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Mathematics Anxiety Among Secondary School Students in Puri District of Odisha: An Empirical Study

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Abstract: Mathematics plays a vital role in a student's academic as well as everyday life. A large number of students experience mathematics anxiety, which negatively affects their performance in educational settings. The present study aimed to examine the overall level of mathematics anxiety among secondary students and also aimed to compare the mathematics anxiety based on demographical variables such as gender, type of school and medium of instruction. This study adopted a cross-sectional survey research design to conduct the study, and a total number of 220 secondary school students (13-15 years old) were selected as the sample through non-proportional stratified sampling techniques. The relevant data were collected using a standardized Mathematics Anxiety Scale and the collected data were analysed using descriptive statistics and t-tests. The findings of the study revealed that secondary school students experience a moderate level of mathematics anxiety. Further, the study revealed significant differences between male and female students, with male students showing higher mathematics anxiety in comparison to female students. Government secondary school students experience a higher mathematical anxiety compared to the private secondary school students and students who are studying in Odia medium secondary school had higher levels of mathematics anxiety than their English medium counterparts. The overall findings indicate that mathematics anxiety is influenced by various factors such as contextual, institutional, and medium of instruction. The study highlights the need for learner-friendly, concept-based, and supportive teaching practices to reduce mathematics anxiety among secondary school students. Improving instructional resources, reducing examination pressure, and adopting context-sensitive pedagogy may help in enhancing students' confidence and performance in mathematics.

Keywords: *Mathematics Anxiety; Anxiety; School Students; Secondary School Students.*

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I. INTRODUCTION

In the 21st century, the focus on science, technology, engineering, and mathematics (STEM) education seeks students to advance in these disciplines to encounter the challenges in the real world. Mathematics is an essential tool for every person in everyday life. The working language of science and technology is mathematics, which makes it important for students in the era of advanced science and technology. (Sevindir et al., 2014). Not only in science and technology, but mathematical knowledge is crucial for advancement in different stages and different aspects of life(Chand et al., 2021). Mathematics in the school curriculum was introduced to prepare students to be competent to apply the mathematics knowledge to make good decisions and solve problems in everyday life(Zakaria et al., 2012). However, the performance of the students in mathematics remained a significant issue over the years (Wahid et al., 2014). As per the report of the Annual Status Educational Report (ASER), 2018, it was found that most students enter the primary stage without the recognition that numbers are an essential component for mathematics learning. It was also found that 36% of the students in grade I were not able to recognise even a single digit number. While most of the students pass out of primary school without having Basic arithmetic skills. Moreover, 48% of the students

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in 5th grade were found unable to perform two-digit number subtraction and division of a 3-digit number by a one-digit number. These numbers represent an unsatisfactory performance in mathematics (ASER Centre, 2019). The ASER report 2022, "A National Math problem" published after the COVID-19 pandemic, also highlighted the math performance issue among the students. According to the report, 9.8% of the students from class 3rd were unable to recognise a single-digit number, while 27.6% of the students were unable to recognise the two-digit numbers. Only 8.3% of the class 3rd students were able to perform division, while 21.6% and 38.7% of class 5th students, respectively from private and government Schools were able to perform division. The report also highlighted that 53.8% of students from class VIII were able to perform divisions (Aser Centre, 2023). Mathematics is regarded as the basic need for students at primary, secondary and university level, while at the secondary stage, students should be paid more attention (Kour & Rafaqi, 2024). Poor learning and performance in the mathematics discipline is affected by several factors, such as cognitive demand (Dowker et al., 2016) and mathematics anxiety (García-Santillán et al., 2016), which negatively affect academic performance. Mathematics anxiety is regarded as the affective, cognitive and psychomotor act that results from an unfavourable experience related to mathematics knowledge, mathematical thinking and problem solving (Arem, 2009). These feelings affect the students' mathematics performance negatively, resulting in students' poor ability in mathematics learning (Zakaria et al., 2012). Mathematics anxiety is a predictor(Szczygieł, 2020) and a significant hindrance (Rozgonjuk et al., 2020) for mathematics learning, which affects children as well as adults (Wahyuni et al., 2025). Mathematics anxiety is a vital factor causing mathematical impairment among students, particularly among primary students (Sorvo et al., 2019) and secondary students (Nzeadibe et al., 2025).

Mathematics anxiety has four major aspects that clearly explain the anxiety of the students towards mathematics learning, which are "mathematics evaluation anxiety", "mathematics learning anxiety", "mathematics problem-solving anxiety", and "mathematics teacher anxiety" (Chiu & Henry, 1990; Keshavarzi & Ahmadi, 2013). Mathematics evaluation anxiety is considered the students' fear of the evaluation or exam. Mathematics learning anxiety refers to the students' fear to learn new concepts in mathematics, for which students need to learn how to learn first, as suggested by NEP 2020 (Tikader, 2023). Mathematics problem-solving anxiety is related to the interpretation of the data or the use of the information to solve math problems. Mathematics teacher anxiety is students' fear towards mathematics teacher, who is generally perceived as strict and rude by the students. Students with high mathematics anxiety tend to perceive mathematics as a more difficult subject and as unattainable for them. This perception affects students' attitudes negatively toward becoming a student of the mathematics discipline (Heydari et al., 2013). Mathematics anxiety among students can be defined as students' self-ratings of their preparedness for mathematics. Students struggling in mathematics tend to have more anxiety towards mathematics learning (Dowker et al., 2016). Mathematics anxiety is found among students who fear failure and have low self-esteem, which causes them to process mathematical information and solve problems using prior knowledge (Karimi & Venkatesan, 2009). This sense of fear results in poor mental health, which is an alarming concern for higher secondary students (Subhrajyoti & Acharya, 2025).

II. REVIEW OF LITERATURE

Mathematics anxiety has been identified as an emotional component that is considered to impact the study experience, performance, and mathematical literacy orientation of students. Various studies have identified the difference in mathematics anxiety felt by male and female students, but the results are not conclusive. Multiple studies found that female students experience mathematics anxiety to a greater extent than male students. For example, a study found that females exhibit higher anxiety levels, both general anxiety and mathematics anxiety, where a mathematical background also impacts the level of anxiety (Hossain et al., 2025). Similarly, another study found that women felt more anxiety in the assessment context, whereas men felt more anxiety in the task context (Larracilla-Salazar et al., 2019). Nugroho et al. (2025) found that females experience more mathematics anxiety than males, though no significant difference was depicted in self-perception anxiety. Similarly, a study found that gender was identified to impact the level of mathematics anxiety (Appiah Essuman et al., 2021; Oluyomi & Abdussalam, 2024). In contrast, several other studies reported no significant difference in anxiety related to mathematics among the genders, and do not show any variation between males and females in anxiety (Rabuya, 2023). Other similar studies reported that gender may not be a determining cause (Ambaranti & Retnowati, 2019; Baba, 2023; Kumar & Srivastava, 2021; Malvankar & Ansari, 2022; Sangral & Kumar, 2021). Another study reported that gender does not significantly affect the relationship among mathematics anxiety, motivation, and academic achievement (Zou, 2025). Such results suggest that gender-related differences in mathematics anxiety would vary according to the social, cultural, and classroom contexts. Furthermore, most studies have been conducted regarding the levels of mathematics anxiety among secondary school students as being at a middle level, which have indicated a moderate level of mathematical anxiety among students (Ambaranti & Retnowati, 2019; Ian Paul J. Colinares & Jenyliza T. Ucang, 2025; Jeffry & Amran, 2025; Malvankar & Ansari, 2022; Omar et al., 2022; Rabuya, 2023). On the other hand, certain studies identified high levels of anxiety in mathematics, such as studies reported that students experienced high to very high anxiety, especially due to examination pressure and performance apprehension (Bula et al., 2025; Escarez Jr. & Ching, 2022; Nurwijayanti, 2025).

Most of the studies have also been widely conducted to identify the relationship between mathematics anxiety and academic achievement. Most of the studies reported a negative relationship, which indicates that higher anxiety leads to lower performance (Appiah Essuman et al., 2021; Bornaa et al., 2023; Casty et al., 2021; Ian Paul J. Colinares & Jenyliza T. Ucang, 2025; Nurwijayanti, 2025) and

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underlined that mathematics anxiety strongly influences learning outcomes (Nurwijayanti, 2025). These findings suggest that anxiety would interfere with concentration, problem-solving ability, and confidence in mathematics. On the other hand, some studies indicate complex or mixed relationships of anxiety with performance; Anderson-Waugh and Oliver (2025) did not find any significant relationship between mathematics anxiety and achievement, but they noted a strong connection between anxiety and students' attitude toward mathematics(Anderson-Waugh & Oliver, 2025). Another result also shows that the relationship between anxiety and performance may not always be direct; it might depend on other emotional and academic factors (Escarez Jr. & Ching, 2022; Kodukula et al., 2024). Notably, sometimes a moderate degree of anxiety can contribute to improved performance, and there seems to be the possibility that it can motivate the student to perform even better as long as it does not cross the threshold of being manageable or debilitating to performance (Dalnaik, 2022; Oluyomi & Abdussalam, 2024). It has also been shown in research studies that the performance levels and background of the student affect mathematics anxiety collectively as a variable factor on its own. Further, studies also showed that the anxiety experienced by the higher-grade levels of students was high (Ambaranti & Retnowati, 2019; Luu-Thi et al., 2021). Contrary to the desired expectation in many research studies, it has also been discovered that the performance levels of the student do not directly affect the anxiety levels produced as a constituent factor in mathematics.

Furthermore, various studies have revealed that students' attitude, confidence, and motivation are also important in the case of mathematics anxiety. Such as a study indicated that a strong link exists between students' anxiety, achievement, and their mindset (Jeffry & Amran, 2025). The support of instructors and support from parents and peers affect students' level of mathematics anxiety (Casty et al., 2021; Qurrotu'ain & Fadli, 2024). Further, a study stressed that students' emotional reactions and experiences have a great impact on mathematics anxiety, and it differs from students' demographic characteristics (Li, 2025). The environment also plays an important role in mathematics anxiety. According to Moyo (2023), parental pressure, instructional practices, and classroom environment are some important components contributing towards students' fear of mathematics (Moyo, 2023). Further, another study indicated that students' interaction with peers and mathematics classroom communication patterns tend to evoke higher mathematics anxiety or overcome it depending on the supportive or non-supportive nature of the communication (Garba et al., 2019). The studies based on intervention reveal methods to overcome mathematical anxiety. Counsel-based methods were very effective in reducing anxiety among students regarding the subject to a great extent (Egara & Mosimege, 2025). Nolasco and Makaka et al. emphasised that self-control techniques, motivation, and supportive classroom environments are effective in managing anxiety and remaining interested in the subject (Makaka et al., 2023; Nolasco, 2025). In general, the studies examined school, geographical, and family factors. Further, some studies concluded that there were highly significant differences between schools regarding anxiety levels (Sangral & Kumar, n.d.; Srivastava et al., n.d.), and mothers' educational levels influenced anxiety among students(Kumar & Srivastava, 2021). Another study found that the anxiety among students in non-science streams is higher (Ambaranti & Retnowati, 2019). The studies cited in the review indicated that the anxiety among secondary school students is caused by emotional, educational, and environmental factors affecting students' engagement and academic performance. Despite several studies examining students' mathematical anxiety, there is a scarcity of studies that analysed the difference in mathematics anxiety among students from various perspectives.

Mathematics is the foundation to develop critical thinking, logical reasoning and problem-solving skills among the students in school as well as in real life. It is also crucial for students to develop higher-order cognitive skills. Despite its importance among school students, the students find it difficult to understand and develop a sense of fear and anxiety towards the subject. At the secondary stage, the concepts of mathematics cumulatively becoming more complex, which may result in intensifying the anxiety among students. Mathematics anxiety not only affects students' performance, but it also affects their self-confidence and mental health. So, understanding the pattern of mathematics anxiety during the secondary stage is highly inevitable. So, the present study examines the level of mathematics anxiety among secondary students and analyses the difference across gender, school type and medium of instruction. The findings of the study will assist the educators and policymakers in planning the curriculum and designing classroom activities to reduce the mathematics anxiety among students and improve their performance in mathematics and allied subjects.

➢ *Objectives*

- To examine the overall level of mathematics anxiety among secondary students
- To compare the mathematics anxiety of male and female secondary students
- To compare the mathematics anxiety of Government and Private secondary students
- To compare the mathematics anxiety of secondary students based on the medium of instruction

➢ *Hypothesis*

- There is no significant difference between male and female secondary students' mathematics anxiety.
- There is no significant difference between government and private secondary students' mathematics anxiety.
- There is no significant difference between secondary students' mathematics anxiety in relation to their medium of instruction

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III. METHODOLOGY

The researcher employed a cross-sectional survey research design to conduct the study. The population of the study comprise of the 9th-grade students of the secondary schools, both government and private, in the Puri district of Odisha. The students selected for the study were of the age group of 13 to 15. A total of 220 samples were collected using non-proportional stratified sampling. Where 110 were selected from government secondary schools, and the remaining 110 from private secondary schools. In the group of 110 samples, 55 were boys, and 55 were girls. Additionally, the samples were selected in such a manner that the groups of 110 also have 55 students from English medium schools and 55 were from Odia medium schools. The sampling frame is represented in the figure 1 below,

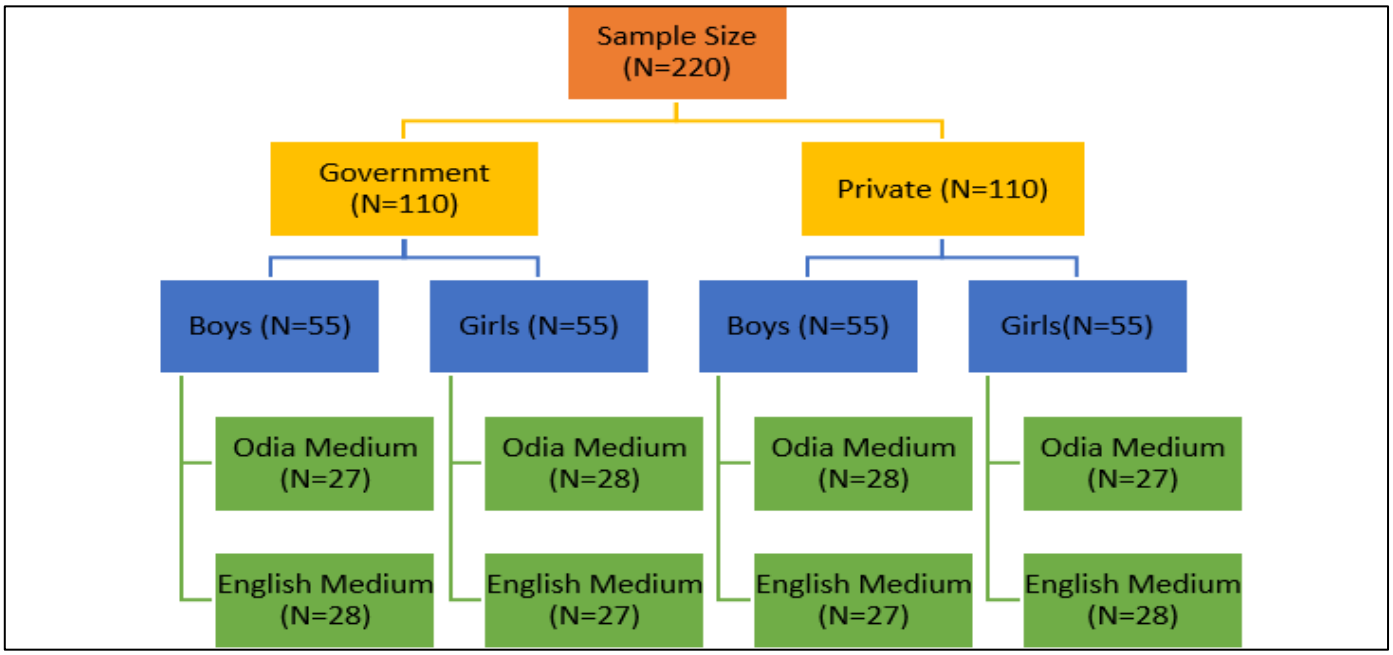

Fig. 1. Sample Frame

➢ *Instrument*

A standardised mathematics anxiety scale (MAS) for secondary school students, developed by Dr. Sadia Mahmood and Dr. Tahira Khatoon and published by National Psychological Corporation of India, was administered to the students for data collection. The MAS consists of 14 items, out of which 7 are negatively scoring items. The tool used a 5-point Likert scale, and the minimum and maximum scores of the tool are 14 and 70, respectively. The reliability of the tool was established at 0.89 through split half method and 0.87 through the Cronbach's alpha method. The tool was completely adopted due to its high reliability of the tool and can fulfil the purpose of the stated problem.

➢ *Data Collection Procedure*

Data were collected from secondary school students through surveys and field visits to secondary schools in the Puri District of Odisha. Before data collection, formal permission was obtained from the heads of the institutions. The researcher explained the purpose of the study, administered the questionnaire, and obtained informed consent from all participants. Completed responses were coded, securely stored, and analysed using appropriate statistical techniques.

➢ *Analysis Technique*

The study aimed to accomplish 4 objectives. For the first objective, descriptive statistics, mean, and standard deviation were used. For the 2nd, 3rd and 4th objectives, inferential statistics, the t-test was used.

IV. RESULTS

➢ *To Examine the Overall Level of Mathematics Anxiety Among Secondary Students*

Table 1 Mathematics Anxiety Among Secondary Students

Sample Size	220
Mean	48.71
SD	11.28

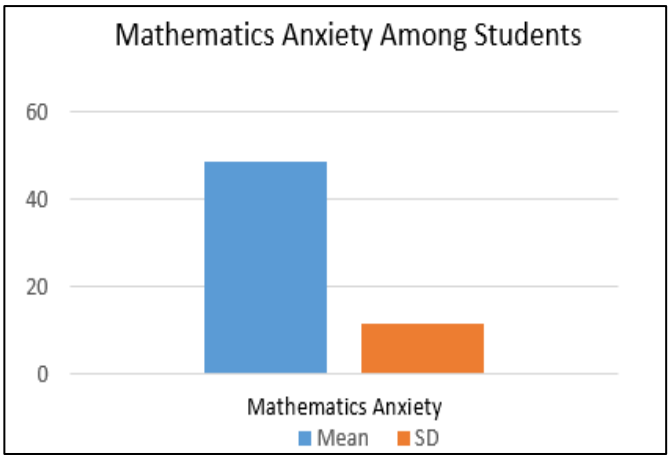

Fig 2 Mathematics Anxiety Among Secondary Students

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The mathematics anxiety score among the secondary school students is 48.71 with a standard deviation of 11.28, representing a moderate level of mathematics anxiety among the students. The mean score of 48.71 represents a potential influence on students' engagement and fear of failure in mathematics. The moderate dispersion of 11.28 also represents that some students experience high mathematics anxiety, while some of the students also experience low mathematics anxiety.

- *To Compare the Mathematics Anxiety of Male and Female Secondary Students*

Table 2 Mathematics Anxiety of Male and Female Secondary Students

Group	Male	Female
n	110	110
Mean	51.96	45.45
Sd	11.88	9.64
SEM	1.13	0.92
df	218	
t-value	4.4627*	
significance	<0.0001	

*Significant at 0.01 level

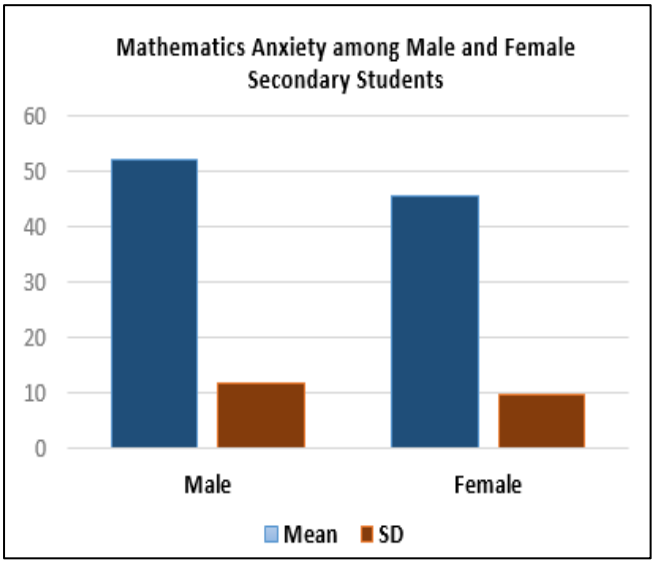

Fig 3 Mathematics Anxiety of Male and Female Secondary Students

The comparison table of mathematics anxiety shows a higher mean of male students, that is 51.96 with a standard deviation of 11.88, than the female students with a mean mathematics anxiety score of 45.45 and a standard deviation of 9.64. The t-test also confirms the difference is statistically significant, as the calculated t-value of 4.4627 is significant at the 0.01 significance level. So, the researcher rejected the null hypothesis, concluding that male students have higher mathematics anxiety than female students.

- *To Compare the Mathematics Anxiety of Government and Private Secondary Students*

Table 3 Mathematics Anxiety of Government and Private Secondary Students

Group	Government	Private
n	110	110
Mean	50.88	46.20
Sd	9.77	12.38
SEM	0.9	1.23
df	218	
t-Value	3.1351*	
significance	0.002	

*Significant at 0.01 level

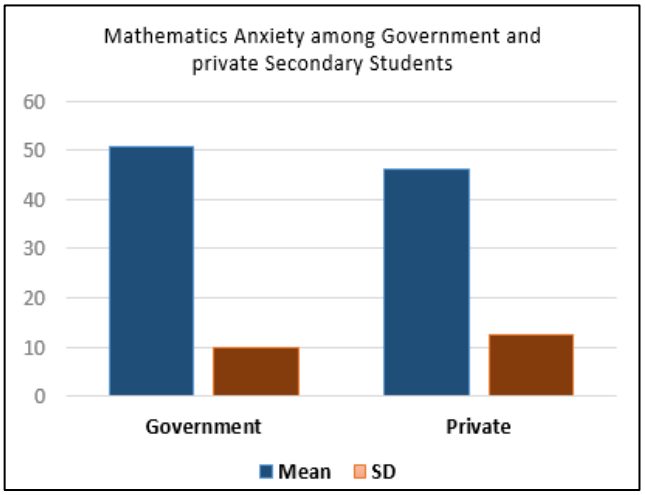

Fig 4 Mathematics Anxiety of Government and Private Secondary Students

The comparison of the mathematics anxiety of secondary school students based on the school type, that is, government (N=110) and private (N=110), indicated a statistically significant mean difference between 50.88 with a standard deviation of 9.77 for government secondary school students and 46.20 with a standard deviation of 12.38 for private secondary school students. The t-value of 3.1351 is significant at a 0.01 significance level, so the null hypothesis was rejected, indicating that the government secondary school students experience a higher mathematical anxiety compared to the private secondary school students.

- *To Compare the Mathematics Anxiety of Secondary Students Based on the Medium of Instruction*

Table 3 Mathematics Anxiety of Secondary Students Based on the Medium of Instruction

Group	Odia	English
n	110	110
Mean	51.07	46.35
Sd	9.14	12.67
SEM	0.87	1.21
df	218	
t-stat	3.1733*	
significance	0.0017	

*Significant at 0.01 level

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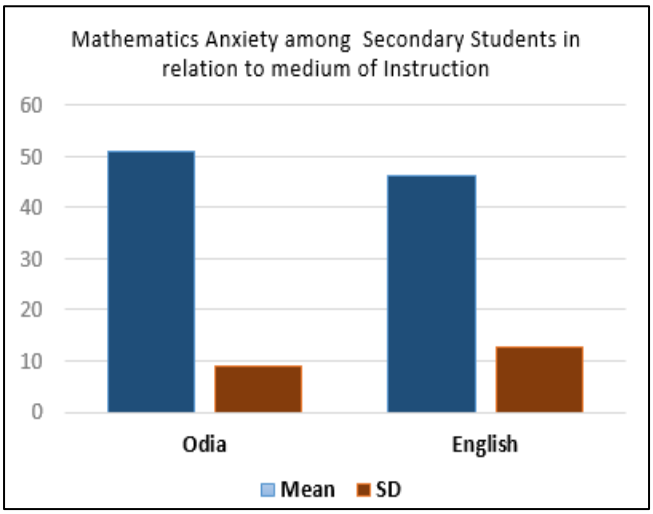

Fig 5 Mathematics Anxiety of Secondary Students Based on the Medium of Instruction

The comparison of students' mathematics anxiety based on their medium of instruction revealed a statistically significant difference in students' mathematical anxiety between students instructed in Odia and students instructed in English. The t-value 3.1733 indicated a statistically significant result at a 0.01 significance level, hence the null hypothesis was rejected. The mean value of 51.07 and standard deviation of 9.14 for students instructed in Odia medium is higher than the mean value of 46.35 and standard deviation of 12.67 for students instructed in English medium, indicating secondary students of Odia medium experience higher mathematics anxiety than the secondary students of English medium.

V. DISCUSSION

The study found that male students experience more mathematical anxiety compared to female students. The result contradicts many previous studies that frequently reported a higher level of mathematics anxiety among female students (Hossain et al., 2025) and no gendered difference in mathematics anxiety among students (Rabuya, 2023) In addition to the finding that gender is not a determining factor for mathematics anxiety (Ambaranti & Retnowati, 2019; Baba, 2023; Kumar & Srivastava, 2021; Malvankar & Ansari, 2022; Sangral & Kumar, 2021). The finding indicates a shift in patterns of gender related anxiety towards mathematics at the secondary level. The possible factor contributing to the result is increasing academic pressure and expectation to perform well in science and technology, where mathematics acts as a gateway. Such expectations have contributed to increased fear of failure among male students, resulting in high mathematics anxiety.

The study found that secondary students of government schools exhibited higher mathematics anxiety compared to the private school students. The study finding contradicts to many previous studies, indicating no difference in mathematics anxiety among students of government and private schools (Kumari & Kumar, 2025; Sangral & Kumar, 2023) While many studies supported the finding (Awasthi et al., 2015; Jha, 2010) represents a context-specific effect on mathematics anxiety. Government schools often encounter a large classroom size and fewer facilities, especially a lack of individualised instruction and technology, which is a barrier for conceptual understanding and increases students' fear of failure. These differences in attributes between government and private secondary schools contribute to the difference in mathematics anxiety among the students of government and private secondary schools.

The study also found that Odia medium secondary students experience more mathematical anxiety compared to English medium students. The result may be found as a result of different instructional strategies in English and Odia medium schools in Odisha. English medium students tend to receive different facilities, like quality instructional material, digital resources and assessment tools. On the other side lack of learning resources increases the cognitive load of the Odia medium students, contributing to an increase in the mathematical anxiety of the students.

VI. CONCLUSION

The study found a moderate level of mathematics anxiety among the secondary students, which indicates a need for a shift in approaches to teaching mathematics, especially moving from a focus on examinations to an emphasis on understanding the mathematical concepts for real-world problem solving to reduce mathematics anxiety among students. The study also revealed a higher level of mathematics anxiety among the male, Odia medium and government secondary school students, indicating a need of context sensitive pedagogy for teaching mathematics. Discouraging rote memorisation of mathematics concepts among the students can also reduce mathematics anxiety.

From the perspective of the medium of instruction, the study highlighted the importance of instructional support to reduce the fear of failure. The institutes should focus on producing quality books in the regional language that will help them to enhance conceptual quality. Policymakers should consider providing equitable access to learning resources across institutions. Higher mathematics anxiety among government secondary students indicates the need for quality interventions, such as reducing class size, integrating technology, and individualised instruction, to help reduce mathematics anxiety among secondary students.

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