Systematic literature review: Identification of students’ mathematical anxiety in mathematics learning

Woro Anglia Banda Sutomo *, Dadang Juandi
Universitas Pendidikan Indonesia, Bandung, Jawa Barat, 40154, Indonesia
* Corresponding Author. Email: woroanglia22@upi.edu

Received: 7 December 2023; Revised: 17 January 2024; Accepted: 21 January 2024

Abstract: Mathematics anxiety can be found at all levels of education, from elementary school to college students. This study aims to conduct a literature review related to mathematics anxiety in mathematics learning. The research method chosen in this study is the Systematic Literature Review. Data collection was carried out by documenting all articles that had similar research in this research report. The articles used in this study were 98 articles published for the period 2014–2022. The research was conducted at all levels of education. Based on the research results, there were 98 relevant articles published in 2014–2022 regarding mathematics anxiety in mathematics learning. It was noted that articles related to mathematical abilities including soft skills and hard skills dominated the number of articles. The collected articles mostly focus on research at the junior high school level, and researchers tend to prefer using quantitative research methods in their research.

Keywords: Mathematic anxiety, Mathematic learning, Systematic literature review


INTRODUCTION

Mathematics is the basic science of other branches of science. Science and technology and various other fields will not experience rapid progress without help mathematics. Almost all activities in our lives are related to mathematics, so proper understanding is needed for children to be able to accept the fact that mathematics is very necessary for them in the future. This is because mathematics is considered the queen of sciences, serving as the primary foundation for various disciplines to comprehend and explore the complex aspects of the world. It acts as a cornerstone in detailing the laws of nature, analyzing patterns, and constructing systems that define our reality (Ramdani, 2006). Seeing the useful role of mathematics, it is not surprising that mathematics lessons are found at all levels of education from elementary school to university.

Nurhaina et al. (2019) stated that by studying mathematics, students will have thinking abilities that can solve mathematical problems. Studying mathematics will train someone to have the ability to think critically, logically, analytically, creatively and systematically. This ability will influence a person in making decisions in various life problems. In other words, studying mathematics will affect the quality of life and ready human resources.

However, in reality, students often experience difficulties in mastering mathematical material. This is thought to occur because mathematics is abstract and requires understanding of concepts so that students feel less confident in learning mathematics. Aligned with Yuliani (2017) stated that students’ first experiences when studying mathematics will influence students’ attitudes towards mathematics at the next stage. An interesting and fun impression
can foster students' love of mathematics. On the other hand, the impression of being afraid, difficult, and boring will cause students to avoid mathematics. Therefore, to learn it requires a certain will, ability, and intelligence. Besides that, students still have anxiety when learning mathematics.

Besides that, students still have anxiety in learning mathematics. Anxiety that arises during the mathematics learning process can be called mathematics anxiety. Mathematics anxiety has been universally recognized as a non-intellectual factor that hinders mathematics achievement. Symptoms of mathematics anxiety appear not only in the learning process, but also negative attitudes and views often arise in certain situations or conditions, for example when someone studies or faces a previous mathematics test, causing students to be afraid even before learning takes place. Anxiety about mathematics cannot be seen as a normal thing because the inability of students to adapt to lessons causes students to have difficulty, resulting in a phobia of mathematics which ultimately causes learning outcomes and student achievement to be low. However, mathematical anxiety is not said to be a problem because anxiety is also needed in learning related to motivating students, only at a certain level.

Atmojo and Ibrahim (2021) stated that students who face mathematics anxiety are more likely to avoid conditions or activities that they don't want because they feel stressed and will think negatively about themselves. On a physiological level, symptoms of math anxiety include increased heart rate, sweaty hands, stomachache, and dizziness. Mathematics anxiety and feelings of tension, or the assumption that students may feel their heart beating faster when faced with mathematics problems (Luttenberger et al., 2018). It can be concluded that anxiety has a very big impact on a person's feelings and physical sensations are considered excessive if someone is experiencing anxiety.

Beilock and Maloney (2015) suggests that individuals with higher math anxiety may not represent or process numbers in the same way as their counterparts with lower math anxiety. Students who are faced with mathematics assignments experience mathematics anxiety, they tend to experience concerns about the work process or poor performance in dealing with it and this worry is closely related to the thinking and reasoning power needed to complete the task at hand. When this tendency appears, individuals will withdraw because they feel inadequate so that in learning mathematics, they do not have much readiness, so they withdraw from mathematics learning activities which have a negative impact on mathematics achievement.

The problem of mathematics anxiety among students when facing mathematics subjects should be able to find a solution. From this description it is known that it is important to reduce students’ mathematics anxiety from an early age so that their mathematics learning achievement is not hampered. The teacher as an educator has a very important role and is one of the success factors in the process of teaching and learning activities. Therefore, a teacher should have good mathematical content skills in addition to pedagogical skills. And a student should also have good control over his emotions when facing mathematics. So, the hope is that students have good self-confidence and do not have mathematics anxiety which has an impact on success in the mathematics learning process. This is line with Rohaeti and Pratiwi (2021)’s article where Furner dan Berman explain that the teachers need to take a more proactive role in encouraging students to be enthusiastic about learning mathematics and to feel confident and capable of solving mathematical problems. Furthermore, Freedman suggests that students should give themselves positive suggestions that mathematics is "easy" and everyone is capable of mastering it, including themselves, to overcome anxiety in facing mathematics learning (Setiawan et al., 2021).

Mathematical anxiety can have a significant impact on students' mathematics learning outcomes. When students’ experiences anxiety towards this subject, it can disrupt their focus, concentration, and ability to understand mathematical concepts deeply (Ashcraft, 2002). Students who are anxious about mathematics tend to struggle in handling math tasks or exams, resulting in a decline in their academic performance. Moreover, mathematical anxiety can also
shape a negative attitude towards mathematics as whole, causing students to be reluctant to approach the subject with enthusiasm. This impact can be detrimental to learning motivation, trigger avoidance of mathematical tasks, and even affect students’ learning outcomes (Imro’ah et al., 2019).

Despite mathematical anxiety being generally associated with negative impacts on mathematics learning outcomes, the presence of anxiety management strategies can yield positive consequences. When students are able to overcome mathematical anxiety, they tend to experience improved concentration and focus during learning. Self-awareness of anxiety and the ability to manage it can help students feel more confident in handling challenging mathematical materials (Khasawneh et al., 2021). The positive consequences may include an enhanced understanding of concepts, increases self-confidence, and improve mathematics learning outcomes. Students who successfully overcome mathematical anxiety may discover that previously daunting mathematical challenges become more manageable, opening doors to better academic achievements.

The understanding that mathematical anxiety can be overcome is a crucial initial step in assisting students in addressing their challenges (Febryliani, 2021). With the right approach, emotional support, and inclusive learning, students can build their confidence in facing mathematical content. Similarly, the role of the learning environment in creating a supportive atmosphere or, conversely, triggering mathematical anxiety is significant. Mathematical anxiety can be viewed as a challenge that can be overcome through collaborative efforts among educators, parents, and students themselves (Furner & Berman, 2012).

Teachers or educators need to understand the dynamics of mathematical anxiety in order to design learning strategies that support students in overcoming such anxiety. The initial utilization of high-pressure methods such as timed assessments, as opposed to employing more suitable and interactive approaches in line with developmental stages, contributes to a significant prevalence of mathematical anxiety (Geist, 2010). In other words, teachers should provide positive experiences for students, such as when a teacher is dissatisfied with teaching mathematics or does not find joy in being with students in the classroom, it is less probable that students will be motivated to engage with the subject matter (Furner & DeHass, 2011). In the study conducted by Dwirahayu et al. (2018), it is mentioned that the role of teachers in reducing students' mathematical anxiety involves selecting varied teaching strategies, implementing relaxation techniques in the classroom when students exhibit signs of boredom and fatigue, and preparing various approaches to address students' readiness to learn in class. Increasing awareness of mathematical anxiety can help create a more inclusive learning environment and support the positive development of students in mathematics learning.

Parents play a highly significant role in assisting their children in overcoming mathematical anxiety. In a study by Hadzic (2021), it is explained that parents who adopt positive attitudes, such as instilling confidence in their children that they can succeed in learning mathematics, and showing appreciation for any mathematical achievements, play a crucial role. Involving children in enjoyable mathematical activities beyond the formal curriculum, such as playing mathematical games or demonstrating the practical applications of mathematics in daily life, can also help alleviate tension associated with mathematics (Elliott et al., 2019). Overall, the role of parents is not only limited to providing academic assistance but also involves creating a positive atmosphere, offering emotional support, and helping children build confidence in facing mathematical challenges.

Furthermore, students play a crucial role in overcoming mathematical anxiety within themselves by implementing various strategies that can enhance their emotional well-being and academic performance. In a study by Saputra (2014), it is explained that controlling attention and regulating negative emotional reactions can be one way to address mathematical anxiety in some students. Students need to overcome their fear of mathematics and challenge themselves to undertake more advanced mathematical topics (Smith, 2004).
The results of studies or research results regarding mathematical anxiety in mathematics learning do not fully guarantee that it will have a bad influence on supporting aspects such as mathematical competence, gender, learning methods, media and categories and there is the possibility that some research has the potential to be biased. By using a systematic literature review method, this research aims to find and synthesize comprehensive research that refers to specific questions, uses coherent procedures, and can be replicated. Supported by research conducted by Juandi (2020) which states that a good systematic literature review can be an adequate research method to minimize research errors and bias.

Based on the explanation above, it is still found that students feel afraid and find it difficult to study mathematics, so students try to avoid studying mathematics. Feelings of fear and difficulty are part of mathematical anxiety. This research aims to examine students' mathematical anxiety in mathematics learning based on year of research, level of education, sample size, and type of research. Therefore, an important stage of a systematic literature review is collecting data in the form of research results on mathematical anxiety regarding its supporting aspects.

The problem formulation in this systematic literature review includes:
1. What is the description of the research results regarding students' mathematical anxiety in mathematics learning based on the year of research?
2. What is the description of the results of research regarding students' mathematical anxiety in learning mathematics based on education level?
3. What is the description of the research results regarding students' mathematical anxiety in mathematics learning based on the type of research?

**METHOD**

The method used in this study is the systematic literature review method. A systematic literature review (SLR) does not specifically refer to qualitative or quantitative types of research. SLR performs several steps: identifying, reviewing, evaluating, and interpreting all available research results (Tirandini et al., 2019). By employing the systematic literature review research methodology, researchers conduct reviews and systematically identify journals following established steps in each process. The purpose of this research method is to provide a holistic and in-depth view of the research topic, as well as to identify knowledge gaps or potential findings that may exist in the literature. A systematic literature review aids in building a comprehensive understanding of a specific issue, mapping the progress of research, and laying the groundwork for further studies.

In conducting a systematic literature review, several steps must be taken, (1) identify the research topic and establish inclusion criteria to determine relevant literature sources, by identifying the appropriate research topic and establishing relevant inclusion criteria, a systematic literature review can be conducted in a structured and comprehensive manner, resulting in a deep and informative synthesis of the literature; (2) establish research procedures for the literature review, by setting out these detailed research procedures, a systematic literature review can provide clarity and transparency regarding the methodology used in gathering and evaluating scientific literature; and (3) systematically and comprehensively. It is to implement the literature. Review using relevant databases (Google Scholar), (4) data tabulation of information found during the literature search, tabulating data in systematic literature review not only aids in organizing information but also serves as a highly useful tool for systematically analyzing and synthesizing literature findings; (5) data extraction, by employing a systematic approach in data extraction, researchers can ensure that the extracted literature results represent an accurate and comprehensive overview of the research topic. Furthermore, this extracted information will form the basis for the analysis and synthesis of literature that will guide the authors in formulating relevant findings, and (6) analysis and synthesis of results to identify trends and similarities in the literature, or identify differences, (7) summarize and present research results, by organizing the research findings in a structured
and clear manner, researchers can make a meaningful contribution to the existing literature, detailing relevant information, and identifying directions for future research. A well-presented research outcome will help readers understand the contribution of this study within the context of the investigated topic and (7) publish.

Systematic literature review research generally does not use research instruments like another research. However, in this Systematic Literature Review, the researcher adopted guidelines or protocols used in Juandi (2020) that detail methodological steps and procedures, literature search strategies, and inclusion criteria. This helps ensure that SLR is performed systematically and transparently, and thus makes a valuable contribution to a comprehensive explanation.

There are specified inclusion criteria, namely (1) articles are the result of mathematics education research, (2) articles published from 2014 to 2022, this is due to differences in curriculum usage during that period, where despite the similarities in student-centered learning, there is a distinct difference caused by the pandemic that influences the psychological aspect of students in mathematics education, (3) articles obtained from electronic databases such as Google Scholar, DOAJ, Garuda Portal and national journal URLs, by combining these sources, a systematic literature review can provide a more comprehensive, in-depth, and contextual overview related to the influence of mathematical anxiety on learning outcomes, (4) Articles contain qualitative, quantitative, mixed and development types of research, (5) Articles contain research from elementary, middle school, high school to university levels.

RESULTS AND DISCUSSION

Results

The results of the research data included in this literature review are an analysis and summary of documented articles related to mathematics anxiety in mathematics learning. Categorized further based on four moderating variables, namely year of study, level of study, sample size and type of research in each aspect - aspects related to mathematics anxiety. The aspects related to mathematical anxiety in this research include (1) mathematical ability and (2) media and tools used in mathematics learning, (3) approach and methods learning, (4) gender difference and (5) profile of mathematics.

There is a significant relationship between mathematical ability, gender differences, learning media, teaching approaches, math anxiety, and educational practices. Embracing a holistic educational approach, paying attention to gender differences, utilizing appropriate learning media, and adopting teaching strategies that support student diversity, educational practices can positively contribute to the understanding and development of mathematical abilities while reducing anxiety levels in the context of learning mathematics.

The first aspect of the low mathematical competence of students in Indonesia is students' negative views towards mathematics. They consider mathematics as a difficult subject because the characteristics of mathematics are abstract, logical, systematic and full of confusing symbols and formulas. In line with this, research conducted by Auliya (2016) where Hellum-Alexander found that mathematics anxiety also influences students' mathematical abilities, namely hard skills and soft skills. Hard skills in the field of mathematics are mastery of science, technology and technical skills related to the field of mathematics. Meanwhile, soft skills are a person's skills in relating to other people and self-management skills that are able to develop maximum performance or a mathematics learning approach that can actively involve students so as to reduce students' mathematical anxiety (Setiani, 2016).

The second aspect is the media and tools used in mathematics learning, the educational world has entered the era of media. The world of adult education is entering the era of the world of media, where learning activities require the lecture method to be reduced and replaced with the use of many media. Learning media is one of the methods or tools used in the teaching and learning process. This is done to stimulate learning patterns so that they can support the success of the teaching and learning process so that teaching and learning activities
can be effective in achieving the desired goals. In line with Khairani (2016) who states that learning media is a factor that supports the success of the learning process in schools because it can help the process of conveying information from teachers to students or vice versa.

The next aspect is the learning approach and methods. To be able to answer every challenge in dealing with students' mathematical anxiety, students need greater motivation and higher self-confidence in reducing mathematical anxiety so that mathematics learning activities are not hampered. Thus, bringing the goal of mathematics learning in a direction that can reduce mathematical anxiety, learning must start from learning that makes students active. So there is a need for innovation to search for and seriously apply models of psychological differences in learning. Thus, biology cannot explain the differences in the ability of men and women to achieve academic achievement. Social and cultural factors are the main reasons causing gender differences in academic achievement. The gender roles that define mathematics are more the domain of male students than female students, female students may be more willing to admit feelings of anxiety or be more critical of themselves than male students (Imro'ah et al., 2019).

The fourth aspect is gender. Gender differences certainly cause physiological differences and influence the second aspect, namely media and mathematics learning tools. Referring to the article Flessati & Jamieson (1991) there is the opinion of Boswell, Hunsley, and Flessati which states that gender may or may not influence mathematics anxiety. As explained by Boswell, gender affects mathematical anxiety due to the sex-role socialization explanation, which focuses on the conviction that abilities and behaviors in mathematics are included in the range of male behaviors and the end result is that females are very concerned with and feel anxious about their skills in math. Meanwhile, Hunsley and Flessati explain that mathematical anxiety is not influenced by gender but occurs as a result of previous learning experiences. Thus, a holistic understanding of these factors is necessary to elucidate the extent to which gender may play a role in mathematical anxiety and when its impact may not be as prominent.

The final aspect concerns the category of mathematical anxiety. This aspect contains a description of the categories of mathematical anxiety, namely high, medium and low. One of the results of the research was that quite a lot of students experienced moderate to high levels of anxiety which affected their math exams. This is supported by the results of research conducted by Sugiatno et al. (2017) namely that of the 38 research subjects, 19 students experienced severe levels of mathematical anxiety and 19 students experienced moderate levels of mathematical anxiety. So, for students who have high mathematical anxiety, students can relax before studying mathematics so they can be calmer first, one of which is by taking deep breaths. Apart from that, educators can help students reduce anxiety in mathematics lessons by trying several learning methods. new ones that are more fun and can be well received by students.

<table>
<thead>
<tr>
<th>Criteria</th>
<th>Aspects of Math Anxiety</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mathematical Competency</td>
</tr>
<tr>
<td>Research Year</td>
<td></td>
</tr>
<tr>
<td>2014 – 2016</td>
<td>4</td>
</tr>
<tr>
<td>2017 – 2019</td>
<td>9</td>
</tr>
<tr>
<td>2020 – 2022</td>
<td>18</td>
</tr>
<tr>
<td>Educational level</td>
<td></td>
</tr>
<tr>
<td>ES</td>
<td>3</td>
</tr>
<tr>
<td>JHS</td>
<td>23</td>
</tr>
<tr>
<td>SHS</td>
<td>5</td>
</tr>
<tr>
<td>College</td>
<td>0</td>
</tr>
<tr>
<td>Types of Research</td>
<td></td>
</tr>
<tr>
<td>Qualitative</td>
<td>6</td>
</tr>
<tr>
<td>Quantitative</td>
<td>23</td>
</tr>
<tr>
<td>Mix Method</td>
<td>1</td>
</tr>
<tr>
<td>RnD</td>
<td>1</td>
</tr>
<tr>
<td>Total Article</td>
<td>31</td>
</tr>
</tbody>
</table>
Based on Table 1, a total of 98 articles were found on mathematics anxiety in mathematics learning. Table 1 shows that research on mathematical anxiety related to students' mathematical competence dominates with a total of 31 studies. This shows that mathematical anxiety related to students' mathematical competence in the form of soft skills and hard skills still occurs frequently in mathematics learning. However, this does not mean that there is not a lot of other research in mathematics learning; this is another research that needs to be paid attention to by future researchers. In fact, research on mathematical anxiety related to media and learning tools, learning approaches or methods, gender and the profile of mathematical anxiety needs to be improved so that we can get solutions regarding how mathematical anxiety is related to these points. To obtain more explicit information, it will then be discussed according to the moderator variables that have been determined.

Several alternatives are efforts that can be made by teachers to overcome mathematical anxiety in students. This alternative can be used to improve the mathematical competence of male and female students, namely by using (1) various learning models or approaches, namely rote learning, Concrete Pictorial Abstract (CPA), Think Pair Share (TPS), Discovery Learning, Cooperative Learning Type Group Investigation (CLGI), Means-Ends Analysis, Problem Based Learning (PBL), mind mapping learning model, SAVI (Somatic, Auditory, Visual, Intellectual), Brain Based Learning, Think Talk Write, Role Play Learning, Project-Based Learning, Guided Inquiry with Group Investigation Model, (2) various conventional and ICT learning media assistance such as classical music, cartoons, teaching materials, logic games, smartphones, geoboards, and MIT App Inventor. Creating a learning environment and atmosphere, delivering mathematics material, and using various interesting tricks in learning mathematics can change the perspective of students who think mathematics is a scary subject. This makes students no longer feel too worried and try to understand mathematics lessons.

Discussion

Grouping based on research year is divided into 3 sections, namely (1) 2014–2016, (2) 2017–2019, (3) 2020–2022. In this year's period, the following data has been obtained as seen in Figure 1.

![Figure 1. Data based on the year of publication](image)

Based on Figure 1, it can be concluded that research on mathematical anxiety related to soft skills and hard skills, learning media and tools, learning approaches or methods, gender, and the profile of mathematical anxiety increased significantly in the 2017–2019 period and students' mathematical competence (soft skills and hard skill) is the point that has been researched the most compared to the other four related items. This shows that researchers have a higher interest in mathematical anxiety related to students' abilities. These results show that there are still problems with students who have mathematical anxiety about their abilities.
Firstly, the period from 2014 to 2016 provides an initial overview of literature that may explore conceptual frameworks and measurement methods for mathematical anxiety. During this period, there were not many studies conducted on mathematical anxiety in mathematics learning. This might be because the topic of mathematical anxiety had not yet fully gained primary attention and was not widely recognized as an urgent research area during this time. The understanding of its impact on mathematics learning might not have been sufficiently profound.

From 2017 to 2019, there was an increase in research on mathematical anxiety. One of the reasons for this is the occurrence of the COVID-19 pandemic, which made researchers more inclined to conduct studies. During this period, there was an escalation in research on the use or development of instructional media in relation to the impact of mathematical anxiety on learning outcomes. This is because the COVID-19 pandemic has driven the increased use of instructional media such as digital learning, online platforms, and various educational technologies. Similar to the study conducted by Şengül and Dereli (2010), which developed cartoon-based instructional media that successfully reduced students' mathematical anxiety.

The period from 2020 to 2022, as the most recent timeframe, enables research to explore the impact of the COVID-19 pandemic and the potential changes in mathematical anxiety on mathematics learning outcomes. It is evident that research on mathematical anxiety related to mathematical competence dominated studies during these years. Salvia et al. (2022) conducted a study where the low understanding of mathematics among students, influenced by excessive mathematical anxiety, directly affects students' numeracy literacy skills.

The use of instructional media from 2020 to 2022 also includes the utilization of online resources and interactive mathematical simulations to provide a more dynamic and relevant learning experience. Based on the research results that have been collected, it received a positive response from students. The use of learning media such as classical music, cartoons, logic games, geoboards, mobile learning as well as learning devices and teaching materials can have a positive effect on students' mathematical anxiety. Teacher insight is needed in preparing learning media so that it supports enjoyable learning (Coesamin et al., 2021). This means that the various types of learning media also function to attract students' interest well so that they can reduce students' mathematical anxiety levels in learning mathematics. Therefore, media learning has a positive contribution to the learning process.

**Educational Level**

Grouping based on education level is divided into four categories, namely Elementary School (ES), Junior High School (JHS), Senior High School (SHS), and College. The number of studies based on educational level is presented in Figure 2.

![Figure 2. Data Based on Educational Level](image)

The categorization of educational levels such as elementary school, junior high school, senior high school, and higher education in this study is due to each educational level having unique characteristics in the mathematics learning process that can influence mathematical anxiety. Based on Figure 2, all points related to mathematical anxiety, especially students'
mathematical competence, are more researched at the junior high school level, except for the mathematical anxiety profile points which are more researched at the tertiary level. The middle school education level is where students enter the adult process. Development towards adulthood requires attention from teachers and requires psychological, pedagogical, and sociological approaches to student development, including the mathematical anxiety they face. Formal reasoning is characterized by the ability to think about abstract ideas, organize ideas, think about what will happen next (Aini & Hidayati, 2017). So, it can be possible for junior high school students to experience mathematical anxiety disorders because they feel worried about these ideas.

Meanwhile, there has been no research regarding mathematical anxiety related to students' mathematical competence at the tertiary level. In the process of implementing mathematics learning in the classroom, when educators deliver mathematical material without using varied approaches or models, it cannot be denied that there are still students who still do not respond to something explained by the educator. This may reflect that students feel uncomfortable or worried about learning mathematics. Therefore, interactive learning can require students to be active in learning activities that can improve their mathematical competence (Syaiffuddin et al., 2020).

Likewise, research on mathematical anxiety is related to gender at the elementary school level. In fact, gender differences in students influence the way students learn and also their mathematical anxiety, including at the elementary school level. Wijaya et al. (2018) states that the differences between men and women certainly cause differences in thought patterns and different ways of dealing with various problems in learning. So, the psychology of male and female students in overcoming the mathematical anxiety they face certainly has many differences.

**Types of Research**

Grouping based on research type is divided into 4 categories, namely qualitative, quantitative, mix method (mixed) and development. The number of studies based on research type is presented in [Figure 3](#).

**Figure 3.** Data Based on Types of Research

Based on [Figure 3](#), quantitative research types dominate in research on mathematical anxiety. Research on mathematical anxiety related to gender has the highest percentage compared to other types of research. Meanwhile, the mixed method type of research on media and learning tools has the lowest percentage compared to other types of research. In the picture it can be seen that this type of development research is dominated by media points and learning tools. This is because if researchers create or develop media and learning tools to help
students who have mathematical anxiety, they must be validated first by the experts concerned and must be tested first on respondents. Furthermore, if validation and testing have been fulfilled then the learning media and tools are suitable for general use.

CONCLUSION

Based on the results and discussions presented above, it can be concluded that research on mathematical anxiety in mathematics learning, particularly related to mathematical abilities, is the most extensively studied. The interest in researching learning media is not as prominent among researchers, possibly due to the uneven distribution of learning media infrastructure in various regions. Documented studies also reveal that researchers tend to focus more on the junior high school level. The prevalence of quantitative research methods indicates that researchers find value in quantifying and systematically analyzing the phenomenon of mathematical anxiety. This approach enables them to measure and analyze mathematical anxiety systematically and statistically, exploring the extent to which it affects mathematics learning outcomes. It is hoped that future researchers can examine and reconsider other supporting aspects that may have correlations with mathematical anxiety in mathematical learning.

This research synthesis recommends continuing with a better method, namely meta-analysis, by reviewing the aspects that form it. By presenting pooled statistics from various studies, meta-analysis provides a more accurate and measured overview of the observed effects among the research population. This ability makes meta-analysis an effective tool for constructing a stronger framework of understanding regarding factors influencing mathematical anxiety, providing a solid foundation for the development of more precise and targeted intervention strategies. Furthermore, by comprehending the impact of specific variables and proven strategies for reducing mathematical anxiety, teachers can adopt a more adaptive learning approach and motivate students to overcome their fear of mathematics. Therefore, meta-analysis significantly contributes to advancing our understanding of mathematical anxiety and provides empirical foundations for improving learning approaches and psychological support in mathematics education. In future research, researchers can leverage the findings of this systematic literature review to conduct a meta-analysis on various aspects of mathematical anxiety and its impact.

ACKNOWLEDGMENTS

In this article, I would like to express my gratitude to lecturers for their valuable guidance and encouragement. Special thanks are also extended to my colleagues who have shared valuable ideas in group discussions. I appreciate my beloved alma mater, the Universitas Pendidikan Indonesia, for providing the environment where I pursued knowledge. My family and friends also deserve recognition for their invaluable support. All these contributions, from academic guidance to personal support, have been meaningful and have greatly assisted in completing this research article.

DECLARATIONS

Author Contribution: WABS: Conceptualization, Writing - Original Draft, Editing and Visualization; DJ: Writing - Review & Editing, Formal analysis, Methodology, and Validation.

Funding Statement: This research was conducted without external financial support. The author(s) did not receive funding from any organization, institution, or individual for the design, data collection, analysis, and writing of this article. The research was solely undertaken as part of academic and scholarly endeavors, and all associated costs were borne by the authors.
Conflict of Interest: The authors declare no conflict of interest.
Additional Information: There is no additional information to disclose for this article.

REFERENCES


