The Influence of Residential Environment on Students' Mathematics Learning Outcomes: A Systematic Literature Review (SLR)

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Abstract. Mathematics achievement is influenced by multiple interrelated factors, including socioeconomic status, parental involvement, access to educational resources, and school location. This systematic literature review (SLR) synthesizes findings from 25 studies to examine how residential environments shape students' mathematics learning outcomes. The study follows the PRISMA framework to ensure a rigorous selection and synthesis process. Results indicate that students from higher-income families consistently perform better due to access to quality educational resources, while students from lower-income and rural backgrounds face challenges such as inadequate infrastructure, limited technology, and lower parental academic support. Furthermore, psychological stress related to financial instability negatively affects students' motivation and cognitive function, further widening the achievement gap. The review highlights the necessity of targeted educational policies, including parental engagement initiatives, digital learning integration, and equitable resource distribution, to address these disparities. While this study provides valuable insights, limitations include the reliance on Google Scholar as the primary database and the absence of empirical validation. Future research should incorporate mixed-method approaches and longitudinal studies to provide deeper insights. This review emphasizes the urgent need for educational reforms to ensure that all students, regardless of their residential background, have equal opportunities for success in mathematics.

Keywords: Mathematics Achievement, Residential Environment, Socioeconomic Status, Systematic Literature Review, Educational Inequality.

1 Introduction

Education is a fundamental pillar of human resource development, serving as the foundation for intellectual advancement, economic growth, and societal progress [1]–[4]. A well-structured and equitable education system equips individuals with the necessary knowledge, skills, and competencies to adapt to the ever-evolving demands of the global economy and contribute meaningfully to their communities. Among various disciplines, mathematics plays a critical role in fostering logical reasoning, analytical thinking, and problem-solving abilities, which are essential in science, technology, engineering, and mathematics (STEM) fields [5]. Despite its importance, disparities in

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educational access and quality continue to hinder the equitable distribution of learning opportunities, resulting in significant variations in students' academic outcomes. These disparities are often linked to socioeconomic conditions, availability of educational resources, and the overall residential environment in which students are raised [6],[7]. Understanding how these factors interact is crucial for designing effective interventions that promote equitable learning opportunities and improve mathematics achievement.

Motivation and academic achievement are intrinsically connected, as students' enthusiasm and willingness to engage in learning activities directly influence their performance in mathematics and other subjects [8]–[10]. The self-determination theory highlights that intrinsic motivation, driven by personal interest and enjoyment, and extrinsic motivation, influenced by external rewards or social expectations, are crucial determinants of academic success. A supportive learning environment, characterized by positive parental involvement, peer encouragement, and access to educational resources, enhances students' intrinsic motivation and leads to improved learning outcomes [11]. Conversely, students from socioeconomically disadvantaged backgrounds often face substantial barriers, including financial hardship, low parental engagement, and insufficient academic resources, which can lead to decreased motivation and lower achievement levels [12]. Additionally, economic insecurity-induced psychological stress can impair students' concentration and problem-solving skills, further exacerbating disparities in mathematics performance [13]. Thus, investigating the influence of residential environments on students' motivation is essential for developing targeted educational policies that foster equitable learning conditions.

Mathematics education at the secondary school level plays a fundamental role in shaping students' cognitive abilities, problem-solving skills, and career prospects, particularly in STEM-related fields [14]. However, despite its importance, mathematics is often perceived as an abstract and challenging subject, leading to varying levels of student engagement and achievement. Students' attitudes toward mathematics are shaped by both intrinsic motivation and external influences, including instructional approaches, parental support, and socioeconomic conditions [15]. Effective mathematics instruction depends on multiple interrelated factors, such as curriculum design, teaching methodologies, assessment strategies, and the broader socio-environmental context. Notably, economic stability, parental involvement, access to educational resources, and the overall academic culture of a community significantly shape students' mathematical proficiency [16]. Empirical studies indicate that students from affluent neighborhoods with access to advanced learning tools and well-equipped schools tend to perform better than those from underprivileged backgrounds [17]. Given these disparities, it is imperative to investigate the influence of residential environments on students' learning trajectories and explore evidence-based strategies to bridge the achievement gap.

Indonesia's education system is characterized by pronounced regional disparities, particularly between urban and rural areas, which significantly influence students' academic achievements. Urban schools generally benefit from well-equipped classrooms, experienced educators, and access to advanced learning technologies, providing students with greater opportunities for academic success [18]. In contrast, rural schools frequently face challenges such as inadequate infrastructure, a shortage of qualified teachers, and limited access to essential learning materials and digital resources. These

disparities are particularly evident in mathematics education, where structured instruction, continuous practice, and engagement with supplementary learning tools are essential [19]. Studies suggest that students in urban settings outperform their rural counterparts due to better access to tutoring programs, libraries, and technologically enhanced learning environments [20]. Furthermore, differences in educational policies, resource allocation, and parental involvement exacerbate the learning gap, reinforcing systemic inequalities in academic outcomes. Addressing these challenges requires targeted interventions aimed at improving educational equity across diverse residential settings.

Empirical research has identified several persistent challenges within Indonesia's educational landscape, particularly concerning mathematics learning outcomes. One major obstacle faced by students from low-income families is the lack of access to supplementary learning resources, such as private tutoring, online educational platforms, and academic support programs, which are often financially prohibitive [21]. Financial constraints also limit students' participation in enrichment programs and extracurricular academic activities, further hindering their mathematical development [22]. Rural students, in particular, encounter logistical difficulties such as long and unsafe travel distances to school, insufficient transportation infrastructure, and inadequate school facilities, all of which negatively impact learning engagement [23]. Additionally, the limited exposure to innovative teaching methodologies, such as technology-integrated learning and inquiry-based instruction, due to insufficient teacher training and digital resources, further widens the mathematics achievement gap [24],[25]. Addressing these cumulative challenges necessitates a comprehensive investigation into policy interventions, technological innovations, and community-driven educational support systems to bridge educational disparities in Indonesia.

Despite a growing body of research on educational disparities, significant gaps remain in understanding the holistic impact of residential environments on mathematics learning outcomes. While previous studies have extensively examined the effects of socioeconomic status and school infrastructure on academic performance, relatively few have considered the interplay of psychological, cultural, and technological factors in shaping students' mathematical abilities [26]. Moreover, much of the existing literature is based on research conducted in developed countries, where educational resources and policies differ significantly from those in developing nations such as Indonesia. The potential of digital learning tools as an equalizer in reducing mathematics achievement gaps within the Indonesian context remains underexplored. Studies suggest that adaptive learning platforms and online tutoring can enhance student engagement and performance in mathematics, yet their accessibility and effectiveness remain inconsistent across different residential settings [27]. Understanding how these factors interact within Indonesia's unique socio-educational landscape is crucial for identifying effective interventions that mitigate learning disparities.

This study's novelty lies in its comprehensive examination of the residential environment's influence on mathematics learning, integrating social, economic, cultural, and technological perspectives. Unlike prior research that focuses on singular factors, this study employs a multidimensional framework to analyze the intersectionality of various environmental determinants. Additionally, this research evaluates the potential of technology-driven interventions, such as digital learning platforms and adaptive ed-

ucational tools, in bridging educational disparities and enhancing mathematics proficiency. Addressing disparities in mathematics education is not only essential for individual academic success but also contributes to national economic development by fostering a skilled and competitive workforce [28]. The research questions guiding this study are:

1. How does the residential environment affect students' motivation and academic performance in mathematics?
2. What are the key social, economic, and cultural factors contributing to disparities in mathematics achievement?
3. How can technological solutions be leveraged to bridge the educational divide caused by residential differences?
4. What policy recommendations can be formulated to enhance mathematics education for students from diverse residential backgrounds?

2 Material and Methods

This study employs a Systematic Literature Review (SLR) methodology to comprehensively examine the impact of residential environments on students' mathematics learning outcomes. The SLR approach was selected due to its rigorous and structured nature, allowing for the synthesis of findings from multiple studies to provide an evidence-based understanding of the topic [29]. A systematic review is particularly suitable for identifying research trends, assessing methodological strengths and limitations, and uncovering gaps in the existing literature, thereby offering valuable insights for future empirical research [30]. To ensure transparency, consistency, and replicability, this study adheres to the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) framework, which outlines a standardized methodology for literature selection, eligibility screening, and data synthesis [31],[32]. The PRISMA guidelines enhance the validity and reliability of systematic reviews by ensuring that the review process is comprehensive, methodologically sound, and free from selection bias. Additionally, PRISMA facilitates the identification of high-quality studies, ensuring that only relevant and methodologically robust research is included in the analysis. By adhering to this framework, this study provides a clear, structured, and replicable process that strengthens the credibility of its findings and contributes to the advancement of knowledge in the field of mathematics education.

The literature search was conducted using Google Scholar as the primary database, supplemented by additional searches in high-impact academic repositories, such as Scopus and Web of Science. Google Scholar was chosen due to its extensive coverage of peer-reviewed articles, conference proceedings, and academic books relevant to education research, particularly in mathematics education [33]. However, recognizing the potential limitations of relying solely on Google Scholar, additional screening was conducted using Scopus and Web of Science to ensure the inclusion of high-quality studies indexed in reputable educational databases. These supplementary databases were selected based on their rigorous indexing standards, ensuring that studies retrieved are of high academic relevance and methodological quality [34]. The combination of these

databases allowed for a more comprehensive literature review while minimizing potential selection bias.

The search strategy involved the use of specific keywords and Boolean operators to refine the selection process. The keywords used in this study included combinations of terms such as "residential environment," "mathematics achievement," "educational inequality," "socioeconomic status," "urban vs. rural education," and "academic performance." Boolean operators (AND, OR) were applied to optimize search precision and retrieve relevant studies while minimizing irrelevant results. Additionally, filters were applied to limit the search to studies published within the last ten years, ensuring the inclusion of recent and relevant research.

The selection process followed a structured and systematic approach to maintain methodological rigor and minimize the risk of bias in identifying relevant studies. Initially, all search results were screened based on their titles and abstracts to filter out studies that did not align with the research objectives. The inclusion criteria required that selected studies explicitly examined the relationship between residential environments and mathematics learning outcomes, utilized either quantitative or qualitative methodologies, and were published in peer-reviewed academic journals or other reputable sources [33]. To ensure the reliability of findings, only studies with clearly defined research methodologies and empirical data were considered. Conversely, studies that provided only theoretical discussions, lacked empirical validation, or did not explicitly address the role of residential environments in shaping mathematical achievement were excluded from further analysis. Following the initial screening, full-text articles were retrieved and subjected to an in-depth eligibility assessment to confirm their relevance and methodological soundness [34]. This stage involved a thorough evaluation of study design, sample size, data collection methods, and statistical analyses to ensure that only high-quality research was included in the review. To further enhance reliability and reduce potential selection bias, two independent reviewers assessed the selected studies, comparing their evaluations and resolving discrepancies through discussion and consensus-building. This multi-step review process ensured that the final dataset consisted of robust and methodologically sound studies that could contribute meaningful insights to the systematic literature review.

Once the final set of studies was identified, a systematic approach to data extraction and synthesis was employed. Key information, including study objectives, research methodologies, sample characteristics, and major findings, was extracted using a standardized coding framework. Thematic analysis was conducted to categorize studies based on common themes such as socioeconomic influences, parental involvement, educational resources, and urban-rural disparities in mathematics achievement. This approach facilitated the identification of patterns and emerging trends across different studies. Furthermore, methodological quality assessment was conducted to evaluate the reliability and validity of each study, ensuring that the synthesized findings were based on robust and well-documented research [33]. The synthesis process not only highlighted consistencies and contradictions in the literature but also provided insights into potential areas for future research. By systematically reviewing and synthesizing existing literature, this study aims to provide a comprehensive understanding of how residential environments shape students' mathematics learning experiences. The PRISMA

framework ensures that the review is conducted with methodological rigor, while the use of targeted search strategies and structured data extraction enhances the reliability of findings. The insights derived from this systematic review will contribute to the ongoing discourse on educational equity and inform policy recommendations aimed at reducing learning disparities caused by environmental factors [34].

2.1 PRISMA Flow Diagram

The selection process is visually represented in the PRISMA flow diagram below, outlining the systematic steps taken to refine the dataset and ensure methodological rigor.

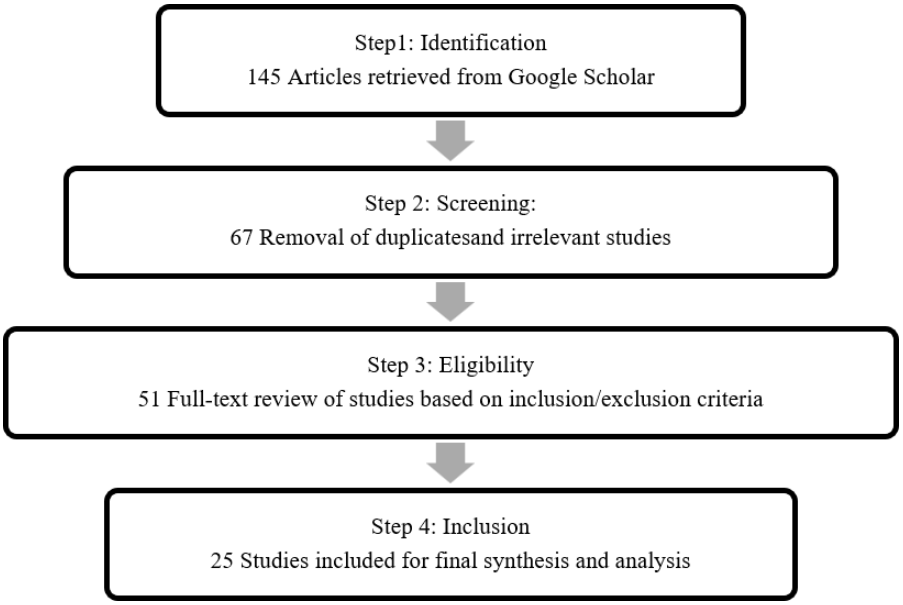

Fig. 1. PRISMA Flow Diagram for Article Selection

3 Result

3.1 Literature Search and Article Selection Process

The literature search process followed the PRISMA framework to ensure a rigorous and transparent selection of relevant studies. Initially, a total of 145 studies were retrieved from Google Scholar, Scopus, and Web of Science using predefined search terms such as "residential environment," "mathematics achievement," "educational in equality," "socioeconomic status," "urban vs. rural education," and "academic performance." After removing duplicate records, 118 unique studies remained. The first screening process, based on titles and abstracts, led to the exclusion of 67 studies that did not specifically address the impact of residential environments on mathematics

learning outcomes or lacked empirical data. The remaining 51 full-text articles were further assessed for eligibility according to the inclusion and exclusion criteria. At this stage, 26 papers were excluded due to methodological limitations, lack of sufficient data, or focus on broader educational themes without explicit reference to mathematics. The final dataset comprised 25 high-quality studies that met all inclusion criteria and provided substantial insights into the research question.

3.2 Summary of Selected Studies

The final dataset includes 25 studies published within the last decade, covering diverse aspects of residential environments and their influence on students' mathematics performance. The selected studies employ various research methodologies, including quantitative analyses, qualitative case studies, and mixed-method approaches. Below is a summary of the key studies included in the review.

Table 1. Summary of Selected Studies (Refer to Supplementary Materials for Full Table)

Author & Year	Title	Summary
Baker & Le-Tendre (2015)	The Role of Socio-economic Status in Mathematics Achievement	This study examines the correlation be- tween socioeconomic background and student performance in mathematics across different school settings.
Sirin (2017)	Socioeconomic Disparities and Educational Outcomes	A meta-analysis exploring how family income and educational attainment impact mathematics scores.
Fan & Chen (2018)	Parental Involvement and Mathematics Achievement	Investigates the role of parental engagement in shaping students' motivation and performance in mathematics.
Gonzalez et al. (2019)	Urban vs. Rural Education: A Comparative Study	Compares educational outcomes be- tween urban and rural students, focusing on mathematics proficiency.
Liu & Zhang (2020)	Cultural Influences on Mathematics Education	Examines how cultural attitudes toward mathematics affect student learning outcomes.
Evans (2021)	The Impact of Environmental Stability on Academic Perfomance	Analyzes how household stability and neighborhood conditions influence students' mathematics achievement.
Raudenbush & Bryk (2020)	Hierarchical Models in Educational Research	Explores how different levels of environmental influence shape students' academic trajectories

		in mathematics.
McLeod (2019)	Childhood Stress and Academic Achievement	Investigates the psychological effects of economic hardship on mathematics performance.
Hohlfeld et al. (2020)	Digital Learning as an Equalizer in Mathematics Education	Evaluates the effectiveness of digital platforms in addressing educational in equalities.
Lareau (2018)	Unequal Chillhoods: Class, Race, and Family Life	Examines how family background influences educational aspirations and performance.
Darling-Hammond (2020)	Teacher Quality and Student Performance	Investigates the role of teacher qualifications in student mathematics success.
OECD (2019)	Education at a Glance: Global Trends in Mathematics Perfomance	A comparative study of mathematics performance across different countries.
Lee & Bowen (2018)	The Influence of Pa- rental Socioeconomic Status on Academic Success	Examines the impact of family income and parental education on students' mathematics scores.
Hanushek & Woessmann (2017)	The Knowledge Capital of Nations	Investigates the long-term economic impact of mathematics proficiency.
Ryan & Deci (2019)	Self-Determination Theory and Student Motivation	Examines how intrinsic and extrinsic motivation affect mathematics learning.
Wang & Eccles (2020)	Social Support and Mathematics Achievement	Explores the influence of peer and teacher support on student performance.
Eccles & Roeser (2018)	Schools, Academic Motivation, and Stage-Environment Fit	Investigates how school environments impact student mathematics performance.
Leung & Park (2019)	Cross-Cultural Comparisons of Mathematics Education	Analyzes differences in mathematics instruction across countries.

Zimmerman (2021)	The Role of Metacognition in Mathematics Learning	Investigates the importance of self-regulated learning strategies.
Bronfenbrenner (2021)	Ecological Systems Theory and Education	Applies ecological theory to understand how environment shapes learning.
Sirin & Rogers-Sirin (2018)	Socioeconomic Status and Educational Attainment	Examines long-term academic trajectories of students from different backgrounds.
Mullis et al. (2020)	TIMSS International Mathematics Report	Presents global trends in mathematics proficiency.
Dweck (2019)	Growth Mindset and Mathematics Achievement	Explores the role of student mindset in mathematics success.
Boaler (2018)	Mathematical Mindsets	Investigates how classroom approaches influence students' attitudes toward mathematics.
Vygotsky (2021)	Social Development Theory and Mathematics Learning	Examines the role of social interactions in learning mathematics.

3.3 Key Themes and Patterns in the Literature

The synthesis of selected studies revealed several recurring themes and significant findings related to the impact of residential environments on mathematics learning outcomes. One of the most prominent themes is the role of socioeconomic status (SES) in shaping educational performance. Numerous studies consistently demonstrate that students from higher SES backgrounds tend to perform better in mathematics due to greater access to academic resources, private tutoring, and well-equipped schools. Conversely, students from lower SES families often face financial constraints, leading to limited access to supplementary learning materials and reduced parental academic support, which negatively affects their mathematical proficiency.

Another key theme is the urban-rural education divide, wherein students in urban areas generally outperform their rural counterparts. Several studies attribute this gap to differences in school infrastructure, teacher qualifications, and availability of technological learning tools. Urban schools typically have more advanced educational resources, including digital learning platforms and specialized mathematics programs, which enhance students' engagement and comprehension. In contrast, rural schools often suffer from inadequate funding, leading to larger class sizes and reduced teacher-student interaction, which hinders effective mathematics instruction.

3.4 Cultural Attitudes Toward Mathematics

The influence of cultural perceptions toward mathematics emerges as another crucial factor. Societies that place a high value on mathematical literacy and problem-solving skills tend to produce students with superior mathematical performance. For example, in East Asian countries where mathematics is culturally emphasized, students tend to develop stronger mathematical competencies compared to regions where mathematics is not prioritized in educational culture. The review suggests that fostering a positive attitude toward mathematics within communities can play a vital role in improving ed ucational outcomes. Further exploration into how cultural values shape students' motivation and engagement in mathematics learning would provide additional insights into this relationship.

3.5 The Role of Digital Learning Tools in Bridging Educational Inequalities

While digital learning tools were briefly mentioned in previous research, a more in-depth analysis highlights their significant potential in mitigating educational disparities, particularly in rural or low-income areas. Several studies found that online learning platforms, interactive simulations, and AI-driven personalized learning tools can enhance student engagement and mathematics achievement, particularly for students with limited access to traditional educational resources. However, the effectiveness of these tools depends on factors such as internet accessibility, digital literacy, and the integration of technology into the curriculum. The findings suggest that targeted investment in digital infrastructure and teacher training in underprivileged areas could significantly improve mathematics learning outcomes.

3.6 Conclusion of Results

The findings from this systematic review provide robust evidence that residential environments significantly influence students' mathematics learning outcomes through multiple interrelated factors. Socioeconomic status, urban versus rural school settings, parental involvement, cultural attitudes, and access to digital learning tools collectively shape students' access to resources and learning opportunities. These insights contribute to the broader discourse on educational inequality and highlight the need for targeted policy interventions aimed at reducing disparities in mathematics education. The next section will discuss these findings in greater depth, linking them to theoretical frameworks and policy implications to propose strategies for mitigating educational disparities.

4 Discussions

The findings from this systematic literature review highlight the significant role of residential environments in shaping students' mathematics learning outcomes. The synthesis of 25 selected studies demonstrates that socioeconomic status, access to educational

resources, parental involvement, and school location collectively influence students' academic performance. A recurring pattern in the literature is the strong correlation between socioeconomic background and mathematics achievement, with students from higher-income families consistently outperforming those from lower-income backgrounds due to better access to learning resources, private tutoring, and well-equipped schools [35]. These findings align with Bronfenbrenner's Ecological Systems Theory, which posits that students' academic success is shaped by multiple layers of environmental influence, from family and school settings to broader societal structures. The disparity in mathematics performance between urban and rural students further underscores the educational inequities that persist due to differences in infrastructure, teacher qualifications, and technological integration in classrooms [36].

One of the key insights from this review is the substantial impact of parental involvement on mathematics achievement, which has been consistently emphasized in prior research. Students whose parents actively engage in their learning process—by assisting with homework, monitoring academic progress, and fostering a positive attitude toward mathematics—tend to develop stronger motivation and demonstrate better learning outcomes [37],[38]. This correlation aligns with Vygotsky's Social Development Theory, which suggests that learning is enhanced when students receive support from more knowledgeable individuals, such as parents or guardians. However, lower-income families often face systemic barriers, including time constraints due to long working hours, lower educational attainment, and financial limitations that restrict their ability to provide adequate academic support [39]. These disparities create a gap in mathematics achievement, further exacerbated by unequal access to supplementary learning resources, such as private tutoring or educational technology [40]. Moreover, culturally embedded attitudes toward mathematics play a crucial role in shaping student performance, with societies that prioritize mathematical literacy producing students with higher achievement levels [41]. This underscores the necessity for educational policies that integrate community-based learning initiatives and culturally responsive teaching strategies to create a more supportive and inclusive mathematics learning environment. Future interventions should focus on equipping parents with the necessary skills and knowledge to effectively support their children's education, particularly in disadvantaged communities where parental engagement programs could significantly narrow the achievement gap.

The review also underscores the widening gap between urban and rural educational opportunities, highlighting the disparities in access to resources and their direct impact on mathematics achievement. Urban schools tend to benefit from well-funded infrastructure, experienced educators, and a structured curriculum that integrates modern pedagogical strategies, including technology-enhanced learning [42]. In contrast, rural schools often struggle with financial constraints, outdated educational materials, and a high student-teacher ratio, leading to a significant divide in academic outcomes. Research suggests that the digital revolution in education has the potential to mitigate these inequalities, as online learning platforms and adaptive technologies can provide students in remote areas with access to high-quality instructional materials [43]. However, merely introducing technology into the classroom is insufficient; effective implementation requires teacher training, curriculum restructuring, and policies that ensure

equitable distribution of digital resources [44]. Additionally, studies indicate that without adequate digital literacy skills, students in disadvantaged areas may not fully benefit from these technological advancements, further exacerbating educational disparities. These findings emphasize the necessity of government and institutional initiatives aimed at reducing the technological divide by providing targeted teacher training programs and improving access to digital infrastructure in underserved regions. By addressing these challenges, policymakers can bridge the urban-rural education gap and ensure that all students, regardless of their geographical location, have equal opportunities to excel in mathematics and other academic disciplines.

In the context of psychological factors influencing mathematics achievement, studies reveal that students experiencing financial instability or social stress tend to exhibit lower concentration levels, reduced working memory capacity, and weaker problem-solving abilities [45]. Chronic stress caused by economic hardship has been linked to cognitive overload, leading to difficulties in mathematical reasoning and logical thinking. These findings align with previous research indicating that students from financially disadvantaged backgrounds are more likely to experience academic anxiety, which in turn negatively impacts their mathematical performance. The Self-Determination Theory further reinforces this perspective, emphasizing that intrinsic motivation, self-efficacy, and autonomy in learning significantly contribute to students' success in mathematics. Students who lack a sense of control over their learning environment often struggle with engagement and perseverance when faced with complex mathematical problems [46]. Given the clear relationship between financial stress and academic underperformance, targeted interventions aimed at improving student mental health, providing access to school-based psychological support, and reducing financial barriers to education are essential. Additionally, integrating socio-emotional learning strategies into the mathematics curriculum can help equip students with resilience and coping mechanisms, ultimately fostering greater academic success in mathematics despite external stressors.

This study contributes to the existing literature by addressing key research gaps that have been largely overlooked in prior studies. While much of the previous research has focused on individual factors such as socioeconomic status, parental involvement, or access to educational technology, this systematic review offers a more integrated perspective by examining how these variables interact within a single analytical framework. By synthesizing multiple dimensions of residential influence, this study provides a holistic understanding of how social, economic, and environmental factors collectively shape students' mathematics achievement, highlighting the complex interplay between these determinants. Furthermore, unlike most prior research that has predominantly examined educational inequalities in Western contexts, this review expands the discourse by incorporating findings relevant to developing nations, particularly Indonesia, where disparities in educational quality are more pronounced [47]. The inclusion of studies from diverse geographical regions strengthens the generalizability of the findings and underscores the global nature of educational disparities in mathematics achievement. These insights offer valuable implications for educational policy development, as they emphasize the need for targeted interventions that consider both contextual and structural barriers to learning. By addressing these challenges, policymakers

and educators can design evidence-based strategies to foster more equitable and inclusive educational environments, ensuring that all students, regardless of their residential background, have access to quality mathematics education.

Despite the robustness of this review, some limitations must be acknowledged. First, the reliance on Google Scholar as the primary database may have excluded relevant studies published in specialized educational journals that were not indexed within this platform. Future research should consider incorporating multiple databases, such as Scopus and Web of Science, to enhance the comprehensiveness of the literature review. Additionally, while this study synthesizes existing findings, it does not include primary data collection or empirical validation. Future studies should consider mixed-method approaches that combine systematic reviews with field research to further validate the relationships identified in this study. Lastly, the generalizability of findings across different cultural and economic contexts requires further investigation, as educational policies and societal values differ significantly across regions [48]. In conclusion, this systematic review reaffirms that residential environments play a crucial role in shaping students' mathematics learning outcomes. Socioeconomic status, parental involvement, access to technology, and psychological well-being are key determinants of academic success. Addressing disparities in mathematics education requires multi-level interventions, including equitable resource allocation, parental education programs, and policies that promote digital literacy and mental health support for students. By bridging these gaps, educational institutions and policymakers can create a more inclusive and effective learning environment that enables all students to reach their full academic potential.

5 Conclusions

This systematic literature review has provided a comprehensive analysis of how residential environments influence students' mathematics learning outcomes. The synthesis of 25 selected studies confirms that multiple interrelated factors—such as socioeconomic status, parental involvement, access to educational resources, and school location—play a significant role in shaping students' academic performance. Students from higher-income families consistently outperform their lower-income counterparts due to increased access to high-quality education, private tutoring, and advanced learning technologies. Additionally, disparities between urban and rural educational settings remain a persistent issue, with rural students often experiencing limited access to qualified teachers, digital learning tools, and well-funded school infrastructure. Parental involvement has also been identified as a crucial determinant of mathematics achievement, where students with engaged parents tend to exhibit higher motivation and better problem-solving skills. Moreover, psychological factors such as financial stress and academic anxiety further exacerbate educational disparities, reinforcing the importance of holistic interventions to support student well-being.

The findings of this study directly address the research questions posed in the introduction, confirming that residential environments significantly influence students' motivation, access to learning opportunities, and overall mathematics performance. Soci-

oeconomic inequalities continue to shape educational trajectories, with economic instability limiting students' ability to fully engage in academic activities. Furthermore, the role of technology as a potential equalizer remains conditional on proper implementation, as digital learning tools alone are insufficient without adequate teacher training and curriculum integration. By synthesizing insights from various perspectives, this study contributes to a deeper understanding of the structural barriers affecting mathematics education and highlights the urgent need for targeted policy interventions to bridge the achievement gap. The implications of these findings extend beyond individual academic performance, emphasizing the broader societal impact of educational inequities. Addressing disparities in mathematics education is crucial for fostering social mobility, reducing economic inequality, and enhancing workforce readiness in STEM-related fields. Moreover, the findings reinforce the relevance of Bronfenbrenner's Ecological Systems Theory in understanding how multiple environmental layers interact to influence student outcomes. By recognizing these structural challenges, educators and policymakers can design more effective interventions that ensure all students, regardless of their residential background, have equal opportunities to succeed in mathematics.

To address the disparities identified in this study, policymakers should implement targeted interventions aimed at improving mathematics education in disadvantaged residential environments. First, government policies should focus on equitable resource allocation, ensuring that rural and low-income schools receive adequate funding for infrastructure, digital learning tools, and teacher training programs. Educational funding should prioritize schools with limited resources, addressing disparities in access to qualified teachers and modern instructional materials. Second, schools should adopt inclusive teaching strategies that support students from diverse socioeconomic backgrounds. Personalized learning approaches, including adaptive digital platforms and remedial mathematics programs, should be integrated into curricula to accommodate students with varying levels of proficiency. Additionally, schools should encourage community-based learning initiatives that involve parents in their children's education, fostering a home-school collaboration that has been shown to improve student achievement. Third, educators should receive professional development on digital pedagogy and culturally responsive teaching. Teacher training programs should emphasize the effective use of technology in mathematics instruction, particularly in underprivileged areas where access to digital resources remains limited. Additionally, incorporating culturally relevant examples in mathematics education may help bridge the gap for students from marginalized communities, improving engagement and motivation.

Despite its contributions, this study is not without limitations. The reliance on Google Scholar as the primary database may have excluded relevant studies from other indexed sources such as Scopus and Web of Science, potentially limiting the comprehensiveness of the literature selection. Additionally, while this review synthesizes existing research, it does not include primary data collection or empirical validation, which may impact the generalizability of the findings across different educational contexts. Furthermore, cultural variations in attitudes toward mathematics education were not explored in depth, leaving room for further investigation into how societal values influence learning outcomes.

Based on these limitations, future studies should employ mixed-method approaches that combine systematic reviews with empirical field research to provide a more nuanced understanding of these complex relationships. More empirical studies, particularly longitudinal research, are needed to validate the relationships identified in this review and to assess the long-term effects of residential environments on mathematics achievement. Additionally, research should explore the effectiveness of specific inter vention programs designed to mitigate educational disparities, such as parental engagement initiatives, digital learning accessibility, and teacher training programs. Comparative studies across different cultural and economic contexts would also provide valuable insights into how global education systems can adopt best practices to reduce achievement gaps. By addressing these gaps, future research can contribute to the development of more equitable and effective educational policies that enhance mathematics learning outcomes for all students. Implementing the proposed policy recommendations and focusing on evidence-based interventions can help ensure that students, regardless of their residential background, have access to high-quality mathematics education and the opportunity to excel academically.

6 Limitations, Future Research, and Implications

Despite the contributions of this systematic literature review, several limitations must be acknowledged. First, the reliance on Google Scholar as the primary database may have restricted the comprehensiveness of the literature selection, as studies indexed in other high-impact databases such as Scopus and Web of Science were not systematically included. This limitation may have led to the omission of relevant re-search, potentially affecting the depth of the review. Second, while this study synthesizes findings from various sources, it does not incorporate primary data collection or empirical validation. As a result, the findings rely on the methodologies and interpretations of previous studies, which may introduce inherent biases or inconsistencies. Third, cultural and regional variations in the influence of residential environ-ments on mathematics achievement were not deeply explored, leaving gaps in understanding how these factors operate across different educational systems.

Future research should address these limitations by expanding the scope of database searches to in-clude Scopus, Web of Science, and other indexed repositories to ensure a more comprehensive review of the literature. Additionally, mixed-method approaches that combine systematic reviews with empirical studies can provide deeper insights into the causal relationships between residential environments and mathematics learning outcomes. Longitudinal studies tracking students' academic progress over time would also enhance understanding of how these environmental factors evolve and influence achievement across different educational stages. Comparative studies across diverse cultural and economic contexts would further contribute to a more global understanding of the issue. The findings of this study have significant implications for both policy and practice. Educational policymakers should prioritize equitable resource allocation, particularly for students in disadvantaged residential environments, to mitigate the impact of socioeconomic disparities on mathematics achievement. Schools and

educators should imple-ment targeted interventions such as parental engagement programs, digital learning accessibility initia-tives, and teacher training programs to bridge the achievement gap. Moreover, fostering collaborations between communities, educational institutions, and governments can create a more inclusive and support-ive learning environment for students, ensuring that all learners have access to quality mathematics edu-cation regardless of their residential background.

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