Students' Interest in Learning Mathematics Across Countries: A Systematic Review of Influencing Factors

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Abstract. Students' interest in learning mathematics is an important factor that influences their learning outcomes and academic success. This study aims to identify and analyze the factors that influence students' interest in learning mathematics in various countries through a systematic review of 135 articles from 35 countries. This study uses the PRISMA framework to ensure transparency and replication of the research process. The analysis results show that the factors influencing students' interest can be grouped into four main categories: individual, social, pedagogical, and environmental. Individual factors include self-efficacy, intrinsic motivation, and mathematics anxiety. Social factors include parental support, teacher-student relationships, and social norms such as gender stereotypes. Pedagogical factors involve the relevance of material to real life, the use of technology, and active learning approaches. Environmental factors include family economic conditions, resource availability, and local culture. Additionally, cultural differences and educational systems in various countries influence how these factors interact, creating a complex dynamic in shaping students' interest in mathematics. This study provides important insights for educators and policymakers to develop relevant and contextual strategies to increase students' interest in mathematics globally.

Keywords: Students' interest, Mathematics education, Systematic review, Learning motivation, Pedagogical factors

1 Introduction

The study of mathematics plays a crucial role in global education [1]. Mathematics not only serves as the foundation for many disciplines Masanja [2] but also functions as a tool for developing critical thinking Obidovna [3] and problem-solving skills Choudhar et al. [4]. According to a Uddin [5], strong mathematical skills contribute to the

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development of abilities required in the workforce, including data analysis and programming. In many countries, mathematics is considered one of the primary indicators of students' academic success [6]. For instance, in the Programme for International Student Assessment (PISA), held every three years, countries with high mathematics scores often demonstrate higher overall education levels and more stable economies [7].

Students' interest in learning mathematics is a crucial factor influencing their learning outcomes [8]. Research shows that students with a high interest in mathematics tend to be more motivated to learn and perform better in exams [9]. This interest can be influenced by various factors, including early experiences with mathematics Lavidas et al. [10], support from teachers Chiu et al. [11], and a positive learning environment [12]. A study [13] revealed that these factors can enhance students' motivation, which in turn contributes to better academic achievement. Furthermore, students who are interested in mathematics are more likely to pursue careers in STEM (Science, Technology, Engineering, and Mathematics), which are increasingly important in the digital era [14].

Variations in students' interest in learning mathematics can be observed across countries. For example, students in Singapore and Japan exhibit very high interest and achievement in mathematics, while students in some developing countries often face greater challenges in terms of motivation and performance [15]. According to the TIMSS (Trends in International Mathematics and Science Study) report, students from countries with education systems that support active and collaborative learning tend to have higher interest in mathematics [16]. Additionally, cultural and social factors play a significant role; in some countries, mathematics is highly valued as a discipline, whereas in others, there may be a negative stigma associated with the subject's difficulty Alam & Mohanty [17].

Although much research has been conducted on the factors influencing students' interest in learning mathematics, there remains a lack of comprehensive understanding of how these factors interact across different cultural contexts and education systems. Previous studies often focus on a single country or region, neglecting cross-country comparisons that could provide broader insights. Therefore, there is an urgent need for a systematic review to identify and analyze the factors influencing students' interest in learning mathematics across various countries.

The purpose of this systematic literature review is to identify and analyze the factors that influence students' interest in learning mathematics in different countries. By collecting and analyzing data from previous studies, this review aims to uncover patterns and trends that explain differences in students' interest. It also seeks to provide deeper insights into how education policies and teaching practices can be improved to enhance students' interest in mathematics. This is particularly relevant given the challenges many countries face in improving students' mathematics achievement.

The research questions to be addressed in this review include: What are the factors influencing students' interest in learning mathematics across different countries? How do cultural differences and education systems affect students' interest? By answering these questions, this study aims to make a significant contribution to the development of more effective and relevant educational strategies to increase students' interest in

learning mathematics worldwide. This research will not only enrich the existing literature but also provide practical recommendations for educators and policymakers to create more supportive and engaging learning environments for students.

1.1 Scope of the Research

Interest in learning mathematics is a critical factor influencing students' success in understanding and mastering mathematical concepts [18]. According to [19], interest can be defined as an individual's tendency to engage in a particular activity, which, in this context, is learning mathematics. This interest is not only related to students' attraction to the subject matter Darmawan Harefa. [20] but falso involves emotional and cognitive aspects that affect their motivation to learn [21]. In this study, interest will be limited to two main aspects: intrinsic interest, which arises from within the student, and extrinsic interest, which is influenced by external factors such as the social and educational environment.

Data from PISA indicates that students' interest in learning mathematics varies across countries. For instance, in the PISA 2018 report, countries like Singapore and Japan demonstrated high levels of interest in mathematics, with 80% of students reporting that they enjoy learning the subject [22]. In contrast, in some European countries, such as France and Spain, this figure is significantly lower, with only about 50% of students expressing interest in the subject. This suggests that students' interest in learning mathematics is influenced by various contextual and cultural factors.

Another limitation to consider is that students' interest in learning mathematics is not solely determined by their learning experiences in school but also by factors outside the formal educational environment. For example, family support, access to educational resources, and peer influence can play a significant role in shaping students' interest. Research by Yeung [23] shows that emotional and instrumental support from parents can enhance students' interest in learning, particularly in subjects perceived as challenging, such as mathematics.

Furthermore, it is important to distinguish between short-term and long-term interest. Short-term interest may be triggered by positive learning experiences, such as success in exams or recognition from teachers. However, building long-term interest requires a more holistic approach that includes the development of problem-solving skills and the practical application of mathematics in everyday life. Research by Judith M. Harackiewicz, Jessi L. Smith [24] suggests that sustained interest can be fostered through relevant and meaningful learning experiences.

In a global context, understanding students' interest in learning mathematics is essential for designing effective curricula and teaching strategies. By understanding the factors that influence students' interest, educators can develop approaches that better align with the needs and expectations of students in different countries. Therefore, this study aims to explore the various factors influencing students' interest in learning mathematics across countries, with the hope of providing valuable insights for the development of mathematics education on a global scale.

2 Methodology

This systematic review was conducted following the guidelines of the Preferred Reporting Items for Systematic Review and Meta-Analyses (PRISMA). The PRISMA framework consists of a 27-item checklist and a 4-phase flow diagram [25]. The study began with a search for articles related to mathematics achievement worldwide using the Scopus and ERIC databases. The process followed four phases: identification, screening, eligibility, and inclusion.

2.1 Identification Phase

This systematic review primarily utilized Scopus as the main source. Scopus is a reference information database managed by Elsevier and launched in 2004. It includes approximately 36,377 titles from around 11,678 publishers, with 34,346 being peer-reviewed journals across various fields, including life sciences, social sciences, physical sciences, and health sciences. To ensure the retrieval of relevant studies, specific keywords were used during the search process. These keywords were designed to capture studies related to students' interest in mathematics and the factors influencing it across different countries. The search string included terms such as "interest," "motivation," "engagement," and "mathematics learning," combined with Boolean operators to refine the results. Table 1 below shows the keywords used for each database.

Table 1. Keywords used in the literature search process

Database	Keywords Used
Scopus	TITLE-ABS-KEY (“interest” OR “motivation” OR “engagement”) AND (“mathematics learning” OR “mathematics” OR “mathematics education”)

2.2 Screening Phase

Researchers carefully identified duplicate articles found in both Scopus and ERIC. The remaining articles were then thoroughly examined to ensure alignment with the research objectives. Articles that did not explicitly address factors influencing students' interest in mathematics or were not relevant to a global or cross-country context were excluded at this stage.

2.3 Eligibility Phase

The eligibility phase involved a more in-depth examination of the full text of articles that passed the screening phase. To qualify for inclusion, studies had to meet specific criteria. These criteria are detailed in Table 2.

Table 2. Eligibility and exclusion criteria

Criterion	Eligibility	Exclusion
Literature type	Peer-reviewed journal articles	Books, book chapters, conference proceedings, systematic reviews
Language	English	Non-English
Timeline	Published between 2021 and 2025	Published before 2021
Geographical scope	Studies with global or cross-country focus	Studies limited to a single country

2.4 Inclusion Phase

In the final inclusion phase, only articles that fully met the eligibility criteria were included in the review. The selected studies encompassed various research designs, including qualitative, quantitative, and mixed-method approaches, to provide a comprehensive understanding of the factors influencing students' interest in learning mathematics. Studies that focused solely on theoretical discussions or systematic reviews were excluded to maintain the empirical focus of this review.

2.5 Visual Representation of the Process

The entire process of identification, screening, eligibility, and inclusion was systematically documented and visualized in a PRISMA flow diagram (Figure 1). This diagram illustrates the number of articles retrieved, screened, excluded, and ultimately included in the review, ensuring transparency and replicability of the methodology.

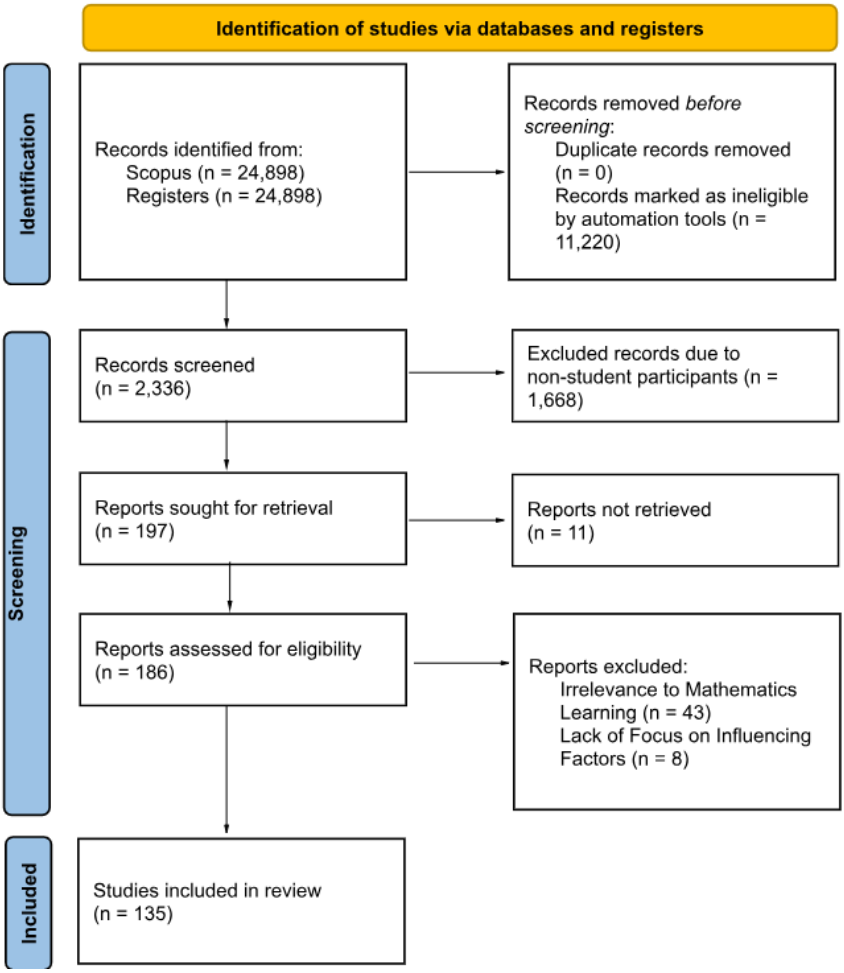

Fig 1. PRISMA Flow Diagram

3 Result and Discussion

RQ1: What are the factors influencing students' interest in learning mathematics across different countries? This study analyzed 135 articles from various countries to identify the factors influencing students' interest in learning mathematics. These articles represent studies from 35 countries, highlighting the global scope of this research. The countries represented include Australia, Bolivia, Brazil, Canada, China, Colombia, Egypt, Finland, France, Germany, Hong Kong, Indonesia, Ireland, Italy, Japan, Jordan,

Macau, Mexico, Nepal, Netherlands, New Zealand, Nigeria, Norwegia, Pakistan, Republic of South Africa, Russia, Saudi Arabia, Spain, Sudan, South Korea, Switzerland, Taiwan, Türkiye, United Kingdom, United States of America.

Of the total articles analyzed, the majority originated from the United States of America, with 49 articles, accounting for approximately 36.30% of the total data. United Kingdom ranked second with 15 articles (11.11%), followed by the China with 11 articles (8.15%). Other countries with significant contributions include Spain and Indonesia, each with 6 articles (4.44%). Australia and Germany each contributed 5 articles (3.70%), followed by Switzerland with 4 articles (2.96%) and Taiwan with 3 articles (2.22%). Several other countries, such as Canada, Colombia, Ireland, Mexico, and Nigeria each contributed 2 articles (1.48%), while the remaining countries contributed 1 article each (0.74%).

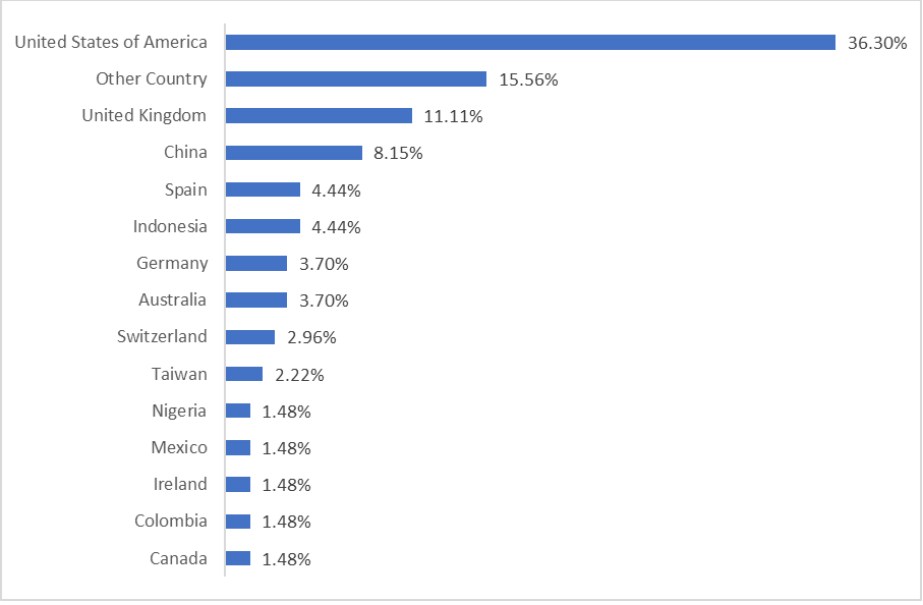

Fig 2. Distribution of Articles by Country

The distribution of research on students' interest in learning mathematics shows a significant disparity between developed and developing countries. Of the 135 articles analyzed, the majority came from the United States, with 49 articles or 36.30% of the total data. This dominance reflects the country's great attention to mathematics education, driven by a complex education system.Stylianides et al. [26], the availability of abundant research fundsDalal et al [27], and a national focus on STEM development[28]. In addition, the UK and China also made significant contributions, with 15 articles (11.11%) and 11 articles (8.15%) respectively. The UK, as one of the countries with a long tradition in educational research, shows a focus on teaching innovation and mathematics curriculum development.[29]Meanwhile, China, with its

highly competitive education system, is prioritizing research to increase student interest in mathematics as part of its economic and technological development strategy.[30].

Other countries such as Spain and Indonesia each contributed 6 articles (4.44%), indicating a significant attention to mathematics education at the national level. In Spain, this research may be driven by efforts to improve the quality of education in Southern Europe, while in Indonesia, attention to mathematics education reflects the need to improve the quality of education and global competitiveness.[31]. Moderate contributions were also seen from Australia and Germany, each with 5 articles (3.70%), and Switzerland with 4 articles (2.96%). These countries, which have advanced education systems, tend to focus on innovation in mathematics teaching to support human resource development in STEM fields.

However, the contribution from other countries is relatively small. Several countries such as Canada, Colombia, Ireland, Mexico, and Nigeria each contributed only 2 articles (1.48%), while other countries, including Japan, Brazil, Egypt, and others, contributed only 1 article (0.74%). This shows that research on students' interest in mathematics is still dominated by developed countries, while developing countries, despite facing great challenges in mathematics education, are underrepresented in this research. This imbalance may be caused by limited research resources, infrastructure, or different policy priorities in developing countries.

This distribution of research reflects the global focus on mathematics education, but also highlights the significant gap between developed and developing countries. Developed countries tend to have more resources to fund educational research, while developing countries may face limitations in terms of funding and research infrastructure. Therefore, collaborative efforts are needed to increase the representation of developing countries in this research. In addition, further research is needed to identify specific factors that influence students' interest in mathematics across cultural and economic contexts. Thus, a more equitable distribution of research could provide a more comprehensive understanding of how to improve students' interest in mathematics around the world.

Students' interest in learning mathematics is influenced by various factors that vary from country to country. These factors include individual, social, pedagogical, and environmental aspects that interact to shape students' learning experiences. Some factors that often emerge include self-efficacy, intrinsic motivation, relevance of the material to real life, parental support, teacher-student relationships, use of technology, and the influence of the learning environment. In addition, social factors such as gender stereotypes, cultural norms, and peer support also play an important role in building students' interest in mathematics. These factors not only reflect differences in educational contexts across countries but also demonstrate the importance of a holistic and contextual approach in enhancing students' interest in mathematics. Table 3 below presents the factors that influence students' interest in learning mathematics across countries based on the data analyzed

Table 3.factors that influence students' interest in learning mathematics in various countries

Country	Factor
Australia	Key Factors: Interactive learning approach, relevance of material to the real world, use of technology, collaboration, and balance between theory and practice. Supporting Factors: Teacher support, feedback, creativity, personalization, and stress reduction.
Bolivia	Key Factors: Parental support, childhood experiences, gender stereotypes, self-confidence, and quality of teaching. Supporting Factors: Availability of mathematics subjects in schools, flexible learning spaces, and intrinsic motivation.
Brazil	Key Factors: Technology integration, active learning, group collaboration, and visualization of abstract concepts. Supporting Factors: Practical experiments, the role of the teacher as a facilitator, and increased understanding of concepts.
Canada	Key Factors: Limited basic math skills, online resource design, relevance of materials, and STEM learning experiences. Supporting Factors: Learning support, student engagement, and the influence of early experiences.
China	Key Factors: Use of technology, flipped classroom, problem-based learning, relevance of material, and intrinsic motivation. Supporting Factors: Teacher support, supportive learning environment, and additional skills development.
Colombia	Key Factors: Quality of teacher-student relationships, intrinsic motivation, relevance of mathematics to real life, and influence of mentors. Supporting Factors: Supportive learning environment, transformational teaching, and collaboration.
Egypt	Key Factors: Personalization of learning, gamification, relevance of material, and use of AI technology. Supporting Factors: Student emotional involvement, learning efficiency, and multisensory approach.
Finland	Key Factors: Quality of teacher-student relationships, teacher emotional support, and student intrinsic motivation. Supporting Factors: Supportive learning environment and parental support.
France	Key Factors: Quality of material, relevance to real life, interactivity, and student confidence. Supporting Factors: Motivation enhanced by technology and enjoyable learning experiences.

Germany	Key Factors: Quality of teacher-student relationships, basic cognitive abilities, personalization of context, and subjective task value. Supporting Factors: Socio-economic background, academic self-concept, and task relevance.
Hong Kong	Key Factors: Students' attitudes towards mathematics, relevance to real life, and teacher influence. Supporting Factors: Previous learning experiences, difficulties in problem solving, and learning environment support.
Indonesia	Key Factors: Mathematical identity, self-efficacy, teacher support, and technology use. Supporting Factors: Student well-being, gamification, and emotional intelligence.
Ireland	Key Factors: Relevance of mathematics to real life, attitudes towards mathematics, and meaningful learning experiences. Supporting Factors: Teacher support, student engagement, and math anxiety.
Italy	Key Factors: Intrinsic motivation, cognitive engagement, and use of technology. Supporting Factors: Social support, personal feedback, and real-life applications of mathematics.
Japan	Key Factors: Gender stereotypes, relevance of mathematics to careers, and parental support. Supporting Factors: Information about gender equality, social norms, and the effects of educational interventions.
Jordan	Key Factors: Gamification, intrinsic motivation, and use of technology. Supporting Factors: Teacher support, entertainment elements, and collaboration within the team.
Macau	Key Factors: Use of AI technology, personalization of learning, and timely feedback. Supporting Factors: Parental support, student involvement, and assignment quality.
Mexico	Key Factors: Relevance of the material to the real world, positive learning experiences, and intrinsic motivation. Supporting Factors: Social support, innovative approaches, and faculty involvement.
Nepal	Key Factors: Interactive learning methods, relevance to the real world, and student motivation. Supporting Factors: Collaboration, feedback, and teacher support.
Netherlands	Key Factors: Student mindset, gender stereotypes, and self-concept towards mathematical ability.

	Supporting Factors: Previous achievement, social support, and relevance of mathematics.
New Zealand	Key Factors: Use of real-world contexts, authentic learning experiences, and teacher support. Supporting Factors: Increased self-confidence and contribution to society.
Nigeria	Key Factors: Intrinsic motivation, relevance of the material, and engaging program design. Supporting Factors: Access to technology, self-regulation, and teacher involvement.
Norwegia	Key Factors: Instructor presence, student interactivity, and innovative teaching methods. Supporting Factors: Availability of technology and instructor motivation.
Pakistan	Key Factors: Student motivation, relevance of material, and providing feedback. Supporting Factors: Interactivity, challenges, and the role of the teacher as a facilitator.
Republic of South Africa	Key Factors: Academic performance, parental support, and relevance of mathematics to the future. Supporting Factors: Gender influence, teacher support, and financial independence.
Russia	Key Factors: Use of smart technology, relevance of materials, and personalization of learning. Supporting Factors: Teacher support, creativity, and integration of mathematics with technology.
Saudi Arabia	Key Factors: Use of AI, personalization of learning, and relevance of the material. Supporting Factors: Teacher support, interactive media, and reduced dependence on textbooks.
Spain	Key Factors: Relevance of material, quality of teaching, and use of technology. Supporting Factors: Gender stereotypes, personal motivation, and positive learning experiences.
Sudan	Key Factors: Situational interest, teaching methods, and learning environment. Supporting Factors: Evaluation, feedback, and psychological factors.
South Korea	Key Factors: Gamification, personalization, and rewards. Supporting Factors: Interface aesthetics, intrinsic motivation, and teacher involvement.
Switzerland	Key Factors: Use of technology, personalization of learning, and relevance of material.

	Supporting Factors: Teacher support, anxiety reduction, and simulation.
Taiwan	Key Factors: Social interaction, relevance of material, and learning design. Supporting Factors: Teacher support, active involvement, and practical application.
Türkiye	Key Factors: Mathematics anxiety, student engagement, and the influence of the classroom environment. Supporting Factors: The relationship between anxiety, engagement, and achievement.
United Kingdom	Key Factors: Mathematics anxiety, relevance of the material, and student motivation. Supporting Factors: Social support, technology, and learning environment.
United States of America	Key Factors: Self-efficacy, mathematical identity, relevance of the material, and intrinsic motivation. Supporting Factors: Teacher-student relationships, gender stereotypes, and previous learning experiences.

Based on the analyzed article data from various countries that have been presented in Table 3, there are a number of factors that influence students' interest in learning mathematics. These factors can be grouped into four main categories, namely individual factors, social factors, pedagogical factors, and environmental factors.

In the individual factor category, student interest is influenced by self-efficacy, which is students' belief in their abilities in mathematics, which is found in many countries such as the United States, Indonesia, and the United Kingdom. In addition, math identity is also an important factor, where students who feel like "math people" tend to have higher interest, as seen in the United States, Indonesia, and Japan. Intrinsic and extrinsic motivation also play a big role, with intrinsic motivation found in countries such as Italy, Nigeria, and South Korea. However, math anxiety is a major barrier in some countries, such as Turkey, the United Kingdom, and the United States. Other individual factors include perceived utility of mathematics, situational interest, and basic cognitive ability.

Individual factors have a significant role in shaping students' interest in mathematics.[32]. One of the main factors is self-efficacy, which is students' belief in their abilities in mathematics. Students who have high self-efficacy tend to be more interested in learning mathematics.[33]. This shows the importance of building students' confidence and connectedness to mathematics through positive and relevant learning experiences.[34]. In addition, intrinsic and extrinsic motivation also play a big role in shaping students' interests. Intrinsic motivation, which is the drive from within students to learn mathematics because of interest or pleasure.[35]. On the other hand, extrinsic motivation, such as the drive due to grades, awards, or social pressureMorris et al [36], also contributes to student interest. However, a major challenge faced is math anxiety. This anxiety can hinder students' understanding of mathematical concepts.Khasawneh

et al [37] and decrease their interest in these subjects[38]. Therefore, it is important to develop strategies that can reduce anxiety.Hsu & Goldsmith [39], such as creating a friendly and supportive learning environment.Fadhli et al [40]. Other individual factors that influence student interest include the perception of the usefulness of mathematics (utility value), where students see mathematics as something useful in their daily lives or careers.Leyva et al [41] tend to be more interested in learning it. In addition, situational interest, which arises from interesting or relevant learning activities, and basic cognitive abilities, such as logic and problem solving, also play an important role.

In social factors, parental support is one of the most frequently occurring elements, such as in the United States, Japan, and Indonesia. Positive teacher-student relationships also play an important role in building student interest, as found in Finland, Germany, and Colombia. In addition, peer influence and social norms, including gender stereotypes, influence student interest, especially in countries such as Japan, the United Kingdom, and Spain. Gender stereotypes are often a barrier, especially for female students, who feel that mathematics is more suitable for boys. A supportive social environment, including a learning community, is also an important factor in increasing student interest.

Social factors have a significant influence on students' interest in studying mathematics.[42]. One important element is parental support, which has been found to be a major factor across countries. This support can be in the form of emotional encouragement, assistance in learning, or the provision of resources that support mathematics learning.[4]. Parents who demonstrate a positive attitude toward mathematics tend to transmit that interest to their children.[44]. In addition, positive teacher-student relationships also play a big role in building students' interest in mathematics.[45]. Findings from Finland, Germany, and Colombia show that teachers who are able to create good relationships with students, such as providing support, attention, and relevant teaching, can increase students' motivation to learn mathematics. Friendly and caring teachers can create a comfortable learning environment, so that students feel more confident and motivated.[46].

Apart from the role of parents and teachers, the influence of peers and social norms are also important factors.[46]. In countries such as Japan, the UK and Spain, social norms, including gender stereotypes, often influence how students view mathematics. The stereotype that mathematics is more suitable for boys is a major barrier, especially for female students, who may feel less confident or motivated to pursue mathematics.[47]. This shows the need for efforts to address these stereotypes, for example through gender equality campaigns, female representation in STEM fields, and providing special support to female students.[48]. In addition, a supportive social environment, such as a learning community, is also an important factor in increasing student interest.[46]. A collaborative learning community can provide a space for students to support each other, share knowledge, and build confidence in learning mathematics.[49].

In the pedagogical factor category, the relevance of the material to real life is the most dominant factor in almost all countries, such as the United States, Australia, and China. Students are more interested in mathematics if they can see its application in everyday life or future careers. The use of technology, such as robotics, virtual reality,

and digital-based learning, is also an important element in increasing student interest, as seen in China, the United States, and Switzerland. Active learning approaches, such as problem-based learning and flipped classrooms, have been found to be effective in countries such as China, the United States, and the United Kingdom. In addition, teaching quality, gamification, and constructive feedback are also important factors in this category.

Pedagogical factors have a very important role in building students' interest in mathematics, especially through relevant and innovative teaching approaches.[50]. One of the main findings is the relevance of the material to real life, which is a dominant factor in almost all countries. Students tend to be more interested in mathematics if they can see its application in everyday life.[51]. This shows the importance of teaching that connects mathematical concepts to real situations.Collar & Hodnik [52], such as the use of mathematics in personal finance, technology, or certain fields of work. In addition, the use of technology is also an important element in increasing students' interest in mathematics.[53]. In countries like China, the United States, and Switzerland, technologies like robotics, virtual reality, and digital learning have proven effective in making math learning more engaging and interactive. These technologies not only help students understand complex concepts, but also provide a more enjoyable and immersive learning experience.[54].

Another effective approach is active learning, such as problem-based learning and flipped classrooms, which have been found to be successful in countries such as China, the United States, and the United Kingdom. These approaches directly engage students in the learning process, encouraging them to think critically, work collaboratively, and find solutions to real-world problems.[55]. This method not only improves students' understanding of mathematicsNurulaini Jaafar et al[56], but also build important skills such as problem solving and teamwork.[57]. In addition, other factors such as teaching quality, gamification, and constructive feedback also play a big role in increasing student interest. Teachers who have good teaching skills, are able to explain concepts clearly, and provide support to students can create a positive learning experience.[58]. Gamification, which is the use of game elements in learning, can make mathematics more fun and motivate students to learn.[59]. Meanwhile, constructive feedback helps students understand their strengths and weaknesses, and provides guidance for improvement.[60].

Finally, in terms of environmental factors, a supportive, inclusive, and positive learning environment is a key element in increasing student interest, as found in Finland, Switzerland, and the United States. Family economic conditions also affect students' access to mathematics education, especially in countries such as South Africa and Nigeria. The availability of resources, such as learning tools and technology, is also an important factor, as seen in Canada and Switzerland. In addition, local culture and identity influence students' perceptions of mathematics, as found in Japan and the United States.

Environmental factors have a significant influence on students' interest in learning mathematics, especially through supportive learning conditions and access to educational resources.Nature & Mohanty [18]. One of the key elements is a supportive, inclusive and positive learning environment, which has been found to be an important

factor in countries such as Finland, Switzerland and the United States. A conducive learning environment allows students to feel comfortable, valued and supported in the learning process.[46]. A classroom atmosphere that encourages active participation, self-confidence, and good relationships between students, teachers, and peers are important elements in creating interest in mathematics.[61]. In addition, the economic condition of the family is also a factor that influences students' access to mathematics education. Students from families with low economic conditions often face limitations in accessing educational resources, such as books, learning tools, or technology, which can hinder their ability to learn mathematics optimally.[62].

RQ2: How do cultural differences and education systems affect students' interests? Cultural differences and educational systems have a significant influence on students' interest in learning mathematics. Culture shapes students' values, norms, and perceptions of mathematics, while educational systems determine how mathematics is taught and learned. In the cultural context, gender stereotypes, values toward education, relevance of mathematics to real life, and students' motivation are the main factors that influence interest. For example, in countries such as Japan and the United States, gender stereotypes often hinder female students, while in Finland and Norway, a culture of gender equality helps reduce these barriers. In addition, cultures that value education, such as China and South Korea, encourage students to take mathematics more seriously, in contrast to developing countries that face cultural challenges such as lack of role models and unsupportive social norms.

Education systems also play an important role through teaching methods, use of technology, teacher support, curriculum, and equitable access. Interactive and problem-based learning approaches, such as those in Finland and Australia, have been shown to increase student interest, while exam-oriented methods, such as those in China and Russia, while producing high achievement, can reduce students' intrinsic interest. The use of technology in developed countries, such as robotics and digital learning, also increases the appeal of mathematics, but limited access in developing countries is a barrier. In addition, teacher support and inclusive learning environments, such as in Finland, contribute to increased student interest, in contrast to countries with less supportive education systems.

The interaction between culture and education systems creates complex dynamics. In countries such as China and Japan, cultures that value education combined with achievement-oriented systems produce students with high ability but low intrinsic interest. In contrast, in Finland and Norway, cultures of gender equality and inclusive education systems create environments that support student interest, especially for girls. Therefore, to increase student interest in mathematics, strategies are needed that take into account the cultural context and education system of each country. Some recommendations include integrating the relevance of mathematics to real life, reducing gender stereotypes, increasing access to technology, and creating inclusive learning environments. With a contextual and effective approach, student interest in mathematics can be increased globally.

4 Conclusion

This study comprehensively identifies factors that influence students' interest in learning mathematics across countries, answering two main questions. The analysis of 135 articles from 35 countries shows that students' interest is influenced by four main categories: individual, social, pedagogical, and environmental factors. Individual factors include self-efficacy, intrinsic motivation, mathematical identity, and perceived usefulness of mathematics, while mathematics anxiety is a significant barrier in some countries. Social factors include parental support, teacher-student relationships, peer influence, and social norms such as gender stereotypes. Pedagogical factors involve the relevance of the material to real life, the use of technology, active learning approaches, and the quality of teaching. Environmental factors include family economic conditions, availability of resources, local culture, and a supportive learning environment.

The study also found that differences in culture and education systems create complex dynamics in building students' interest in mathematics. Cultures that value education, such as in China and South Korea, encourage students to take mathematics more seriously, while gender stereotypes in countries such as Japan and the United States create barriers for female students. Exam-oriented education systems, such as in China and Russia, while producing high achievement, can reduce students' intrinsic interest. In contrast, interactive and problem-based learning approaches, such as in Finland and Australia, have been shown to increase student interest. The use of technology in developed countries also increases the appeal of mathematics, but limited access in developing countries is a barrier.

However, this study has several limitations. First, the data analyzed mostly come from developed countries, so the representation of developing countries is still limited. Second, this study only includes English-language articles, which may cause linguistic bias. Third, the interaction between factors that influence students' interest has not been fully explored in depth. Therefore, further research is recommended to increase the representation of developing countries, explore the interaction between factors, and conduct longitudinal studies to understand the development of students' interest in the long term. In addition, a multicultural approach and the development of practical interventions, such as the use of technology or problem-based learning, can provide more relevant guidance for educators and policymakers. By addressing these limitations, it is hoped that students' interest in mathematics can be increased globally, supporting the development of more inclusive and relevant mathematics education.

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