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Gender-Based Mathematics Anxiety: Strategies for Teachers to Foster Confidence and Inclusion

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Abstract: This study aims to examine how teachers address students' mathematics anxiety from a gender perspective at a public high school in Mataram. Employing a qualitative approach with a case study design, this research involves in-depth interviews and document analysis. The participants include mathematics teachers and students who experience varying levels of mathematics anxiety. The research process encompasses participant selection, instrument preparation and validation, data collection through interviews regarding teachers' strategies for managing mathematics anxiety, data analysis, triangulation, and interpretation. The findings reveal that teachers implement several key strategies, including fostering a supportive and inclusive learning environment, utilizing collaborative and differentiated instruction, integrating technology, and providing gender-sensitive feedback. These strategies have proven effective in reducing students' anxiety and increasing their confidence in mathematics learning. The study highlights the crucial role of teachers in mitigating mathematics anxiety and promoting equitable learning experiences. Future research could explore the impact of these strategies in different educational settings and examine additional factors influencing mathematics anxiety from a broader perspective.

Keywords: Gender in Learning, Mathematics Anxiety, Teacher Strategies

Introduction

Mathematics is one of the fundamental disciplines that plays a crucial role in daily life and technological advancement. Within the education system, this subject serves as the foundation for various fields, including science, technology, and economics. Therefore, early mastery of mathematics is essential to enhance the global competitiveness of the younger generation. However, in reality, not all students perceive mathematics learning positively. Many experience difficulties in understanding concepts and solving problems, often leading to high levels of academic anxiety (Luttenberger et al., 2018).

Mathematics anxiety is a well-documented psychological phenomenon in the field of education. The term mathematics anxiety refers to feelings of fear, anxiety, or discomfort when students encounter mathematical tasks (Pantoja et al., 2020). Studies indicate that such anxiety negatively impacts academic performance, hinders cognitive processes, and lowers students' motivation to learn mathematics (Putra & Yulanda, 2022). Furthermore, high anxiety levels can lead students to develop avoidance behaviors toward mathematics, ultimately resulting in poor academic achievement (Syafri, 2017).

Indonesia faces significant challenges in mathematics education. According to the 2022 Programme for International Student Assessment (PISA), Indonesian students ranked 69th out of 80 countries in mathematical literacy, with an average score of 366, a decline from 379 in PISA 2018. This data reflects the low level of mathematical understanding among students nationwide, which may be attributed to several factors, including

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teaching methods, learning environments, and psychological factors such as mathematics anxiety.

Over the past decades, gender issues in education have gained increasing research attention. Several studies have identified significant differences in how male and female students respond to mathematics learning. Female students tend to experience higher levels of mathematics anxiety than their male counterparts, which can negatively affect their confidence in solving mathematical problems (Jayantika, 2020). Conversely, male students are generally associated with higher self-confidence in mathematics, even though their academic performance is not necessarily superior to that of female students (Doz et al., 2025).

Teachers play a crucial role in the success of mathematics education. As facilitators of the learning process, teachers are responsible not only for delivering content but also for creating a conducive learning environment and helping students overcome psychological barriers (Hattie, 2023). Teachers who understand psychological factors such as mathematics anxiety can develop more inclusive and differentiated teaching strategies to support students with varying levels of anxiety (Barroso et al., 2021).

Understanding mathematics learning from a gender perspective is essential for educators. Gender differences in mathematics anxiety highlight the need for more personalized and gender-sensitive teaching approaches. If teachers can accommodate these differences, they can implement more effective strategies to reduce students' anxiety in mathematics, regardless of gender (Pantoja et al., 2020). Therefore, further research is needed to explore how teachers can effectively address mathematics anxiety in students from a gender perspective.

To date, research on mathematics anxiety has primarily focused on improving students' academic achievement without deeply considering gender as a moderating factor. For instance, a study by Wang et al. found that mathematics anxiety negatively correlates with academic performance but did not extensively examine how gender influences this relationship (Wang et al., 2020). Additionally, Malanchini et al, highlighted the impact of mathematics anxiety on problem-solving skills but did not specifically address how teachers can tailor their teaching strategies based on gender differences (Malanchini et al., 2020).

Previous studies on mathematics anxiety have primarily focused on its correlation with academic achievement, often neglecting how gender differences shape students' experiences and how teachers can adapt their instructional strategies accordingly. For instance, Wang et al. emphasized the negative correlation between mathematics anxiety and academic performance but did not explore how these effects vary by gender (Madjar et al., 2018). Similarly, Malanchini et al. discussed cognitive aspects of anxiety but overlooked pedagogical approaches that could be tailored to male and female students (Caviola et al., 2019). These limitations indicate a research gap in understanding the intersection of gender and teacher strategies in mitigating mathematics anxiety. Therefore, this study is designed to fill that gap by examining how gender influences students' mathematics anxiety and how teachers respond through inclusive and adaptive practices.

This research is essential as it provides insights for educators and policymakers in developing more adaptive teaching strategies. By understanding how mathematics anxiety develops based on gender and how teachers can mitigate it, the findings of this study are expected to contribute to broader improvements in the quality of mathematics education.

The objective of this research is to explore how gender influences students' mathematics anxiety and how teachers can effectively address it through gender-sensitive teaching strategies. By understanding these differences, more inclusive teaching approaches can be developed, ensuring that all students, regardless of gender, can reach their full potential in mathematics.

Method

This study employs a qualitative approach with a phenomenological research design to explore the role of teachers in reducing mathematics anxiety among students, particularly in relation to gender differences. A phenomenological approach was chosen to capture the lived experiences of teachers and students in the learning process (Creswell, 2020). The study was conducted at one of the public high schools in Mataram, selected because of its diverse student population and its implementation of various teaching strategies aimed at addressing mathematics anxiety. This setting allows for a focused analysis of gender-sensitive teaching practices in mathematics education.

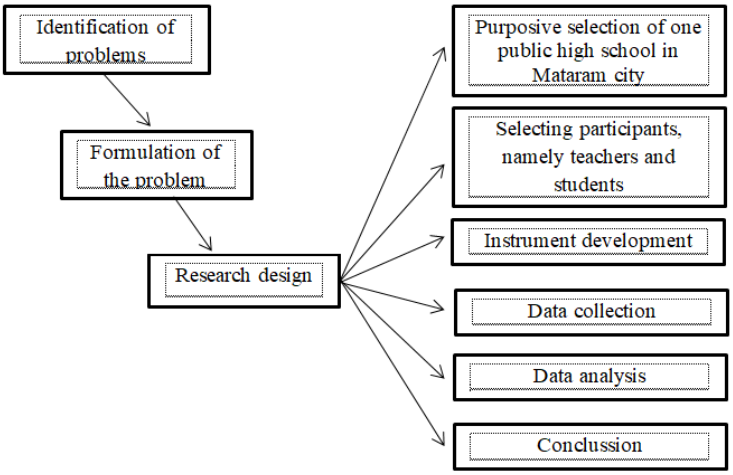

Figure 1. Research steps

A purposive sampling technique (Merriam & Grenier, 2019) was employed to ensure that participants had substantial experience in teaching mathematics and addressing students' learning anxieties. The sample consisted of mathematics teachers and students, both male and female, to capture diverse perspectives on mathematics anxiety and its mitigation strategies. The inclusion criteria required teachers to have a minimum of two years of teaching experience in mathematics and to have implemented various instructional methods. Students selected for the study were those who had previously reported experiencing anxiety related to mathematics. This selection ensured a comprehensive representation of experiences, allowing for a deeper understanding of the challenges and effective teaching strategies in reducing mathematics anxiety.

Data were collected through in-depth interviews, classroom observations, and document analysis. The interview questions were developed based on a review of relevant literature on mathematics anxiety and gender-sensitive pedagogy (Barroso et al., 2021). Before formal data collection, the interview guide was pilot-tested with a small group of teachers and students to ensure clarity and relevance. Each interview lasted between 15 to 20 minutes and was conducted in a semi-structured format, allowing participants to elaborate on their experiences while maintaining consistency across responses. Classroom observations were conducted to examine the implementation of various

instructional strategies in real-time, while document analysis included lesson plans and school policies related to mathematics instruction. All interviews and observations were recorded, transcribed, and manually coded to facilitate accurate data interpretation.

The collected data were analyzed using thematic analysis following the model of Miles et al. (Miles et al., 2014), which consists of three interconnected stages. The first stage, data reduction, involved reviewing transcriptions and identifying relevant themes, focusing on key aspects such as teaching methods, student engagement, and gender differences in mathematics anxiety. The second stage, data display, structured the categorized data into tables and diagrams to highlight recurring patterns and relationships between identified themes, making it easier to compare different perspectives on mathematics anxiety.

The final stage of this research involved data verification and conclusion drawing, which were conducted to ensure the trustworthiness and rigor of the findings in the context of gender-based mathematics anxiety among high school students. To strengthen the validity of the data, this study explicitly applied Lincoln and Guba's four trustworthiness criteria: credibility, transferability, dependability, and confirmability (Alexander, 2019).

Credibility was established through several strategies. The researcher conducted in-depth interviews with both teachers and students who represented diverse levels of mathematics anxiety and gender backgrounds, ensuring variation in perspectives. Triangulation was achieved by comparing data from multiple sources interview transcripts, classroom observation notes, and relevant school documents. Furthermore, member checking was carried out by presenting preliminary findings to selected participants to confirm the accuracy and authenticity of interpretations.

Transferability was addressed by providing thick, detailed descriptions of the research setting a public high school in Mataram along with the cultural and social dynamics that influence students' experiences with mathematics and gender. The characteristics of participants, including their gender, grade level, and degree of anxiety, were described in sufficient depth to enable readers and other researchers to determine the relevance and applicability of the findings to different contexts.

Dependability was ensured by maintaining a transparent and systematic research process. The steps of data collection, thematic analysis, and interpretation were carefully documented. A methodological log was kept throughout the study to track changes, decisions, and rationales, thus creating an audit trail that allows future replication or evaluation of the research process.

Confirmability was enhanced by grounding interpretations firmly in the participants' actual responses. Direct quotations from interviews were used to support the emergent themes. In addition, the researcher engaged in reflexive journaling to minimize personal bias and consulted external experts to review the coding and theme development processes. These measures helped ensure that the findings reflect the participants' experiences rather than the researcher's assumptions.

Results and Discussion

Mathematics Anxiety Levels Based on Gender

The findings reveal notable gender-based differences in the levels and manifestations of mathematics anxiety among students. Through interviews and classroom observations, it was found that female students tend to exhibit more visible emotional responses such as nervousness, hesitation in answering questions, and self-doubt, while male students

more often displayed avoidance behavior, such as disengaging during math discussions or underestimating the importance of math learning.

One female student (S3) stated: "*Setiap kali pelajaran matematika dimulai, saya langsung merasa tegang, bahkan sebelum gurunya menjelaskan. Kadang saya merasa memang perempuan itu kurang cocok di matematika*." This perception of inadequacy appears to be socially constructed and often reinforced by previous academic experiences or teacher feedback, as also noted by Barroso et al. Conversely, a male student (S6) mentioned: "*Saya nggak terlalu takut, tapi kalau nggak ngerti ya sudah, saya diam saja, malas bertanya karena takut dibilang bodoh*." Classroom observation further confirmed that male students were less likely to seek help, even when showing signs of confusion, while female students showed more willingness to engage but with visible anxiety.

Mathematics anxiety is a psychological phenomenon that affects students' academic performance and has been widely studied in various educational contexts. One intriguing aspect of research on mathematics anxiety is the difference in anxiety levels based on gender. Several studies indicate that female students tend to experience higher levels of mathematics anxiety than their male counterparts (Luttenberger et al., 2018; Jayantika, 2020). This is often associated with social, cultural, and psychological factors that shape students' perceptions of their numerical abilities. Additionally, gender expectations from the surrounding environment, including teachers and parents, contribute to the differing anxiety patterns between male and female students in mathematics (Pantoja et al., 2020).

Mathematics anxiety can be categorized into three main aspects: cognitive, affective, and physiological. The cognitive aspect includes negative thoughts or worries that arise when students face mathematical tasks. Meanwhile, the affective aspect involves emotions such as fear or anxiety that hinder the comprehension of mathematical concepts. On the other hand, the physiological aspect manifests in bodily reactions such as increased heart rate, sweating, or even dizziness when dealing with mathematical material (Putra & Yulanda, 2022). Studies suggest that female students tend to experience more intense affective and physiological reactions compared to male students, who more frequently exhibit cognitive anxiety, such as a lack of confidence in solving mathematical problems (Reilly et al., 2019).

One of the primary factors influencing the level of mathematics anxiety is self-efficacy, or students' confidence in completing mathematical tasks. Bandura (1999) stated that high self-efficacy contributes to reduced academic anxiety and increased learning motivation. In the context of gender, recent research suggests that while there is no significant difference in self-efficacy levels between male and female students, female students tend to have higher anxiety due to negative perceptions of their mathematical abilities (Kusumawati & Nayazik, 2017). Low self-efficacy can create a cycle of anxiety that further deteriorates their academic performance in mathematics.

Social and cultural factors also play a role in shaping the differences in mathematics anxiety levels between male and female students. Gender stereotypes that associate mathematics with a male-dominated field can influence female students' confidence in mastering this subject (Levine & Pantoja, 2021). Additionally, expectations from family, school, and society often reinforce the perception that females are less talented in mathematics than males. As a result, female students are more likely to experience higher levels of anxiety when facing mathematical challenges, ultimately impacting their academic achievements (Kusumawati & Nayazik, 2017).

The impact of mathematics anxiety on academic performance is significant. Several studies have shown that students with high levels of anxiety tend to avoid mathematical tasks and perform worse than students with lower anxiety levels (Barroso et al., 2021).

Moreover, persistent mathematics anxiety among female students may lead to a decreased interest in STEM (Science, Technology, Engineering, and Mathematics) fields at higher education levels (Lau et al., 2022). Therefore, it is crucial for educators to understand how mathematics anxiety affects students differently based on gender to implement more effective teaching strategies.

Strategies to reduce mathematics anxiety must consider gender differences to effectively help students develop a positive attitude toward mathematics. Teachers can create a more inclusive learning environment by avoiding gender bias in instruction, providing adequate emotional support, and applying more interactive and experiential teaching methods (Mustika et al., 2024). Additionally, approaches that focus on enhancing self-efficacy, such as providing effort-based praise rather than result-based praise, can help reduce mathematics anxiety among female students (Doz et al., 2025).

The role of teachers is crucial in identifying and addressing students' mathematics anxiety. Teachers must be sensitive to the signs of mathematics anxiety, whether in cognitive, affective, or physiological aspects. By better understanding how this anxiety affects students based on gender, teachers can develop more effective teaching strategies to boost students' confidence and engagement in mathematics learning (Nurhidayat & Djidu, 2022). Furthermore, training programs for teachers on managing academic anxiety can contribute to creating a more supportive and conducive classroom environment for all students.

The implications of education policies in addressing gender-based mathematics anxiety are essential for curriculum development and teaching strategies. Programs aimed at reducing mathematics anxiety should integrate approaches that consider gender differences to ensure their effectiveness (Kusmartiningrum et al., 2024). Thus, synergy among teachers, students, parents, and policymakers is needed to create a supportive learning environment that encourages all students to build greater confidence in mastering mathematics without being influenced by gender stereotypes.

These findings are consistent with prior studies indicating that female students often internalize negative societal beliefs about their mathematical ability, leading to higher affective and physiological anxiety responses (Jayantika, 2020). However, unlike prior research that primarily quantified anxiety levels, this study provides insight into how these differences manifest in classroom experiences and how teachers perceive and address them. While earlier works such as by Wang et al. examined the statistical correlation between gender and anxiety, this study highlights practical classroom observations, offering more pedagogical relevance (Wang et al., 2020).

A strength of this study is its emphasis on lived experiences and teacher strategies, which is often lacking in quantitatively driven studies. However, a limitation lies in the scope, as it focuses on a single school context, making generalizability limited. Future studies might compare settings across regions or student socioeconomic backgrounds.

The Role of Teachers in Reducing Mathematics Anxiety

Teachers play a crucial role in identifying and responding to students' anxiety symptoms in the classroom. Interviews with mathematics teachers showed that they are aware of the emotional and psychological burden mathematics can cause, especially among female students. Teachers reported various efforts, including personalized attention, use of humor, and gradual increase in task difficulty, to build confidence. One teacher (T2) shared: "*Saya sering memulai pelajaran dengan soal-soal ringan dulu, agar mereka merasa berhasil dulu di awal. Terutama anak-anak perempuan, mereka sering langsung merasa tidak mampu sebelum mencoba.*" In-class observations supported this

statement: teachers frequently used motivational language, called on students equally, and provided positive reinforcement to reduce fear of failure. Analysis of lesson plans also showed that some teachers deliberately incorporated low-stakes group activities and games to reduce tension. One document explicitly mentioned, "*gunakan aktivitas kelompok heterogen untuk mengurangi tekanan individu*." These strategies align with existing literature emphasizing the role of teacher emotional support in mitigating anxiety (Quintero et al., 2022).

Teachers play a crucial role in creating a conducive and supportive learning environment for students experiencing mathematics anxiety. As learning facilitators, teachers are not only responsible for delivering subject material but must also understand the psychological factors affecting students' academic performance, including mathematics anxiety (Quintero et al., 2022). This anxiety can hinder students' ability to grasp mathematical concepts, making it essential for teachers to develop strategies that help reduce the pressure students feel during learning. Research has shown that a more inclusive and supportive teaching approach can significantly lower students' anxiety levels, particularly for those with negative perceptions of mathematics (Barroso et al., 2021).

One effective strategy teachers can implement to reduce mathematics anxiety is fostering a positive and pressure-free classroom atmosphere. A study by Namkung et al. (2019) found that students who feel safe and comfortable in their learning environment are more likely to gain confidence in solving mathematical problems. Teachers can create this environment by providing emotional support, avoiding punitive measures for mistakes, and offering constructive feedback. By doing so, students become more motivated to actively participate in learning without the fear of failure.

Additionally, incorporating diverse and experience-based teaching methods can help alleviate mathematics anxiety. Strategies such as game-based learning, project-based learning, and collaborative learning have been shown to improve students' mathematical understanding while reducing the stress associated with the subject (Putra & Yulanda, 2022). These approaches allow students to engage with mathematics in enjoyable and meaningful ways, making the subject less intimidating.

Teachers must also have a strong understanding of gender differences in mathematics anxiety and how to address them. Research indicates that female students are generally more susceptible to mathematics anxiety than male students, largely due to social and cultural influences shaping their perceptions of mathematical ability (Levine & Pantoja, 2021). Therefore, teachers should avoid reinforcing gender stereotypes in their teaching and ensure that all students receive equal opportunities to participate in discussions, solve problems, and demonstrate their mathematical skills.

A self-efficacy-based approach can also be an effective strategy in overcoming mathematics anxiety. Bandura (1999) emphasized that students' confidence in their academic abilities can be strengthened through successful experiences, role model observation, social persuasion, and emotional regulation. In mathematics education, teachers can enhance students' self-efficacy by providing challenges suited to their skill levels, recognizing their efforts, and gradually guiding them through learning obstacles (Masruroh & Nurfitriyanti, 2022).

Beyond classroom strategies, teachers can collaborate with parents to help students manage their mathematics anxiety. A study by Asmawati et al. (2021) found that parental support in mathematics learning can significantly reduce students' anxiety, particularly in reinforcing their numerical confidence. Teachers can provide parents with guidance on

how to support their children's learning at home, such as creating enjoyable study routines, minimizing excessive pressure, and offering positive motivation.

Professional development and training for teachers on recognizing and managing mathematics anxiety are essential to improving classroom strategies. Quintero et al. (2022) highlighted that many teachers still lack sufficient awareness of the impact of mathematics anxiety on students' performance. Training programs on academic anxiety management strategies, educational psychology-based teaching techniques, and individualized approaches for students with anxiety can significantly enhance the quality of mathematics instruction.

Ultimately, the role of teachers in reducing mathematics anxiety extends beyond academics to include emotional and social aspects of learning. By fostering a supportive classroom environment, implementing innovative teaching methods, understanding gender differences in mathematics anxiety, and collaborating with parents, teachers can help students overcome their fear of mathematics and improve their motivation and academic achievement (Braas, 2022). Therefore, it is crucial for teachers to adopt a holistic approach to mathematics education, ensuring that all students have the opportunity to develop confidence and success in the subject.

This study confirms that when teachers adopt a supportive and emotionally safe learning environment, mathematics anxiety particularly among female students can be significantly reduced. This aligns with the theoretical framework by Namkung et al., which emphasizes that classroom climate moderates the anxiety-performance relationship (Jayantika, 2020). Furthermore, the findings extend the research by Quintero et al. (2022) illustrating that teacher awareness and pedagogical adaptability are critical in translating theory into real classroom outcomes.

One of the novel contributions of this study is the identification of gender-responsive instructional patterns used by teachers, such as equal participation and praise strategies, which are rarely detailed in other literature. While existing research often suggests what should be done, this study documents what is actually being implemented, bridging the theory-practice gap. The impact of this research is twofold. First, it provides empirical evidence for teacher training programs to integrate gender sensitivity in anxiety management. Second, it offers policy-level insights, suggesting that gender-informed pedagogy can be institutionalized in curriculum design, classroom assessment, and teacher evaluation frameworks.

Gender-Sensitive Teaching Strategies in Mathematics

Gender-sensitive teaching strategies play a crucial role in mathematics education, particularly in addressing the anxiety gap between male and female students. Research indicates that female students often experience higher levels of mathematics anxiety than their male counterparts, which can negatively impact their academic performance (Levine & Pantoja, 2021). Therefore, teachers must develop instructional methods that take into account gender differences in perceptions and approaches to mathematics. This approach not only aims to create equal learning opportunities but also helps students of all gender backgrounds build confidence and improve their mathematical skills (Dewi & Simamora, 2022).

One of the key strategies in gender-sensitive teaching is fostering an inclusive classroom environment that is free from gender stereotypes. Studies suggest that social perceptions and cultural expectations often lead female students to feel less confident in mathematics compared to male students (Sinaga, 2024). To counter this, teachers should actively eliminate biases in their interactions with students, whether in questioning,

assigning tasks, or providing feedback. For example, teachers can ensure equal opportunities for both male and female students to participate in discussions and lead problem-solving activities in mathematics classes (Jayantika, 2020).

Moreover, implementing collaborative teaching methods can help reduce mathematics anxiety in female students while improving their problem-solving skills. Research suggests that female students tend to feel more comfortable in cooperative rather than competitive learning environments, making strategies such as project-based learning and group discussions particularly effective (Kusmartiningrum et al., 2024). These models encourage students to work together in solving mathematical problems, fostering a supportive environment that alleviates pressure and enhances conceptual understanding.

In addition to collaborative approaches, integrating technology into mathematics instruction can help bridge the gender gap in mathematics anxiety. The use of interactive software and digital learning applications has been shown to increase female students' engagement and motivation in learning mathematics (Sinaga, 2024). Technology provides students with a more personalized and flexible learning experience while reducing the social pressure they may feel in traditional classroom settings. This strategy enables students of diverse gender backgrounds to develop greater comfort and confidence in tackling mathematical challenges.

Another effective approach is providing role models who can inspire students, particularly female students who may lack representation in STEM (Science, Technology, Engineering, and Mathematics) fields. A study by Sansone (2019) found that the presence of female educators or professionals in STEM can boost female students' motivation and confidence in learning mathematics. Teachers can invite women professionals in STEM as guest speakers or introduce students to success stories of accomplished women in mathematics to help shift perceptions of mathematical ability.

Conclusion

Mathematics anxiety among students, particularly based on gender differences, is a significant challenge in education. Female students tend to experience higher levels of anxiety compared to male students, influenced by social factors and gender stereotypes. Therefore, the role of teachers is crucial in creating an inclusive, supportive, and bias-free learning environment to enhance students' confidence and reduce their anxiety toward mathematics. Gender-sensitive teaching strategies, such as collaborative learning, technology integration, role model provision, and differentiated instruction, have proven effective in addressing mathematics anxiety. Through these approaches, students can become more confident, motivated, and have equal learning opportunities. The implementation of these strategies not only improves students' understanding and academic performance in mathematics but also fosters a more equitable and inclusive education system for all genders.

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Author Contribution

Authors contributed equally to the conception, design, and writing of this article. SB was primarily responsible for data collection and initial drafting. AH & NH focused on data analysis and critical revision of the manuscript.

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