Math anxiety performance of the 8th grade students of junior high school

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Abstract. The problem of this research is how to identify the level of students' mathematical anxiety in junior high school. The purpose of this research is to find out descriptively the level of anxiety owned by junior high school students and the difference between students' anxiety based on gender and class. The method used is descriptive quantitative study using anxiety questionnaire. The population of the study were all students of Class VIII consisting of 7 classes. The number of samples was 95 students taken with cluster random sampling technique. The research data is a statement that measures students' anxiety. Data were analysed using descriptive statistical, t-test and Kruskal Wallis. The results showed that the condition of mathematical anxiety level is in a low category. There is a difference in mathematical anxiety level of students seen from the class category. There is no difference in the mean mathematical anxiety of students seen from gender. The novelty and impact of the results of this study are, it turns out the results of previous research which states that women tend to be more anxious than men is not proven. A low level of student anxiety is expected to improve the quality of student learning.

1. Introduction

The object of research is the students of class VIII SMP Negeri in Ciamis district as many as 95 students. This research was conducted to know the extent of mathematical anxiety level of students so that in the implementation of learning, teachers can apply appropriate steps to improve the quality of learning outcomes and mathematical ability of students. Several previous studies have suggested that anxiety affects the quality of students' mathematical learning [1,2]. To identify students' mathematical anxiety levels, researchers need to use valid instruments to ensure that it does not interfere with student’s performance in learning math [2].

Mathematical anxiety is a person's psychological condition that arises from interacting with everything related to mathematics. This condition can disrupt the performance of students in their activities such as learning and tests. The benefits of measuring it level are useful for students so they can control it while doing the math activity. Teachers also need to know the anxiety condition of each student to control the learning process quality and math tests [3].

Mathematical anxiety is the negative attitudes, tensions, and fears associated with physiological arousal, including rapid heartbeat, and mismatched thoughts related to mathematics [3]. Mathematical anxiety is an uncomfortable feeling that arises when faced with mathematical problems related to fear...
and anxiety in the face of specific situations related to mathematics. Anxiety is an unpleasant experience of subjective about concerns or tension in the form of feelings of stress, pressure, and emotion experienced by a person. Mathematical anxiety is a feeling of panic, powerlessness, paralysis and mental disorganisation that emerged among some people when they were asked to solve mathematical problems [1,2]. The adverse effects of mathematical anxiety and negative attitudes toward mathematics on performance in tasks that require management are a sign of mathematical anxiety [4,5].

Mathematical anxiety as a feeling of tension, anxiety or fear that interferes with mathematical performance. Students who experience mathematical anxiety tend to avoid situations where they have to learn and do the math. While Richardson and Suin state that mathematical anxiety involves tense and anxious feelings that influence in various ways when solving math problems in real life and academic [1]. Bursal and Paznokas say that mathematical anxiety is a state of helplessness and panic when asked to do mathematical tasks [6]. Furner and Berman also describe mathematical anxiety as "I cannot" syndrome [7]. It can be caused by embarrassing mathematical experiences or because of the inability to apply understanding and use of mathematical concepts. Learners may experience mathematical anxiety because they have never experienced success in a mathematics class [8]. Several previous studies have found that anxiety levels that occur based on gender are similar between men and women [7,9]. However, other findings reveal that women suffer from higher mathematical anxiety than men [10,11]. As a result, women tend to be less eager to solve mathematical problems. They tend to avoid mathematically related activities [10,12-15].

Studies of the adult population consistently found that women had higher levels of mathematical anxiety than men [16,17]. However, less is known about the development of gender differences in mathematical anxiety levels experienced in childhood and adolescence [18,19]. Gender differences related to mathematical anxiety and mathematical performance tested in a sample of 3-8 grade children: only girls were perceived worse in mathematics because of their competence [20]. Further studies confirm that gender differences cause losses in girls in math anxiety, mathematical achievement and other cognitive abilities, such as reading and fluid intelligence [21].

Mathematical anxiety has two indicators, namely anxiety learning mathematics and anxiety evaluation of mathematics, Adopting from Cooke et al. suggests that mathematical anxiety indicator consists of 4 components, namely mathematics knowledge/understanding, somatic, cognitive, and attitude [22]. The indicator given mathematical anxiety has three components, i.e. psychological, physiological and social activity or attitude and behaviour. The indicator is to measure students' mathematical anxiety more deeply. The instrument in this study was developed based on an already validated mathematical learning anxiety indicator and evaluation.

2. Method
The method in this research is descriptive quantitative, with cluster sampling model and research design of cross sections R O where the sample subjects are taken three classes as many as 95 students of class VIII from five classes available as shown in Table 1:

| Gender | Class VIII-B | Total |
|--------|--------------|-------|
| Man    | 15           | 35    |
| Women  | 22           | 60    |
| Total  | 37           | 95    |

The location of the research was carried out in one of SMP in Ciamis District selected by a random cluster. The research procedure begins with instrument making, instrument validation, class sampling, dispute of anxiety questionnaires in grade VIII B, E and D which have been selected based on high achievement grade, medium and low grade. Data collection techniques using the questionnaire as many
as ten statements with five choices of answers using Likert scale (table 2). This research is using analysis descriptive and inferential statistical test, t-test and Kruskal Wallis.

**Table 2.** Criteria score questionnaire mathematical anxiety.

| Answer Options       | Statement Rating Scale |
|----------------------|------------------------|
| Strongly Disagree    | 1                      |
| Disagree             | 2                      |
| Sometimes            | 3                      |
| Agree                | 4                      |
| Strongly agree       | 5                      |

The classification of anxiety questionnaire scores using ideal mean (Mi) and deviation standard (SDi) with rules where $\text{Mi} = \frac{1}{2} (\text{highest score} + \text{lowest score})$ and $\text{SDi} = \frac{1}{3} (\text{Mi})$. We presented the criteria in Table 3.

**Table 3.** Mathematical anxiety scoring criteria.

| Interval Value       | Criteria         | Ordinal Score | Interval Score |
|----------------------|------------------|---------------|----------------|
| $X \geq \text{Mi} + 1,8 \text{SDi}$ | Very high       | 5             | $X \geq 48$     |
| $\text{Mi} + 0,6 \text{SDi} \leq X < \text{Mi} + 1,8 \text{SDi}$ | High            | 4             | $36 \leq X < 48$     |
| $\text{Mi} - 0,6 \text{SDi} \leq X < \text{Mi} + 0,6 \text{SDi}$ | Moderate        | 3             | $24 \leq X < 36$     |
| $\text{Mi} - 1,8 \text{SDi} \leq X < \text{Mi} - 0,6 \text{SDi}$ | Low             | 2             | $12 \leq X < 24$     |
| $X \leq \text{Mi} - 1,8 \text{SDi}$            | Very low        | 1             | $X \leq 12$     |

The Mathematical Anxiety Score ($X$) in this measurement uses the ideal high score = $5 \times 10 = 50$, the ideal lowest score = $1 \times 10 = 10$, $\text{Mi} = \frac{1}{2} (50 + 10) = 30$ and $\text{SDi} = \frac{1}{3} (30) = 10$.

The hypothesis testing using t-test and Kruskal Wallis with a tolerance level of 5% confidence. We build the hypothesis of quantitative research based on theories, conditions and criteria established in the study and based on previous research.

### 3. Results and discussion

The first research question is how the level of mathematical anxiety students in one junior high school in Ciamis? Our hypothesis is the mathematical anxiety of junior high school students in Ciamis is high. From the observation, the average student in Ciamis does not like math lessons. It means the minimum average mathematical anxiety score is at intervals of $36 \leq X < 48$. So the statistical hypothesis average anxiety score is at least 36. With the statistical hypothesis as follows:

- $H_0: \mu < 36$ (the anxiety level of junior high school students is below the high level)
- $H_a: \mu \geq 36$ (the junior high school students' anxiety level is in high category)

The following is the descriptive results of anxiety levels that students get based on the number of students.

**Table 4.** Student anxiety distribution level.

| Anxiety Level | Frequency | Percent |
|---------------|-----------|---------|
| Very Low      | 16        | 16.8    |
| Low           | 49        | 51.6    |
| Moderate      | 28        | 29.5    |
| High          | 2         | 2.1     |
| Total         | 95        | 100.0   |
Apparently the level of anxiety students who enter the high category only two people. Most frequencies are at a low level. So it can be predicted that the initial suspicion of anxiety level students in high school is not proven. For more valid proof, we were conducting a hypothetical test using inferential statistical analyses of one-sided t-test because of its data-scale interval and normal distribution. Table 5 shows the results of a one-tail test against the initial expectation that the average anxiety level of junior high school students is in the high category.

**Table 5. Descriptive statistics of students’ anxiety.**

| N  | Mean | Std. Deviation | Std. Error Mean |
|----|------|----------------|-----------------|
| 95 | 20.26| 8.070          | .828            |

Descriptively the level of mathematical anxiety of students has an average value under the high category that is 20.26 means only in the low level (12 ≤ X <24). Inferentially, the result of a one-tail t-test is in table 6 below:

**Table 6. Inferential statistics of one-tail t-test.**

| T  | df  | Sig. (2-tailed) | Mean Difference |
|----|-----|-----------------|-----------------|
| -19.006 | 94 | .000           | -15.737         |

The value of t table is -19.00 smaller than t critical (95, 5%) = 1.664, meaning we accept Ho. So the mathematical anxiety level of students is less than 36. The average score of students is 20.26 with anxiety level at the low level of 49 students.

The second research question is whether there is a difference in anxiety levels between students who are in the class with high ability, moderate, and low?. This question hypothesis that students in different classes differ in their anxiety levels because the condition of the student's background and teacher varies. Distribution level of students' mathematical anxiety based on the class presented in table 7:

**Table 7. Distribution of students’ anxiety level by class.**

| Class | Mathematical Anxiety Level | Total |
|-------|----------------------------|-------|
|       | Very Low                  | Low   | Moderate | High |       |
| VIII-B| 2                          | 29    | 6        | 0    | 37    |
| VIII-E| 4                          | 11    | 16       | 0    | 31    |
| VIII-D| 10                         | 9     | 6        | 2    | 27    |
| Total | 16                         | 49    | 28       | 2    | 95    |

The mode value of anxiety level in class VIII-B whose ability moderate dominated by low category anxiety levels. The anxiety level of moderate category dominates class VIII-E (high-ability class). It is in line with Eggen and Kaucakah [23] that moderate anxiety is the best state to support academic performance. Very low category anxiety levels dominate class VIII-D (low-ability class).

Overall, junior high school students are governed by low anxiety level of 51.58% while those who are positioned in academic support only about 29.47%, i.e. students who are on the level of moderate anxiety.
Table 8. Descriptive statistics of students’ anxiety based on class.

| Class | B   | E   | D   |
|-------|-----|-----|-----|
| N     | 37  | 31  | 27  |
| Mean  | 18.9459 | 23.2581 | 18.6296 |
| Std. Deviation | 6.23585 | 7.97900 | 9.60428 |
| Minimum | 11.00 | 10.00 | 10.00 |
| Maximum | 33.00 | 36.00 | 38.00 |

Table 8 shows the difference in mean anxiety level of students of each class descriptively. Only class E has an average of more than class B and class D. If viewed based on criteria in table 3 between B, E and D; they are all at intervals of $12 \leq X < 24$. That is, the level of mathematical anxiety of all classes is at a low level. To be able to ascertain the presence and absence of different anxiety levels among all, then the following is the result of inferential statistical tests using the Kruskal Wallis test. We perform the test because one group of data is not normal.

Ho: B = D = E (there is no difference in student anxiety rank among the three classes)
Ha: B ≠ D ≠ E (there is a difference in student anxiety rank among the three classes)

Table 9. Inferential statistics by class.

| CLASS | N   | Mean Rank |
|-------|-----|-----------|
| VIII-B| 37  | 45,70     |
| VIII-E| 31  | 58,29     |
| VIII-D| 27  | 39,33     |
| Total | 95  |           |

Table 9. Describe the different ranking of the three classes. Kruskal Wallis test confirms that the value of the interval between the three existing classes has a significant level of difference, from the table obtained significance value smaller than 5% that means Ha accepted. In other words, there are rank differences. It is that though the intervals are different if looking at the category, all the classes have values at the same interval, i.e. the low-level of anxiety.

Table 10. Inferential statistical test of Kruskal Wallis.

| Kruskal Wallis Test | TS  |
|---------------------|-----|
| Chi-Square          | 7,281 |
| Df                  | 2   |
| Asymp. Sig.         | .026 |

It means different in quantitative but equally qualitative value. Although different still in the same group.

The third question is there a difference in the level of anxiety between men and women? The research hypothesis is that there is a difference of anxiety level. Women's anxiety level is higher than men. Based on some previous studies, in general, women are more dominant having excessive mathematical anxiety compared to men [10, 11].

The following statistical test results use the t-test of two different averages to know whether there are differences in anxiety levels between men and women in junior high school.
Table 11. Mathematical anxiety distribution of students by gender.

| Gender | The Level of Math Anxiety | Total |
|--------|---------------------------|-------|
|        | Very Low | Low | Moderate | High |
| Man    | 9        | 17  | 9        | 0    | 35   |
| Women  | 7        | 32  | 19       | 2    | 60   |
| Total  | 16       | 49  | 28       | 2    | 95   |

Table 11 provides information that male students have low levels of anxiety as well as female students. The number of distributions of the results of this study is in line with [8,9] that the level of anxiety that occurs based on gender is the same between men and women.

Table 12. Descriptive statistics of mathematical anxiety by gender.

| JK     | N  | Mean | Std. Deviation | Std. Error |
|--------|----|------|----------------|------------|
| Man    | 35 | 18.71| 7.242          | 1.224      |
| Women  | 60 | 21.17| 8.444          | 1.090      |

Table 12 gives a different picture when viewed from the average where female students have a higher than men. It is just that it is different quantitatively. As if looking at the criteria of anxiety in table 2, both groups of both men and women are still in the low category.

To further verify whether between groups of men and women have an average difference or not, we perform an inferential test. Since both groups of data are normally distributed and homogeneous, the difference test uses the t-test as in table 13 with the following hypothesis:

Ho: \( \mu_1 = \mu_2 \) (there is no difference in the average anxiety of male and female students)

Ha: \( \mu_1 \neq \mu_2 \) (there is a difference in mean anxiety between male and female students)

Table 13. Inferential statistics t test the difference between two averages.

| T     | Df  | Sig. (2-tailed) | Mean Difference | Std. Difference | Error |
|-------|-----|-----------------|-----------------|-----------------|-------|
| -1.437| 93  | .154            | -2.452          | 1.707           |

Table 13 shows that the significance value of 0.154 is higher than the 5% alpha, meaning Ho is accepted. So it can be inferentially concluded that there is no difference in mean anxiety between male and female students. Although there is no difference in anxiety, there are differences in solving mathematical problems and mathematical understanding [24,25].

4. Conclusion
The anxiety level of Ciamis Junior High School students is in a low category. There is a difference in mean mathematical anxiety among students who have high, medium and low mathematical ability although still at the same interval, i.e. low anxiety level. There is no difference in the anxiety level of male and female students.

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