

Level Of Mathematic Anxiety Of Students In Central Java Province: An Empirical Analysis

Pujiadi, Kartono, Y.L. Sukestiyarno, Mulyono

Abstract: The anxiety experienced by students related to mathematics subjects is commonly referred to mathematics as anxiety subject. The purpose of this study was to determine the level of mathematics anxiety of high school students, thus providing an empirical analysis of high school students' math anxiety, especially in the province of Central Java. This research uses descriptive research method, with sampling using purposive sampling, namely from the population of high school students in Central Java Province, it is determined that students from all districts/ cities in Central Java as the research sample of 2,240 students. The data were collected using a mathematics anxiety measurement instrument from Freedman (mathpower.com) in the form of a questionnaire with 10 items, using a Likert scale model with 5 alternative answers. The score for filling out the questionnaire is classified into 4 categories of mathematics anxiety levels, namely high, medium, low, and no anxiety. The results showed: (1) The level of mathematics anxiety of high school students in Central Java was generally categorized as low anxiety, with an average score of mathematics anxiety of 26.89, (2) The mode of mathematics anxiety score of students was 24.00, also in the anxiety category. low, (3) the lowest average of students' math anxiety items was 1.82, and the highest average was 3.52.

Index Terms: anxiety, math anxiety, high school students, central java.

1 INTRODUCTION

The anxiety that arises in students is due to continuous frustration or trauma that has not been handled. This creates tension, discomfort and worry. Olatunde [1] states that anxiety refers to pressure, stress, tension, or confusion in a person's mind and self. The anxiety that students experience related to mathematics is commonly known as mathematics anxiety. Mathematical anxiety is a psychological condition that is not conducive for a student. These conditions are in the form of feelings of fear, horror, discomfort, tension and the like. This feeling is experienced by students when doing activities with math subjects, such as learning mathematics, doing math, and solving math problems. A person who experiences math anxiety will tend to avoid the subject, this is because it can cause fear and terror [2]. If this condition is experienced by students continuously, it will have an unfavorable effect on the effectiveness of learning mathematics. Likewise, the achievement of student mathematics learning outcomes, as well as student attitudes towards mathematics subjects. As implied in the description by Richardson and Suinn [3], that mathematics anxiety is the cause of some decline in mathematical function. This condition is not only experienced by students at the elementary school level who are prone to anxiety, middle school students, even high school students who can be said to have "mathematical maturity" are also not spared from experiencing math anxiety with its various effects. As stated by Hembree (1990) in Sherman & Wither [4] which states that mathematics anxiety has long been recognized as a role in student mathematics achievement in middle and high school. Given the importance of mathematics anxiety in mathematics education, it is appropriate for mathematics

educators to pay attention to students' mathematics anxiety. As recommended by the study of Ramirez et al. [5], namely mathematics teachers need to investigate the development of students' mathematics anxiety as an important first step in developing interventions designed to minimize mathematics anxiety and improve students' mathematics learning achievement. Based on the description above, this research was carried out, namely with the aim of knowing how the level of mathematics anxiety of high school students, especially in Central Java Province. Data obtained from a sample of high school students in 35 districts/ cities in Central Java Province will provide an empirical analysis of high school student math anxiety in Central Java Province.

2 LITERATURE REVIEW

2.1 Understanding Mathematics Anxiety

Anxiety is actually a mental health disorder for a reason. Anxious people sometimes experience compulsive anxiety, irrational fear, or perhaps socially branched out difficulties. The official CalmClinik website describes seven types of anxiety, namely: generalized anxiety disorder (GAD), social phobia, panic disorder, agora-phobia, specific phobia, post-traumatic stress disorder (PTSD), and obsessive-compulsive disorder (OCD) [2]. Mathematics anxiety is a form of anxiety that can be categorized as a specific phobia [6]. Ashcraft [7] defines math anxiety as feelings of tension, anxiety or fear that interfere with math performance. Students who experience math anxiety tend to shy away from situations where they have to study and engage in mathematics. According to Richardson & Suinn [3], mathematics anxiety is a feeling of tension and anxiety that affects simultaneously when a student solves math problems in everyday and academic life. Meanwhile, Buckley & Ribordy [8] defines math anxiety as an irrational mathematical fear that interferes in number manipulation and solving mathematical problems in a variety of everyday life and academic situations. The definition of math anxiety according to Núñez-Peña, Suárez-Pellicioni, & Bono [9] is a feeling of panic, helplessness, paralysis, and mental disorganization that occurs when some students are faced with math tasks. From the definitions above, it appears that mathematics anxiety is a psychological condition of students that is not conducive when they do activities related

- Pujiadi, Mathematics Education Department, Semarang State University, Semarang, Indonesia, and Education Quality Assurance Institution (Lembaga Penjaminan Mutu Pendidikan – LPMP) Central Java, Semarang, Indonesia. Email: pujiadi@students.unnes.ac.id or pujiadi.lpmpjateng@gmail.com
- Kartono, Mathematics Education Department, Semarang State University, Semarang, Indonesia. Email: kartono.mat@mail.unnes.ac.id
- Y.L. Sukestiyarno, Mathematics Education Department, Semarang State University, Semarang, Indonesia. Email: sukestiyarno@mail.unnes.ac.id
- Mulyono, Mathematics Education Department, Semarang State University, Semarang, Indonesia. Email: mulyono.mat@mail.unnes.ac.id

to mathematics subjects. This has an unfavorable effect on students' mathematical outcomes. As stated by Richardson & Suinn [3], that mathematics anxiety is the cause of some decline in mathematical function, and many theoretical assumptions about this process as stated by Tobias (1976), Brush (1978), Richardson & Woolfolk (1980), Tobias & Weissbrod (1980), Hadfield & Maddux (1988), Hembree (1990), Cooper & Robinson (1991), dan Ashcraft & Kirk (2001) all in Sherman & Wither [4].

2.2 Levels and Symptoms of Mathematics Anxiety

The level of mathematics anxiety is classified into three categories, namely low anxiety, moderate anxiety, and high anxiety. As shown in the following table of Cavanagh and Sparrow's mathematics anxiety model.

Table 1 Cavanagh and Sparrow's model of mathematics anxiety [10]

Dominant trait model of mathematics anxiety			
Level of anxiety	Indicators		
	Attitudinal	Cognitive	Somatic
High anxiety	Scared about what s/he has to do	Worried about others thinking s/he is stupid	Having difficulty breathing
Moderate anxiety	Not wanting to be doing what has to be done	Mind going blank	Heart beats more quickly
Low anxiety	Expecting to have difficulty doing what is required	Being confused	Feeling uncomfortable
Applicable to:	<ul style="list-style-type: none"> In-class instruction: independent work, group work, or whole class In-class assessment: formal exam or tests, informal quizzes Out-of-class applications: other subjects, at home, at work or socially 		

It appears in the Cavanagh and Sparrow model above, that the dominant symptoms that arise from mathematics anxiety include attitudinal, cognitive, and somatic symptoms. Attitudinally, the mildest symptom is an attitude of worry about getting into trouble, then an attitude of not wanting to do what to do, and the worst is an attitude of fear about what to do. Whereas in the cognitive dimension the symptoms that appear at the lowest level are Being confused, then at the moderate level the mind going blank, and finally at the high level it is worried about others thinking s/he is stupid. As for somatic symptoms, namely feeling uncomfortable at low levels, the heart beats more quickly at a moderate level, and having difficulty breathing at high levels.

2.3 Causes of Students' Mathematics Anxiety

Taylor [11] states that there are five causes of student math anxiety, including: (1) pressure, (2) teaching strategies, (3) abstract mathematical concepts, (4) teacher ability and self-confidence, and (5) individual beliefs. According to Butte [12], pressures that cause math anxiety include the amount and burden of school work, relationships with teachers, relationships with peers, family problems that spread to the school environment, physical injuries, emotional well-being, and the number of disciplinary rules at home and school. Regarding teaching strategies, Fiore [13] found that math anxiety began to form from the methods teachers used to teach mathematics. In fact, preparation and thought must be

taken into account when planning how lessons will be delivered and how students will feel during lessons. Regarding abstract mathematical concepts, according to Martinez & Martinez [14], the reasons for math anxiety and math avoidance begin to increase after fourth grade, and the positive attitudes that previous children had about mathematics began to decline because math concepts changed from the concrete world to the abstract world. Regarding the reasons for the ability and self-confidence of teachers, according to Blazer [15], when teachers are unable to explain mathematical concepts in depth, they do not have the patience needed to teach various levels of student achievement, there is little or no love for delivering lessons, but it frightens them. to scare their students into behaving obediently, they must take responsibility for creating students with the highest level of math anxiety. It is important for teachers to feel confident in their ability to plan, teach, and answer questions about various math lessons. As for the causes of mathematics anxiety from individual beliefs, Stuart [16] explains that mathematics is 90% mental, or how students perceive their own beliefs, and only 10% physical, namely how students understand their own level of competence when working mathematics. Therefore teachers need to find methods to increase student self-confidence in order to experience success. Meanwhile, Dodd [17] explains that when a person has low or no self-confidence in their own beliefs, barriers to learning occur because of the idea that "trust regulates action". So according to Ma [18] when educators are able to convert math anxiety into mathematical beliefs, students not only receive an emotional boost to their self-esteem, but teachers can reap huge professional benefits by finding ways to bridge the gap between academics achievement and math anxiety. Meanwhile, Hopko divided mathematics anxiety into two dimensions, namely mathematics learning anxiety (anxiety about the learning process), and mathematics evaluation anxiety. These two dimensions of mathematics anxiety are the research of Hopko [19] which uses the Mathematics Anxiety Rating Scale Revision (MARS-R). This instrument has two subscales, namely Learning Math Anxiety (LMA), which relates to anxiety about the learning process, and Math Evaluation Anxiety (MEA), which is more directly related to the testing situation. And the results of Hopko's research found two factors that were validated by confirmatory factor analysis. These factors are the mathematics learning anxiety factor (anxiety about the learning process), and the mathematics evaluation anxiety factor or related to the test situation.

2.4 The Urgency of Knowing Students' Mathematics Anxiety

For math educators, knowing students' math anxiety is important. This is part of the assessment, especially related to assessment for learning, and assessment as learning, which is an important part of implementing the curriculum that is currently in effect [20]. Thus mathematics educators can think about how to overcome students' math anxiety, and design strategies to increase the effectiveness of their learning. This is in accordance with the research results of Ramirez et al. [5], who recommend that mathematics teachers should investigate the development of students' math anxiety as an important initial step in developing interventions designed to minimize math anxiety and improve students' math achievement. In line with that, Stuart [16] states that as educators, they must be

able to recognize that math anxiety is real, and must think of strategies to reduce students' math anxiety. Stuart [16] also recommends that the classroom should be a mathematical community that thrives on predicting, inventing, and problem solving that builds mathematical confidence in students. Guided by suggestions from NCTM, Stuart [16] applies the following practices to reduce math anxiety, namely: (1) Accommodating different learning styles, (2) Creating various testing environments, (3) Designing experiences so that students feel positive about themselves, (4) Get rid of egoism. This should not be a measure of self-esteem, (5) Emphasize that everyone makes mistakes, (6) Make mathematics relevant, (7) Empower students by letting them incorporate it into their own evaluations, (8) Allowing different social approaches, (9) Emphasizes the importance of original quality thinking over formula manipulation, and (10) Classifies mathematics as a human endeavor.

3 RESEARCH METHOD

This research is a non-experimental quantitative research with descriptive research method, which is a research method aimed at describing existing phenomena, which are taking place today or in the past [21]. The phenomenon that is the focus of this research is students' math anxiety. The sampling technique used nonprobability sampling with purposive sampling type, namely from the population of high school students in Central Java Province, students were selected from all districts/ cities in Central Java (35 districts/ cities) as many as 2.240 people as the research sample, especially class X students who took the eye math lessons (compulsory). Data collection was carried out by using a questionnaire technique using the mathematics anxiety measurement instrument from Freedman [22] on the mathpower.com site in the form of a questionnaire with 10 statement items. The scale model developed adopted from the model developed by Likert with five alternative answers, namely 1 = strongly disagree, 2 = disagree, 3 = neutral 4 = agree, and 5 = strongly agree. The scores of the results of filling out the questionnaire by the sample are classified into categories of students' math anxiety levels, with intervals as shown in the following table.

Table 2
Classification of Students' Mathematics Anxiety Levels [22]

No	Total Score	Mathematics Anxiety Level
1	40 – 50	High Anxiety
2	30 – 39	Moderate Anxiety
3	20 – 29	Low Anxiety
4	10 – 19	Not Experiencing Anxiety

The data obtained were analyzed using descriptive statistics, namely by describing or drawing the collected data as is, without looking for or explaining relationships, testing hypotheses, or making predictions [21].

4 RESULTS AND DISCUSSION

4.1 Students' Mathematics Anxiety Level

The mathematics anxiety scores of Central Java high school students who took part in this research are presented in the following table 3.

Table 3 Statistik Deskriptif Skor Kecemasan Matematis Siswa

Number of Students (N)	Highest Score	Lowest Score	Means	Mode	Standard Deviations
2240	50	10	26,89	24,00	6,51

From table 3, it can be seen that the average score (means) of students' mathematics anxiety is 26.89. If we refer to the classification of students' mathematics anxiety levels in Table 1, it shows that the mathematics anxiety level of high school students in Central Java is generally included in the low anxiety level. This category is also a condition in most high school students in Central Java, as indicated by the mode score of 24.00 which is also included in the low level of anxiety. The achievement of the highest score of students' math anxiety is 50, which means it is included in the high anxiety level category. However, the lowest score achievement of students' mathematics anxiety is in the category of not experiencing anxiety, because the score obtained is 10. In detail, the level of students' math anxiety in each category is shown in Table 4 below.

Table 4 Students' Mathematics Anxiety Levels

No	Mathematics Anxiety Level	Number of Students	Percentage (%)
1	High Anxiety	62	2,77
2	Moderate Anxiety	711	31,74
3	Low Anxiety	1191	53,17
4	Not Experiencing Anxiety	276	12,32
Sum Total		2240	100

From table 4 it can be seen that the most students' math anxiety level is in the low anxiety category, namely 1191 people (53.17%). Only 62 people (2.77%) experienced high anxiety, and 711 people (31.74%) were categorized as moderate anxiety, even those who did not experience math anxiety more than 10% were 276 people (12.32%). Graphically, the students' math anxiety level data is shown in the following figure.

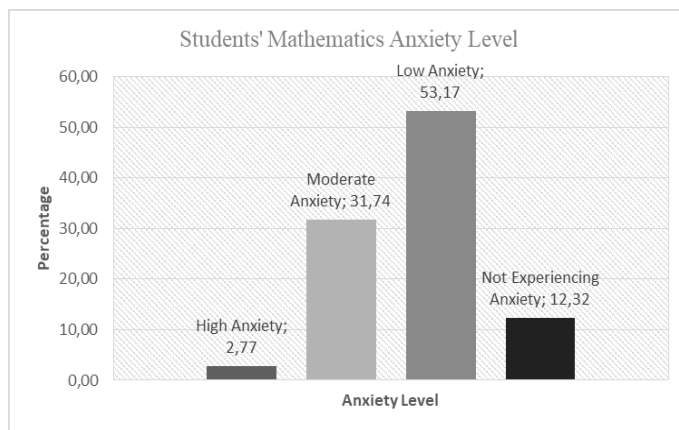


Fig. 1. Percentage of Students' Mathematics Anxiety Levels

From Figure 1, it appears that the order of student anxiety levels starts from the most, namely the category of low anxiety, followed by moderate anxiety in the second place, then in the third place, which is not experiencing anxiety, and the least is high anxiety.

4.2 Descriptive Statistics of Students' Mathematics Anxiety Items

Descriptive statistics about all students' math anxiety items are shown in table 4 which consists of the student sample size (N), means, and the standard deviations (SD).

Table 5 Descriptive Statistics of Students' Mathematics Anxiety Items

No	Expression	N	Means	SD
1	I feel scared when I enter math class	2240	2,18	0,89
2	I get scared when I go to the blackboard in math class	2240	2,67	0,95
3	I feel scared asking questions in math class	2240	2,59	0,94
4	I always worry when the teacher calls me in math class	2240	2,71	0,97
5	At the moment I understand math, but I'm afraid that I might get into trouble the next time	2240	3,52	0,97
6	I tend to want to leave math class	2240	1,82	0,90
7	I am afraid to take math tests if the types of tests vary	2240	2,92	0,99
8	I don't know how to study for math test preparation	2240	2,59	0,99
9	When I was in math class I understood maths material, but when I returned home I felt like I had never been there	2240	2,90	1,08
10	I am afraid that I may not be able to calmly solve problems in class	2240	2,99	1,05

Table 5 shows that of the 10 students' math anxiety items, the lowest average was 1.82, namely the item "I tend to want to leave math class". Meanwhile, the highest average score for the item "At the moment I understand math, but I'm afraid that I might get into trouble the next time" is 3.52. From this highest average result, it can be interpreted that what worries students the most is related to students' worries about having problems at another time, when at a certain time they understand mathematics. On the other hand, student anxiety did not lead to the tendency of students to want to leave mathematics class. This is indicated by the lowest grade point average on the items which states that "I tend to want to leave math class".

In detail, the results in Table 5 have the order of students' math anxiety items from the lowest to the highest as shown in the following figure.

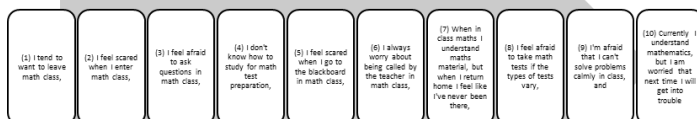


Fig. 2. The sequence of students' mathematics anxiety items

From Figure 2, it appears that the order of the students' math anxiety items from the lowest is: (1) I tend to want to leave math class, (2) I feel scared when I enter math class, (3) I feel afraid to ask questions in math class, (4) I don't know how to study for math test preparation, (5) I feel scared when I go to

the blackboard in math class, (6) I always worry about being called by the teacher in math class, (7) When in class maths I understand maths material, but when I return home I feel like I've never been there, (8) I feel afraid to take math tests if the types of tests vary, (9) I'm afraid that I can't solve problems calmly in class, and (10) Currently I understand mathematics, but I am worried that next time I will get into trouble. If referring to the opinion of Hopko [19] which divides mathematics anxiety into two dimensions, namely mathematics learning anxiety and mathematics evaluation anxiety, it is obtained that the average students' mathematics learning anxiety (items no 1-6) is 2.58, and the average mathematics evaluation anxiety (item no. 7-10) of the students was 2.85. This shows that students have higher math evaluation anxiety than mathematics learning anxiety. This means that student anxiety when facing mathematics evaluation has increased compared to student anxiety when participating in mathematics learning

4.3 Discussion

Based on the results in table 3, it shows that the level of mathematics anxiety of high school students in Central Java is included in the low anxiety category, even this low anxiety category is also a mode among high school students in Central Java. Likewise, the results shown in Table 4 show that only 2.77% of students experienced high anxiety, and 31.74% of students who were categorized as moderate anxiety, even 12.32% of students who did not experience mathematics anxiety. This data is a good asset for mathematics educators in Central Java, to map the condition of students in increasing students' mathematical potential, related to student attitudinal and cognitive, both in the dimensions of the learning process and student mathematics learning outcomes. This is consistent with the recommendation of Stuart [16] that the classroom, among other things, should become a thriving mathematical community for problem solving that builds mathematics confidence in students. Likewise the recommendations from the research results of Ramirez et al. [5], namely that mathematics teachers investigate the development of students' mathematics anxiety as an important first step in developing interventions designed to improve students' mathematics learning achievement. The results in table 5 provide instructions for mathematics educators in Central Java to look at things that are points of student mathematics anxiety. Based on the order that exists, educators can determine the priority focus of handling mathematics anxiety items. Gradually and continuously educators think of strategies to deal with students' math anxiety starting from the anxiety items with the highest average and so on to the anxiety items with the lowest average. This is in accordance with the opinion of Stuart [16] which states that as educators, they must be able to recognize that students' math anxiety is real, and they must think of strategies to reduce students' math anxiety. From table 5 it is also known that the result of the item of anxiety with the highest average is on the item "Currently I understand mathematics, but I am worried that next time I will get into trouble". This point indicates that students' math anxiety problems stem from individual beliefs or students' confidence in mathematics. This condition is reinforced by the results related to the dimensions of students' mathematics anxiety, namely students have higher mathematics evaluation anxiety than mathematics learning anxiety. This is in accordance with the theory put forward by Dodd [17] which explains that when

a person has low or no self-confidence in their own beliefs, learning barriers occur because of the idea that "trust regulates actions". Based on this description, the most important thing for mathematics educators is to determine learning strategies with various methods that can increase students' confidence to succeed in mathematics. This is in line with the opinion of Stuart [16], that mathematics is 90% mental, or how students perceive their own self-confidence, and only 10% physical, namely how students understand their own level of competence when doing mathematics. So, teachers need to find methods to increase students' confidence to ensure they can experience success. Moreover, with the creativity of professional math educators they must be able to convert students' math anxiety into mathematical beliefs. With good confidence and self-confidence, students will follow mathematics well, so that they are better prepared to take math tests without anxiety. And in the end students are able to obtain optimal mathematics learning outcomes. This is consistent with the opinion of Ma [18] who stated that when educators are able to convert math anxiety into into mathematical beliefs, students not only receive an emotional boost to their self-esteem, but teachers are able to find ways to bridge the gap between academic achievement and math anxiety.

5 CONCLUSION AND RECOMMENDATIONS

5.1 Conclusions

The conclusions obtained from this research are: (1). The level of mathematics anxiety of high school students in Central Java is generally at a low level of anxiety, with an average score of mathematics anxiety is 26.89, (2). The percentage of high school students' mathematics anxiety level in Central Java based on the category of anxiety levels namely: high anxiety 2.77%, moderate anxiety 31.74%, low anxiety 53.17%, and 12.32% students who do not experience mathematics anxiety, and (3). Based on the highest average on students' mathematics anxiety items, in general the emergence of math anxiety problems for high school students in Central Java comes from individual beliefs or students' self-confidence about mathematics.

5.2 Recommendations

(1). Mathematics educators in Central Java can take advantage of the findings of empirical data from this study to develop effective learning methods in increasing the potential and learning outcomes of students' mathematics, (2). The need for further research with a focus on the source of students' math anxiety. Especially with regard to student interactions with their environment, especially in school and class when students take mathematics lessons.

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