



## Application of RME to Improve Numeracy and Reduce Math Anxiety using Liveworksheets and Geogebra

Aliyah Aziz<sup>1,\*</sup>, Ari Septian<sup>2</sup>, Siti Rohani D<sup>3</sup>, Rizka Awaliyah R<sup>4</sup>, Marchantia Tatiana K<sup>5</sup>, Rizpan Nurhalim<sup>6</sup>

<sup>1, 2, 3, 4, 5, 6</sup> Universitas Suryakencana, Cianjur, Indonesia

\*Corresponding Author: [aliyahaziz2202@gmail.com](mailto:aliyahaziz2202@gmail.com)

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### ABSTRACT

This study aims to evaluate improvements in numeracy skills and reductions in students' mathematical anxiety by implementing Realistic Mathematics Education (RME) in the Kurikulum Merdeka using Liveworksheets and GeoGebra media. The research method used is the quasi-experiment. The design of this study uses nonequivalent comparison group design. The population in this study were students of class X SMAN 1 Cibeber in the 2024/2025 academic year. From this population, two classes were taken as samples, namely the class that would become experimental group 1 and experimental group 2 which were selected using the purposive sampling technique. Experimental group 1 received intervention with the Realistic Mathematics Education (RME) model based on Liveworksheets and GeoGebra media, and experimental group 2 (control class) received intervention with conventional learning methods. The instruments used were test and non-test instruments (in the form of questionnaires). The material used was about exponent material. Data analysis was carried out on the average gain index between the two sample classes utilizing the similarity of two averages. The results of the research show that in the research process, there was an increase in students' numeracy skills and overcoming mathematical anxiety, in this case, those who used intervention with the Realistic Mathematics Education (RME) model based on Liveworksheets and GeoGebra media were better than learning using conventional learning methods. The increase in numeracy ability in the experimental class obtained an n-Gain score of 0.24 while in the control class it obtained an n-Gain score of 0.17. The final level of mathematical anxiety in the experimental class obtained an average score of 64 while the control class obtained an average score of 65.189. However, the experimental class experienced a significant increase of 36.79% in changes in students' mathematical anxiety.

Keywords: Geogebra; liveworksheets; mathematical anxiety; numeracy skills; realistic mathematics education (RME)

### INTRODUCTION

Currently, the world is facing the era of the Industrial Revolution 4.0 and Society 5.0 where in this era people are required to be able to utilize the use of technology using various new and creative innovations in different aspects of life, one of which is the field of education (Sasikirana & Herlambang 2020). Nadiem Anwar Makarim, Minister of Education and Culture of Indonesia, initiated the concept of independent learning education as an answer to the needs of the education system in Indonesia today. Haryati, Anar & Ghufroon (2022) and Lestari et al. (2023) stated that the Independent Curriculum is an innovative education that responds to changes in the era of society 5.0 which seeks to prepare students with the 21st century skills needed during the industrial revolution 4.0.

However, based on data in the field, there are still many problems in implementing the Kurikulum Merdeka. In the research results of Barlian et al. (2023) teachers still tend to use conventional teaching methods, learning has not been student-centered so there is no differentiation of students in the learning process, and causes a lack of student understanding in mathematical numeracy. This is supported by the latest data in 2022 regarding the results of national assessment achievements, students' numeracy skills on the national education report card are still low, namely 41.13% for SMA/SMK/MA/equivalent levels.

Numeracy is the ability to apply number concepts and numeracy skills in everyday life (Fahrudin 2023). In this case, to improve students' numeracy skills, an effective method is needed, one of which is through the Realistic Mathematics Education (RME). Realistic Mathematics Education (RME) is effective in improving students' numeracy skills because it emphasizes the use of real life contexts to make mathematical concepts more meaningful and applicable. In line with Amaliya Mahmudah & Roosevelt (2024) and Khotimah & As'ad (2020), the Realistic Mathematics Education (RME) has a significant effect on improving students' learning outcomes and math skills. This suggests that when students can relate mathematical ideas to experiences they are familiar with, they are better able to understand, remember, and apply those ideas effectively, thereby strengthening their overall numeracy skills.

In addition to learning methods, students' low mathematical numeracy skills are caused by ineffective modules. The teaching modules for the Kurikulum Merdeka are still limited and the media still do not make much use of technology. This is in line with the research of Holst et al. (2020) and Tri Ajeng Oktavia et al. (2023) which stated that the problems in implementing the Kurikulum Merdeka are difficulties in formulating teaching modules, lack of ability to use technology, lack of ability to use learning methods and media, less interactive learning media, and students' poor perception of mathematics.

In addition, it is undeniable that existing problems also influence the emergence of students' mathematical anxiety. Mathematics anxiety is a feeling of worry and discomfort that arises when doing activities related to mathematics (Marweli & Meiliasari, 2024). Kharis et al. (2023) factors that cause mathematics anxiety include learning motivation, pressure in teaching mathematics, mastery of technology. Mathematics anxiety arises due to various factors such as fear of failure, low self-efficacy, and social and academic pressure during the mathematics learning process (Sadin, 2024; Hermawan et al., 2024). This anxiety affects students' performance in understanding concepts, solving problems, and communicating mathematically. For example, the results of a study by Nurhaliza Ali & Nimah (2023) showed that students with low numeracy skills showed high levels of mathematics anxiety. In a study by Susanti et al., (2023) it also showed that numeracy skills according to students' anxiety levels showed a significant negative correlation. Therefore, there needs to be a learning strategy that supports a comfortable learning climate and increases students' self-confidence in mathematics.

From the description of the existing problems, to implement an effective Kurikulum Merdeka to improve numeracy skills and overcome mathematical anxiety of high school/equivalent students, it is necessary to implement a Realistic Mathematics Education (RME) that helps students easily understand the material, as well as teaching modules that are interactive, practical, and differentiated in terms of process. In the research of Juandi et

al., (2022) it was shown that Realistic Mathematics Education (RME) has a broad impact on improving learning outcomes and reducing mathematical anxiety, especially in developing countries. Khosiyono et al. (2023) Differentiated learning strategies are divided into three strategy components, namely: content differentiation, process differentiation, and product differentiation. Aprima & Sari (2022) process differentiation is the way students choose their learning style. The teaching module that can be developed is with Liveworksheets and GeoGebra-assisted media. The selection of Liveworksheets and GeoGebra was made because both media are easy to develop. In line with research conducted by Septian, Sukma Yanti & Inayah (2023), the modules developed with media assisted by Liveworksheets and GeoGebra are valid, practical, and receive good responses. For example, both media have the advantage of being able to provide convenience in presenting interactive questions and visualizing mathematical concepts dynamically, which are not available in conventional media such as PowerPoint or printed student worksheets (Monalisa et al., 2024). Students access the GeoGebra applet smoothly on a mobile browser, enabling independent learning without the need for technical installation (Green et al., 2023). Liveworksheets enable personalization of student worksheets based on digital activities that are more responsive than ordinary interactive PDFs (Patmala et al., 2024).

The virtue of this research is the novelty that has not been done by previous researchers. Several titles have almost the same variables, namely research conducted by Fitriani, Hidayah & Nurfauziah (2021) and Syafruddin, Khaerunnisa & Rafianti (2022) in the study conducted the development of Realistic Mathematics Education (RME) teaching modules with the help of Liveworksheets and GeoGebra, one of which is the discovery learning model and mathematical literacy skills. Based on this, this research has differences and novelty, especially in the abilities used, namely to improve numeracy skills, reduce students' mathematical anxiety, and process differentiation according to the Kurikulum Merdeka. So researchers are interested in taking the title "Application of RME to Improve Numeracy and Reduce Math Anxiety Using Liveworksheets and Geogebra". This study aims to determine: the difference in the increase in numeracy skills of students who learn using the Realistic Mathematics Education (RME) based on Liveworksheets and GeoGebra compared to the conventional approach; the difference in mathematical anxiety between the two groups after the action; and the achievement of increased numeracy and decreased anxiety as a result of the applied approach.

## **RESEARCH METHODS**

The type of research used is the quantitative method: quasi-experimental. The independent variable is the Realistic Mathematics Education (RME) model based on Liveworksheets and GeoGebra media. The dependent variable is students' numeracy skills and mathematical anxiety. The quasi-experimental research design used in this study was in the form of a "Nonequivalent comparison group design." This particular consideration is taken from students who have not studied and understood the material that the researchers conveyed, namely new class X students at SMAN 1 Cibebber. The instruments used in this study are questions (to measure students' numeracy skills in exponent material) and questionnaires (to calculate students' mathematical anxiety levels). The questions consisted of 5 pretest and post-test questions about students' numeracy skills in exponent material with indicators on the grids presented in Table 1.

Table 1. Student Numeracy Ability Grid

| Student Numeracy Ability Indicator  | Problem Indicator   | No Grain |
|---|---|----------|
| 1. Able to use various kinds of numbers or symbols related to basic mathematics in solving daily life problems.<br>2. Able to analyze information displayed in various forms (graphs, tables, charts, diagrams and so on).<br>3. Interpret the results of the analysis to make predictions and decisions. | Given a problem about the growth of a bacterium related to exponential growth, students can explain the concept and determine the value of bacterial growth.  | 1        |
|   | Given a problem about simplifying root form, learners can determine the simplest root form from the given problem.  | 2        |
|   | Given a problem about rationalizing root form, learners can determine the simplest root form from the given problem.  | 3        |
|   | Given a problem about a substance injected into a patient's body related to exponential decay, learners can explain the concept and determine the decay value of the substance from the patient's body. | 4        |
|   | Given a problem about the target amount of savings related to logarithms, learners can explain the concept and determine the time needed so that the target amount of savings can be achieved.          | 5        |

However, given the limited research time due to the class ascension examination as well as the first week of school entry on July 15, 2024, and the activities of the school environment introduction period which runs in the first week, the researcher only chose 3 items by the learning meeting, namely the material of the properties of exponents and exponent functions (numbers 1, 2, and 4). Meanwhile, the questionnaire consists of 25 positive and negative questions by the indicators presented in Table 2.

Table 2. Student Mathematical Anxiety Grid

| Aspects                           | No                |
|-----------------------------------|-------------------|
| Tense                             | 1, 2, 3           |
| Somatic complaints                | 4, 5, 6, 7, 8     |
| Fear of his own mind              | 9, 10, 11, 12, 13 |
| Restless                          | 14                |
| Worry                             | 15, 16, 17, 18    |
| Fear                              | 19, 20, 21        |
| Impaired concentration and memory | 22, 23            |
| Sleep pattern disorder            | 24                |
| Stressful dreams                  | 25                |

The scoring of the questionnaire answers was carried out using a Likert scale consisting of four answer options, namely point 4 for "Strongly agree", point 3 for "Agree", point 2 for "Disagree", and point 1 for "Strongly disagree". Then the data is processed statistically by determining the frequency table so that the mean and standard deviation are obtained. Meanwhile, to describe the level of mathematical anxiety, categorization in Table 3.

Table 3. Category Norms of Mathematical Anxiety Questionnaire

| Criteria   | Category  |
|--|-----------|
| $Grade \geq \bar{x} + (1,5 \times SD)$           | Very High |
| $\bar{x} \leq Grade < \bar{x} + (1,5 \times SD)$ | High      |
| $\bar{x} - (1,5 \times SD) \leq Grade < \bar{x}$ | Low       |
| $Grade < \bar{x} - (1,5 \times SD)$              | Very Low  |

The tools used in this research are laptops, projectors, smartphones, learning modules (PPT, Liveworksheets, and GeoGebra). The research stages are described in Figure 1.

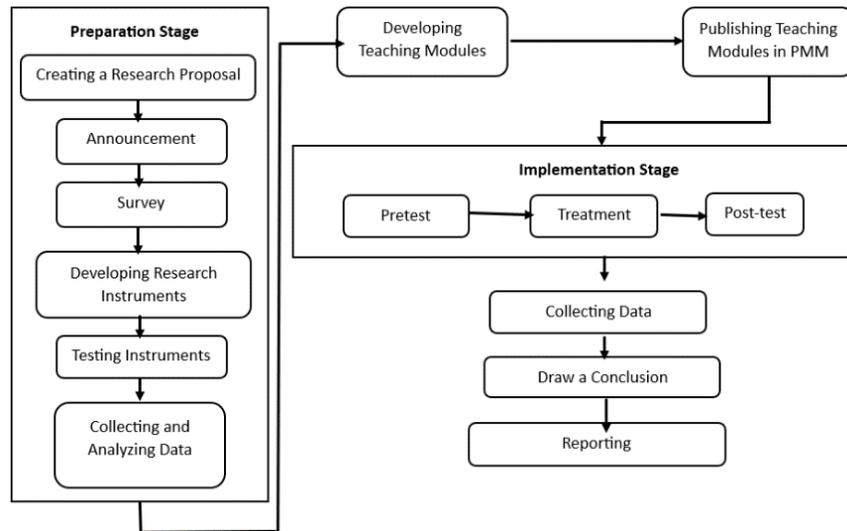


Figure 1. Research Stages

## RESULTS AND DISCUSSION

The research conducted on the application of the Realistic Mathematics Education (RME) in the Kurikulum Merdeka to improve numeracy skills and overcome mathematical anxiety with Liveworksheets and GeoGebra media at SMAN 1 Cibeer can be considered to have gone well because the activities carried out are by the timeline. The first step in this research is an initial location survey whose purpose is to find out the problems of learning mathematics at the school and the schedule of school activities. After that, licensing and consulting various parties, especially the Principal, student affairs, and mathematics teachers in grades X and XI. The response from the party was very supportive of research at school. Before conducting research, the instrument was first tested by a higher level class, namely class XI, which aims to test whether the instrument used is suitable for use as a research instrument. Then the results of the trial were collected, analyzed, and processed to be used as research material in the classroom. After the research instrument is properly validated, the researchers then compile the teaching module for the Kurikulum Merdeka Exponent material with Liveworksheets and GeoGebra media and the Realistic Mathematics Education (RME) model and publish the module on the Platform Merdeka Mengajar. Furthermore, in this study, students will first be given research instruments in the form of pretest questions to test students' initial mathematical numeracy skills and students' mathematical anxiety levels at the school. After the pretest, research was carried out using the Realistic Mathematics Education (RME) model with Liveworksheets and GeoGebra media in the experimental class and research using the conventional model in the control class. In both classes, learning was carried out for approximately two meetings. After being given intervention in each class, a post-test was given to measure students' mathematical numeracy skills and students' mathematical anxiety levels.

### Data Analysis of Students' Initial Numeracy Ability (Pretest)

Before testing the pretest result data, first calculate the data description which includes the average, standard deviation, maximum value, and minimum value. This is done

to get an overview of the data to be tested. Table 4 presents descriptive statistics of the pretest data of the two classes using JASP 0.18.3 software.

Table 4. Descriptive Statistics Table of Pretest Result Data

|         | Group | N  | Mean   | SD    | SE    | Coefficient of Variation |
|---------|-------|----|--------|-------|-------|--------------------------|
| PRETEST | X-9   | 39 | 21.436 | 7.840 | 1.255 | 0.366                    |
|         | X-10  | 37 | 22.216 | 9.693 | 1.593 | 0.436                    |

Furthermore, a normality test was conducted to determine whether the data of the two classes came from a normally distributed population or not. Table 5 Pretest normality test results using JASP 0.18.3 software with Shapiro Wilk test statistics.

Table 5. Pretest Normality Test Results with Shapiro Wilk Test Statistics

|         |      | W     | p     |
|---------|------|-------|-------|
| PRETEST | X-9  | 0.984 | 0.836 |
|         | X-10 | 0.955 | 0.145 |

*Note. Significant results suggest a deviation from normality.*

Because the class pretest score data showed a value of 0.836 (X-9) and 0.145 (X-10), the experimental and control classes showed normally distributed research results (Sig/p-value  $\geq 0.05$ ). The next statistical test carried out is the homogeneity test using Levene's test which is described in Table 6.

Table 6. Pretest Homogeneity Test Results with Levene's Test Statistics

|         | F     | df1   | df2    | p     |
|---------|-------|-------|--------|-------|
| PRETEST | 2,228 | 1.000 | 74.000 | 0.140 |

Based on Table 6, the results that have been achieved in this study obtained a significance value of 0.140, meaning that the significance value of the pretest data is greater than 0.05, so the experimental and control class pretest data are homogeneous ( $H_0$  is accepted).

Furthermore, because the pretest score data of the two research classes were normally distributed and homogeneous, followed by an equality test of two means, the test was carried out using the t-test (independent sample t-test) to determine whether the pretest data from the experimental class and control class had an average numeracy ability that was not different or significantly different as described in Table 7.

Table 7. Two Mean Equality Test with Independent Sample T-test

|         | t     | df | p     | Cohen's d | SE Cohen's d |
|---------|-------|----|-------|-----------|--------------|
| PRETEST | 0.387 | 74 | 0.700 | 0.089     | 0.230        |

*Note. Student's t-test.*

Based on Table 7, the independent sample t-test shows a p-value of  $\geq 0.05$  (0.700). It can be concluded that the initial mathematical numeracy ability of class X-9 students is the same as the initial mathematical numeracy ability of class X-10 students. This initial mathematical numeracy ability was tested to ensure that both classes had comparable abilities before the action. Therefore, it is taken from the descriptive average results where the class that becomes the experimental class is class X-9 and the control class is class X-10. In addition, there is a significant value between the numeracy ability of class X-9 as the experimental class and X-10 as the control class of 0.089 (indicating the size of the difference) where both classes have a level of mathematical anxiety whose effect size is very small.

**Data Analysis of Students' Final Numeracy Ability (Post-test)**

Table 8 presents the descriptive statistics of the post-test data of both classes using JASP 0.18.3 software.

Table 8. Descriptive Statistics Table of Post-test Result Data

|           | Group | N  | Mean   | SD    | SE    | Coefficient of Variation |
|-----------|-------|----|--------|-------|-------|--------------------------|
| POST-TEST | X-9   | 39 | 40.205 | 7.193 | 1.152 | 0.179                    |
|           | X-10  | 37 | 35.405 | 9.555 | 1.571 | 0.270                    |

Furthermore, a normality test was conducted to determine whether the data of the two classes came from a normally distributed population or not. Table 9 Post-test normality test results using JASP 0.18.3 software with Shapiro Wilk test statistics.

Table 9. Results of Post-test Normality Test with Shapiro Wilk Test Statistics

|           |      | W     | p     |
|-----------|------|-------|-------|
| POST-TEST | X-9  | 0.935 | 0.025 |
|           | X-10 | 0.963 | 0.243 |

*Note. Significant results suggest a deviation from normality.*

Because the class post-test score data shows a value of 0.025 (X-9) and 0.243 (X-10), it shows that the data is not normally distributed for class X-9 (Sig/p-value < 0.05), so the homogeneity test does not need to be done but the next non-parametric statistical test, namely Mann-Whitney U is described in Table 10.

Table 10. Results of Post-test Non-parametric Statistical Test with Mann-Whitney U

|           | W       | df | p     |
|-----------|---------|----|-------|
| POST-TEST | 475.500 |    | 0.010 |

Based on Table 10, the results that have been achieved in this study obtained a significance value of 0.010, which means that the significance value of the post-test data is smaller than 0.05, so the experimental and control class post-test data are different ( $H_0$  is rejected). So it can be concluded that the final numeracy ability of class X-9 students is different from the final mathematical critical thinking ability of class X-10 students.

**Data Analysis of Student Numeracy Improvement (Gain Index)**

After obtaining the pretest and post-test scores of the experimental and control classes, Normalized Gain (N-Gain) data analysis was carried out. The N-Gain calculation aims to determine the increase in students' numeracy skills. Table 11 presents descriptive statistics of the gain index data of the two classes using JASP 0.18.3 software.

Table 11. Descriptive Statistics Table of Gain Index Data

|              | Group | N  | Mean  | SD    | SE    | Coefficient of Variation |
|--------------|-------|----|-------|-------|-------|--------------------------|
| N-GAIN SCORE | X-9   | 39 | 0.384 | 0.133 | 0.021 | 0.346                    |
|              | X-10  | 37 | 0.280 | 0.137 | 0.023 | 0.490                    |

Furthermore, a normality test was conducted to determine whether the data of the two classes came from a normally distributed population or not. Table 12 The results of the normality test for the gain index using JASP 0.18.3 software with Shapiro Wilk test statistics.

Table 12. Gain Index Normality Test Results with Shapiro Wilk Test Statistics

|              |      | W     | p     |
|--------------|------|-------|-------|
| N-GAIN SCORE | X-9  | 0.954 | 0.115 |
|              | X-10 | 0.903 | 0.004 |

Note. Significant results suggest a deviation from normality.

Because one of the data is not normally distributed for class X-10 (Sig/p-value <0.05), the homogeneity test does not need to be carried out but the next non-parametric statistical test, namely Mann-Whitney U is described in Table 13.

Table 13. Results of Non-parametric Statistical Test of Gain Index with Mann-Whitney U

|              | W       | df | p     |
|--------------|---------|----|-------|
| N-GAIN SCORE | 372.000 |    | <.001 |

Based on Table 13 the results that have been achieved, the significance value of the gain index data is smaller than 0.05, so the experimental and control class gain index data are different ( $H_0$  is rejected). So it can be concluded that the increase in numeracy skills of experimental class students is different from the control class. This means that the improvement of numeracy skills of students using the Realistic Mathematics Education (RME) with Liveworsheets and GeoGebra media is different from the numeracy skills of students using conventional models.

The score of the increase in students' numeracy ability is calculated using N-Gain to calculate how much the increase in students' learning outcomes is after learning compared to their maximum score, by calculating the initial score (pretest) and the final score (posttest) of the calculation results shown in Table 14.

Table 14. Score of the increase in students' numeracy ability

|              |      | Pretest | Post-test | n-Gain |
|--------------|------|---------|-----------|--------|
| N-GAIN SCORE | X-9  | 0.977   | 0.578     | 0.24   |
|              | X-10 | 0.960   | 0.207     | 0.17   |

Based on Table 14, the results achieved in this study were obtained n-Gain scores of 0.24 for the experimental class and 0.17 for the control class. So it can be concluded that there is a difference in the increase in students' numeracy abilities between students who use learning with the Realistic Mathematics Approach based on Liveworksheets and GeoGebra differentially with students who use conventional, where the increase in the experimental class is more significant compared to the control class, this is in line with the research of Amaliya Mahmudah & Roosevelt (2024) and Khotimah & As'ad (2020), Realistic Mathematics Education (RME) has a significant influence on improving students' learning outcomes and mathematics skills.

### Data Analysis of Students' Mathematical Anxiety Level After Action

To get an overview of the data to be tested, Table 15 presents descriptive statistics of the instrument results of students' mathematical anxiety levels in both classes using JASP 0.18.3 software.

Table 15. Descriptive Statistical Table of Student Mathematical Anxiety Level Instrument Data

|                              | Group | N  | Mean   | SD    | SE    | Coefficient of Variation |
|------------------------------|-------|----|--------|-------|-------|--------------------------|
| Student Mathematical Anxiety | X-9   | 39 | 64.000 | 8.211 | 1.315 | 0.098                    |
|                              | X-10  | 37 | 65.189 | 6.376 | 1.048 | 0.128                    |

Furthermore, a normality test was conducted to determine whether the data of the two classes came from a normally distributed population or not. Table 16 The results of the normality test of the instrument results of students' mathematical anxiety level using the help of JASP 0.18.3 software with Shapiro Wilk test statistics.

Table 16. Results of Normality Test of Student Mathematical Anxiety Level Instrument Data with Shapiro Wilk Test Statistics

|                              |      | W     | p     |
|------------------------------|------|-------|-------|
| Student Mathematical Anxiety | X-9  | 0.977 | 0.578 |
|                              | X-10 | 0.960 | 0.207 |

*Note. Significant results suggest a deviation from normality.*

The next statistical test conducted is a non-parametric statistical test, namely Mann-Whitney U which is described in Table 17.

Table 17. Results of Non-parametric Statistical Test of Student Mathematical Anxiety Level Instrument Data with Mann-Whitney U

|                              | W       | df | p     | Effect Size | SE Effect Size |
|------------------------------|---------|----|-------|-------------|----------------|
| Student Mathematical Anxiety | 772.000 |    | 0.603 | 0.070       | 0.133          |

*Note. Mann-Whitney U Test.*

Based on the Table 17, the results achieved in this study are a significance value of 0.603, meaning that the data significance value is greater than 0.05. So it can be concluded that there is no significant difference in mathematical anxiety between the two groups after the action is taken. In addition, there is a large effect size value, namely 0.070, which indicates that the effect size of the two classes is small. The results of the study also showed that the level of students' mathematical anxiety after the action was taken obtained an average score of 64 for the experimental class and an average score of 65.189 for the control class. This score shows that Realistic Mathematics Education (RME) has a significant impact on students' mathematical anxiety. Juandi et al., (2022) showed that Realistic Mathematics Education (RME) has a broad impact on improving learning outcomes and reducing anxiety.

### Data Analysis of Mathematical Anxiety Levels of Experimental Class Students (Pretest and Post-test)

To find out the achievement of numeracy skills and the decrease in the level of mathematical anxiety of students who use learning with a Realistic Mathematics Education (RME) based on Liveworksheets and GeoGebra is described in the form of a diagram in Figure 2

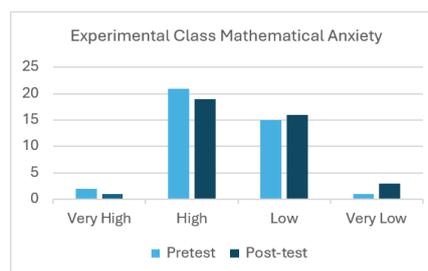


Figure 2. Diagram of Mathematical Anxiety of Experiment Class

The diagram illustrates the results of the pretest and post-test in the experimental class (X-9), this shows that there is a significant decrease in students' mathematical anxiety level after taking action using the Realistic Mathematics Education (RME) with Liveworksheets and GeoGebra media in the study. The diagram shows the number of students who initially had mathematics anxiety in the very high category of 2 students after the action was taken, it became 1 student (decrease 50%), the high category of 21 students became 19 students (decrease 9,52%), the low category of 15 students became 16 students (increase 6,67%), and the very low category of 1 student became 3 students (increase 200%). The average percentage change was about 36.79%, which can be interpreted as a positive average increase in the distribution of students towards lower anxiety. Overall, the number of students with high anxiety decreased, while those with low anxiety increased, indicating that the intervention was successful in reducing the level of mathematical anxiety.

Overall, the results of the study showed a significant difference in the improvement of numeracy skills between students who learned through the Realistic Mathematics Education (RME) based on Liveworksheets and GeoGebra in a differentiated manner and students who received conventional learning. Learning with this approach provides a more contextual and meaningful learning experience. Liveworksheets allow students to practice in a more interactive and tailored way, while GeoGebra helps them visualize mathematical concepts in a more concrete and dynamic way. The combination of the two supports the essence of Realistic Mathematics Education (RME), which is to build mathematical understanding from real-world experiences. In the context of 21st century learning, this is very relevant, considering that the demands of the industrial revolution 4.0 emphasize the importance of critical thinking skills, problem solving, and numeracy literacy in everyday life.

This study also found a more significant decrease in math anxiety in students involved in Realistic Mathematics Education (RME). This decrease can be understood from the Realistic Mathematics Education (RME) which emphasizes gradual understanding through contexts that are close to students' lives. The learning process becomes more contextual and less scary because students are encouraged to understand, not memorize. The exploration facility using GeoGebra and step-by-step exercises through Liveworksheets also provides a sense of confidence, because students can experience success in their learning process. This has a positive psychological impact, because an inclusive and supportive learning atmosphere can reduce anxiety about mathematics.

In addition, the achievement of numeracy skills and the decrease in mathematics anxiety in the experimental group show that the Realistic Mathematics Education (RME) based on digital technology applied in a differentiated manner provides good results. Differentiation in learning opens up opportunities for each student to learn according to their abilities, without feeling left behind or stressed. The guidance process that is carried out encourages students to build their own understanding, so that learning feels more personal and meaningful. By combining real contexts, interactive media, and an approach that is responsive to individual needs, learning becomes more effective, enjoyable, and relevant to today's educational challenges.

The potential that can be developed in this research is that educators can access the Platform Merdeka Mengajar to download teaching materials that have been uploaded on the

proof of work page regarding this research exponent material as teaching materials that can be used in class directly or inspiration to develop teaching materials with a Realistic Mathematics Education (RME) based on Liveworksheets and GeoGebra.

## CONCLUSION

The conclusion obtained from this study is that there is a difference in the increase in numeracy skills and levels of mathematical anxiety of students between those who learn using the Realistic Mathematics Education (RME) based on Liveworksheets and GeoGebra with the conventional approach, and there is an increase in numeracy skills and a decrease in anxiety due to the approach applied after the treatment is carried out. The results of the analysis showed an increase in students' mathematical numeracy results and a significant decrease in students' mathematical anxiety levels in the experimental class that was given mathematics learning treatment using the Realistic Mathematics Education (RME) learning method with Kurikulum Merdeka based on Liveworksheets and GeoGebra. The results shown showed a significant difference with the control class that used the conventional learning model. The suggestion that can be given is to further increase the use of the Realistic Mathematics Education (RME) learning method and also the use of Liveworksheets and GeoGebra media so that learning becomes more interesting for students, can improve students' mathematical numeracy results, reduce students' mathematical anxiety levels, and can increase teacher creativity.

## REFERENCES

- Amaliya Mahmudah, ah, & Roosevelt, J. W. (2024). Pengaruh Pembelajaran Matematika Realistik (PMR) terhadap Kemampuan Berpikir Kreatif Siswa Kelas VII SMP Negeri 16 Samarinda, *Jurnal Inovasi Pendidikan Dan Pembelajaran Matematika*, 10(2). <https://doi.org/10.52166/inspiramatika.v10i2.7910>
- Aprima, D. & Sari, S., 2022, Analisis Penerapan Pembelajaran Berdiferensiasi Dalam Implementasi Kurikulum Merdeka Pada Pelajaran Matematika SD, *Cendikia : Media Jurnal Ilmiah Pendidikan*, 13(1) (2022) pp. 95-101. <https://doi.org/10.35335/cendikia.v13i1.2960>
- Barlian, U.C., Yuni, A.S., Ramadhanty, R.R. & Suhaeni, Y., 2023, Implementasi Pembelajaran Berdiferensiasi dalam Kurikulum Merdeka pada Mata Pelajaran Bahasa Inggris, *ARMADA: Jurnal Penelitian Multidisiplin*, 1(8), 815–822. <https://doi.org/10.55681/armada.v1i8.742>
- Fahrudin, N., 2023, Analisis Strategi Manajemen Kepala Sekolah dalam Meningkatkan Program Literasi dan Numerasi, vol. 4. <https://doi.org/10.33650/adab.v4i2.5426>
- Fitriani, N., Hidayah, I.S. & Nurfauziah, P., 2021, Live Worksheet Realistic Mathematics Education Berbantuan Geogebra: Meningkatkan Abstraksi Matematis Siswa SMP pada Materi Segiempat, *JNPM (Jurnal Nasional Pendidikan Matematika)*, 5(1), 37. <https://doi.org/10.33603/jnpm.v5i1.4526>
- Green, E. C., School, B. H., & Mudaly, V. (2023). An Investigation of the Use of Mobile Technologies in the Teaching and Learning of Congruence in Mathematics. <https://www.researchgate.net/publication/367254525>
- Haryati, L., Anar, A. & Ghufroon, A., 2022, Menjawab Tantangan Era Society 5.0 Melalui Inovasi Kurikulum Merdeka di Sekolah Dasar, vol. 4. <https://doi.org/10.31004/jpdk.v4i5.7441>

- Hermawan, S. E., Zawawi, I., & Khikmiyah, F. (2024). Analisis Kemampuan Pemahaman Konsep Siswa SMK Ditinjau dari Kecemasan Matematis. *Postulat : Jurnal Inovasi Pendidikan Matematika*, 5(2), 144. <https://doi.org/10.30587/postulat.v5i2.9000>
- Holst, J., Brock, A., Singer-Brodowski, M. & Haan, G. de, 2020, Monitoring Progress of Change: Implementation of Education for Sustainable Development (ESD) within Documents of the German Education System, *Sustainability (Switzerland)*, 12(10). <https://doi.org/10.3390/su12104306>
- Juandi, D., Kusumah, Y. S., & Tamur, M. (2022). A Meta-Analysis of the last two decades of realistic mathematics education approaches. *International Journal of Instruction*, 15(1), 381–400. <https://doi.org/10.29333/iji.2022.15122a>
- Kharis, S.A.A., Mahin, N., Lubis, H., Zili, A.H.A. & Robiansyah, A., 2023, Kecemasan Matematika dan Permasalahannya dalam Pembelajaran Jarak Jauh, *EDUKATIF : JURNAL ILMU PENDIDIKAN*, 5(1), 508–518. <https://doi.org/10.31004/edukatif.v5i1.4735>
- Khosiyono, dan, Putri Ery Suwandi, F., Kaulina Rahmaningrum, K., Trie Mulyosari, E., Mulyantoro, P., Ika Sari, Y. & Banun Havifah Cahyo Khosiyono, dan, 2023, Prosiding Seminar Nasional Pendidikan Dasar Yogyakarta, 26 Agustus 2023 Strategi Pembelajaran Diferensiasi Konten terhadap Minat Belajar Siswa dalam Penerapan Kurikulum Merdeka, Yogyakarta. [https://seminar.ustjogja.ac.id/index.php/semnas\\_dikdasUST/issue/view/16](https://seminar.ustjogja.ac.id/index.php/semnas_dikdasUST/issue/view/16)
- Khotimah, S.H. & As'ad, M. 2020. Pendekatan Pendidikan Matematika Realistik terhadap Hasil Belajar Matematika Siswa Sekolah Dasar. *JIPP*, 4. <https://doi.org/10.23887/jipp.v4i3.28568>
- Lestari, N.A.P., Wahyuni, L.T.S., Lasmawan, I.W., Suastra, I.W., Dewi, M.S.A. & Astuti, N.M.I.P., 2023, Kurikulum Merdeka Sebagai Inovasi Menjawab Tantangan Era Society 5.0 Di Sekolah Dasar, *Jurnal Ilmiah Pendidikan Citra Bakti*, 10(4), 736–746. <https://doi.org/10.38048/jipcb.v10i4.1996>
- Marweli, & Meiliasari. (2024). Faktor Penyebab Kecemasan Matematika (Mathematics Anxiety) dalam Belajar Matematika: Systematic Literatur Review. *SUPERMAT Jurnal Pendidikan Matematika*, 8(2). <https://doi.org/10.33627/sm.v8i2.2824>
- Monalisa, L. A., Kristiana, A. I., Fatahillah, A., Hussen, S., & Fatimah, L. N. (2024). The Development of Electronic Worksheets for Students Using Live Worksheets and Geogebra to Enhance Students' Digital Literacy. *JINoP (Jurnal Inovasi Pembelajaran)*, 10(2), 280–293. <https://doi.org/10.22219/jinop.v10i2.33688>
- Nurhaliza Ali, N., & Nimah, K. (2023). Analisis Kemampuan Peserta Didik dalam Menyelesaikan Soal Geometri pada Asesmen Kompetensi Minimum-Numerasi. *Jurnal Ilmiah Matematika Realistik (JI-MR)*, 4(2), 267–274. <https://doi.org/10.33365/ji-mr.v4i2.4006>
- Patmala, K., Ndani, Y. E., Syaputri, I. J., Handican, R., Karim, M., & Nawawi, J. (2024). Developing Liveworksheet Using Cooperative NHT Model: Improving Students' Mathematical Problem-Solving Skills. *JDIME: Journal of Development and Innovation in Mathematics Education*, 2(1), 12–25. <https://doi.org/10.32939/jdime.v2i1.3780>
- Sadin, H. (2024). Pengaruh Efikasi Diri dan Kecemasan Matematika terhadap Kemampuan Komunikasi Matematika Siswa MTS Al- Islamiyah SMIP 1946 Banjarmasin Tahun Ajaran 2023/2024. <http://idr.uin-antasari.ac.id/id/eprint/27322>
- Sasikirana, V. & Herlambang, Y.T., 2020, E-Tech Urgensi Merdeka Belajar di Era Revolusi Industri 4.0 dan Tantangan Society 5.0. <https://doi.org/10.24036/et.v8i2.110765>

- Septian, A., Sukma Yanti, R.N. & Inayah, S., 2023, Pengembangan Modul Siswa pada Materi Program Linear di MA AL-Hidayah, *PRISMA*, 12(1), 285. <https://doi.org/10.35194/jp.v12i1.3187>
- Susanti, S. A., Budiarto, M. T., & Setianingsih, R. (2023). Analisis Kemampuan Pemecahan Masalah Numerasi Siswa Berdasarkan Tingkat Kecemasan Matematis. *JRPM (Jurnal Review Pembelajaran Matematika)*, 8(1), 18–32. <https://doi.org/10.15642/jrpm.2023.8.1.18-32>
- Syafuruddin, I.S., Khaerunnisa, E. & Rafianti, I. 2022. Pengembangan E-LKPD untuk Mendukung Kemampuan Literasi Matematis pada Materi Aritmatika Sosial. *Jurnal Cendekia : Jurnal Pendidikan Matematika*, 6(3), 3214–3227. <https://doi.org/10.31004/cendekia.v6i3.1727>
- Oktavia, F. T. A., & Qudsiyah, K. 2023. Problematika penerapan kurikulum merdeka belajar pada pembelajaran matematika di SMK Negeri 2 Pacitan. *Jurnal Edumatic*, 4(1), 14-23. <https://doi.org/10.21137/edumatic.v4i1.685>