoning risks being neglected. From Schoenfeld's (1992) perspective, understanding how students think mathematically is far more important than merely determining whether they produce correct or incorrect answers. Similarly, within Indonesia, Sumarmo (2013) emphasizes that higher-order mathematical thinking cannot be reduced merely to test achievement because mathematical thinking includes reflective, analytical, and creative activity.

In addition, a considerable number of mathematics education studies continue to view mathematics as primarily procedural activity. Students are regarded as successful when they are able to follow problem-solving procedures accurately. In such

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situations, mathematics is narrowed into the reproduction of procedures rather than understood as an intellectual activity involving exploration, generalization, and meaning-making. Such perspectives contradict Cai's view, which positions mathematical thinking at the center of mathematics learning. Fundamentally, mathematics is not merely the ability to apply formulas, but the ability to construct logical relationships and understand the structures underlying mathematical concepts (Mason et al., 2010). Hudojo (2005) similarly argues that learning mathematics should help students understand mathematical relationships meaningfully rather than merely memorize problem-solving procedures.

Another fundamental issue concerns the limited attention given to *problem posing* in mathematics learning. Most students encounter pre-constructed problems far more frequently than they are given opportunities to formulate their own mathematical questions. Consequently, students become accustomed to viewing mathematics as an activity of answering questions rather than constructing mathematical inquiries. Yet the ability to pose problems demonstrates that students understand mathematical structures more deeply. Silver (1994) argues that problem posing constitutes a higher-level mathematical activity because it involves the ability to perceive new mathematical relationships and possibilities. In this regard, the limited attention given to problem posing indicates that mathematics learning continues to be dominated by a reproductive culture rather than an exploratory one. Within Indonesia, Siswono (2018) similarly states that problem-posing activities are essential for developing students' mathematical creativity because they encourage divergent and reflective thinking.

In the era of artificial intelligence (AI), the question *"Where is the mathematics?"* becomes even more important. The use of AI in mathematics education may broaden access to information and support the visualization of mathematical concepts. However, AI also carries the potential to increase students' dependence on instant answers if learning is not directed toward developing mathematical reasoning. Therefore, AI-based mathematics education research should not focus solely on the effectiveness of technology, but also on how students validate AI-generated answers, detect mathematical errors, and develop epistemic judgment toward mathematical information (Cai & Hwang, 2021). In this context, critical mathematical thinking becomes increasingly important because students are no longer required merely to obtain answers, but also to evaluate the validity of those answers. Asyari (2024) argues that developments in technology and AI within mathematics education must continue to preserve the epistemological dimensions of mathematics so that learning does not lose its reflective depth.

Reflecting on the question *"Where is the mathematics?"* should not be interpreted as an attempt to restrict mathematics education research solely to formal mathematical aspects. Rather, this reflection serves as a reminder that pedagogy, technology, curriculum, and instructional media should function as means for deepening students' mathematical activity. In other words, the primary focus of mathematics education research must remain on how students think, understand, and construct mathematical meaning. From Freire's (1970) perspective, meaningful education is not education that merely transfers procedures, but education that enables individuals to develop reflective consciousness toward the knowledge they learn. In mathematics education, such reflective consciousness manifests in students' ability to understand the mathematical reasons underlying the procedures they employ.

From the perspective of the philosophy of mathematics education, the disappearance of mathematics from mathematics education research may cause the field to lose its epistemological identity. Mathematics education would no longer concern itself with the nature of human mathematical thinking, but would instead become merely a branch of general pedagogical studies. Ernest (1991) argues that mathematics education must preserve its connection with the nature of mathematics as a social, reflective, and constructive human activity. Therefore, it is essential for mathematics education research in Indonesia to reposition mathematical thinking as its central concern. Within Indonesia, such philosophical reflection is particularly important to ensure that mathematics education does not become trapped in methodological pragmatism concerned only with short-term instructional effectiveness.

Ultimately, the question *"Where is the mathematics?"* is not merely a critique of mathematics education research, but also an invitation to undertake deeper reflection on the future direction of the field in Indonesia. Mathematics education research should not merely produce instructional models that are statistically effective; it must also explain how human beings understand, construct, and employ mathematics in their thinking activities. In this way, mathematics may once again appear not merely as the name of a school subject, but as the epistemological core of mathematics education research itself.

D. Reconstructing the Direction of Mathematics Education Research in Indonesia

Critical reflection on the direction of mathematics education research in Indonesia must be followed by epistemological reconstruction so that mathematics once again becomes the central focus of inquiry. Such reconstruction does not imply rejecting the importance of pedagogy, technology, or instructional innovation. Rather, it positions these elements as means for deepening students' mathematical activity. In this way, mathematics education research will not merely generate instructional strategies that are administratively effective, but will also expand understanding of how human beings think and learn mathematics. Within this context, mathematics education research must move from a procedural orientation toward a reflective orientation that places mathematical thinking at the core of inquiry. This shift is essential if mathematics education research is to preserve its epistemological identity amid increasingly pragmatic and performative educational trends.

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The first important step in this reconstruction is to position *mathematical thinking* as the primary focus of mathematics education research. Research should not merely measure increases in test scores or learning outcomes, but should also investigate how students construct mathematical relationships, make generalizations, engage in abstraction, and examine the validity of mathematical arguments. Focusing on mathematical thinking processes will enable mathematics education research to become more substantive and more closely connected to the nature of mathematics itself. According to Mason et al. (2010), mathematical thinking involves the ability to recognize patterns, construct connections, and reflect on the logical structures underlying mathematical situations. Therefore, mathematics education research should not stop at asking *"Did students succeed?"* but should also ask *"How did students think while learning mathematics?"* Within Indonesia, Sumarmo (2013) similarly emphasizes that higher-order mathematical thinking should become the central orientation of mathematics learning because it is directly related to students' creativity, reasoning, and problem-solving abilities.

In addition, mathematics education research in Indonesia needs to provide greater attention to *problem posing* as a fundamental mathematical activity. To date, mathematics learning remains dominated by an answer-oriented culture that positions students primarily as problem solvers. Yet the ability to formulate mathematical problems reflects a deeper level of understanding because students must comprehend the mathematical structures underlying a given situation. Silver (1994) argues that problem posing enables students to develop more flexible relationships with mathematics because they are not merely following existing procedures, but also creating new mathematical possibilities. Consequently, research on problem posing, problem reformulation, mathematical creativity, and mathematical conjecturing should be expanded within Indonesian mathematics education. In the Indonesian context, Siswono (2018) emphasizes that problem-posing activities can foster students' mathematical creativity while simultaneously strengthening divergent and reflective thinking.

Another important reconstruction concerns the integration of technology and artificial intelligence in mathematics learning. AI-based research should not stop at testing the effectiveness of digital applications or instructional media, but should also investigate how AI influences students' mathematical thinking processes. Research should be directed toward exploring students' abilities to evaluate the validity of AI-generated answers, identify mathematical errors, and construct *epistemic judgment* toward mathematical information produced by artificial intelligence systems. In this context, AI should not merely be understood as an instructional tool, but also as an epistemological challenge for mathematics education. Such a perspective is particularly relevant in the digital era, where access to mathematical answers has become increasingly easy, while the ability to validate and critically reflect upon those answers has become even more important (Luckin et al., 2016). Within Indonesia, Asyari (2024) argues that technological and AI developments in mathematics learning must continue to preserve the ontological and epistemological dimensions of mathematics so that learning does not lose its depth of mathematical thinking.

Mathematics education research in Indonesia must also strengthen investigations into mathematical structures and students' abstraction processes. Mathematical concepts such as functions, limits, proofs, groups, and abstract algebraic structures should not merely be treated as instructional topics, but should also be studied as objects of thinking possessing distinctive epistemological characteristics. Research exploring how students understand abstract mathematical objects can enrich the development of mathematics education theory while simultaneously strengthening the mathematical identity of the field. In this regard, Ernest's (1991) social constructivist perspective becomes particularly relevant because it positions mathematics as a product of constructive human activity developed through social interaction and intellectual reflection. Within Indonesia, Hudojo (2005) similarly argues that conceptual understanding in mathematics must be constructed meaningfully through students' mental activity rather than merely transferred from teacher to learner.

Beyond thematic reconstruction, changes are also necessary at the methodological level of mathematics education research. Research approaches should not focus solely on measuring effectiveness, but should also investigate students' mathematical thinking processes in depth. Consequently, qualitative research, case studies, epistemic analysis, task-based interviews, and approaches grounded in mathematical thinking should receive greater attention. Such approaches enable researchers to understand how students construct mathematical meaning rather than merely determining whether they arrive at correct answers. According to Creswell and Creswell (2018), reflective and in-depth research approaches provide more comprehensive understanding of educational phenomena than purely statistical quantitative data alone. Within Indonesia, *Didactical Design Research* (DDR), developed by Suryadi (2019), represents one example of an approach that seeks to understand students' thinking processes more deeply through analyses of didactical situations and students' learning obstacles.

The reconstruction of mathematics education research must also engage explicitly with philosophical dimensions of mathematics education. To date, mathematics education research in Indonesia has relatively rarely discussed ontological, epistemological, and axiological questions concerning mathematics in explicit ways. Yet researchers' understandings of the nature of mathematics inevitably shape how they design instruction, develop research instruments, and interpret students' learning outcomes. Ernest (1998) argues that the philosophy of mathematics education plays a crucial role in shaping the orientation of mathematics education research because it determines how mathematics is understood as both an object of knowledge and a human activity. Therefore, strengthening philosophical inquiry within mathematics education becomes essential if mathematics education research in Indonesia is to maintain its reflective

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depth. Within the Indonesian context, Turmudi (2008) likewise emphasizes the importance of philosophical foundations in mathematics learning so that mathematics education does not become trapped within purely mechanistic and technical approaches.

In the long term, reconstructing the direction of mathematics education research in Indonesia requires broader changes in academic culture. Mathematics education research should not merely be viewed as a means of fulfilling publication demands, but as an intellectual endeavor aimed at understanding the nature of human mathematical learning. Through such a perspective, mathematics education research can regain a strong epistemological identity and make substantive contributions to the development of mathematics learning. In this context, the question *"Where is the mathematics?"* should not be interpreted as a destructive critique, but rather as a reflective call to restore mathematics as the central focus of mathematics education research in Indonesia. By positioning mathematical thinking at the core of inquiry, mathematics education in Indonesia has the potential to develop into a field that is more reflective, more philosophical, and more meaningful for human intellectual development in the digital era.

E. Conclusion

This article has critically reflected on the position of mathematics within mathematics education research in Indonesia through the perspective of JinfaCai. The reflection demonstrates that mathematics education research in Indonesia has increasingly shifted its focus away from mathematical substance toward more general pedagogical concerns. Many studies emphasize the effectiveness of instructional models, the use of media, or the integration of technology rather than deeply exploring students' mathematical thinking. As a consequence, mathematics frequently appears in research merely as a context for instruction rather than as the epistemic core of inquiry. This condition indicates that mathematics education risks losing its disciplinary identity when research is no longer rooted in the nature of human mathematical activity. Within Indonesia, such tendencies can be observed in the dominance of implementation-oriented studies that prioritize procedural achievement over exploration of students' mathematical thinking processes (Suryadi, 2019; Turmudi, 2008).

JinfaCai's perspective provides an important critique of these tendencies by emphasizing that students' learning of mathematics must become the central concern of mathematics education research (Cai, 2025). Mathematics education research should focus on students' mathematical activities, including reasoning, abstraction, problem solving, problem posing, and the development of mathematical dispositions. In this sense, mathematical thinking is not merely an additional outcome of instruction, but the essence of mathematics education itself. Consequently, mathematics education research should not merely produce statistical evidence of improved learning outcomes, but should also explain how students construct mathematical meaning through reflective and creative thinking processes. This perspective aligns closely with Ernest's (1991) conception of mathematics as a constructive human activity inseparable from reflection and meaning-making.

Reflection on the current condition of mathematics education research in Indonesia indicates the need for reconstructing the orientation of the field so that it becomes mathematically more substantive. Mathematics education research must move beyond a narrow concern with pedagogical effectiveness toward deeper exploration of how students construct mathematical knowledge. Problem posing, epistemic judgment, mathematical creativity, and mathematical structures should receive greater attention within Indonesian mathematics education research. Through such orientations, mathematics education research can contribute not only to the development of instructional strategies but also to a deeper understanding of the nature of human mathematical thinking. Within Indonesia, strengthening such orientations is crucial if mathematics education is to avoid becoming trapped in educational pragmatism concerned only with administrative achievement and statistical performance (Hudojo, 2005).

Furthermore, developments in technology and artificial intelligence should not merely be regarded as opportunities for instructional innovation, but also as epistemological challenges concerning how students understand mathematics. Mathematics education research in the era of AI should therefore be directed toward developing students' abilities to validate, reflect upon, and critically evaluate mathematical information. In this context, mathematical thinking becomes increasingly important because students are no longer required merely to obtain answers, but also to understand the mathematical reasoning underlying those answers. Consequently, the integration of AI into mathematics education must be developed reflectively so that technology does not replace students' mathematical thinking, but instead strengthens it. Asyari (2024) emphasizes that technological developments in mathematics must continue to preserve the ontological and epistemological dimensions of mathematics so that learning does not lose its intellectual substance.

Ultimately, the question *"Where is the mathematics?"* is not merely a critique of mathematics education research, but also a reflective invitation to restore the epistemological identity of the field. Mathematics education must not lose its mathematics. Pedagogy, technology, and instructional innovation should function as means for deepening students' mathematical activity rather than replacing mathematics as the central concern of research. By repositioning mathematical thinking as the core of inquiry, mathematics education research in Indonesia has the potential to develop into a field that is more reflective, more substantive, and more meaningful for human intellectual development in the digital era. In this way, mathematics education research will not merely produce instructional innovations, but will also contribute to a deeper understanding of how human beings think, construct meaning, and live with mathematics.

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