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International Journal of Educational Dynamics
Vol. 3 No. 2 (pp. 80-88) June 2021
p_ISSN 2655-4852
e_ISSN 2655-5093

Applying Effect the Reciprocal Teaching Model to Mathematics Anxiety

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Received: 01 Feb. 2021, Revised: 10 Jun. 2021, Accepted: 30 Jun. 2022

ABSTRACT

The background of this research is the lack of self-confidence of students when learning mathematics which is characterized by feelings of fear or worry that are owned by class VIII students of MTs Negeri 3 Kampar. One solution to overcome this problem is to use the reciprocal teaching learning model. The purpose of this study was to find out that the reciprocal teaching learning model could reduce the mathematical anxiety of Grade VIII students at MTsN 3 Kampar. This research is a quasi-experimental study using nonequivalent control group design. The research subjects consisted of 18 students from class IIC and 18 students from VIIID. The sample technique used is purposive sampling. The data collection technique used is the math anxiety questionnaire. The results of this study can be concluded that the reciprocal teaching learning model can reduce the math anxiety of class VIII students of MTs Negeri 3 Kampar. This can be proven through the left side test with a sig (2-tailed) value of 0.0185 <0.025.

Keywords: Mathematical Anxiety, Reciprocal Teaching.

INTRODUCTION

Mathematics is an exact science that is studied at all levels of education. This statement is in line with Law No. 20/2003 Article 37 concerning the National Education System which explains that mathematics is one of the compulsory subjects in the primary and secondary education curriculum (McTiernan *et al*., 2016). This is because the material studied in mathematics is often used in everyday life (Juniati & Budayasa, 2020).

The importance of math skills is not in line with the reality of math skills in Indonesia. This was proven based on the results of the 2018 Program for International Student Assessment (PISA) study, where Indonesia was ranked 67th out of 73 countries listed. Based on the report, it appears that Indonesia has experienced a decline. In 2015 the average score obtained was 386 (Hardianti & Zulkardi, 2019). However, in 2018 the average score obtained was 379 (Hartik *et al*., 2021). Low mathematical ability will have an impact on low learning achievement. According to research conducted by Lestari *et al* (2018)the results of the learning achievement*-test* for class VIIC students of Junior High School (JHS) 2 Gamping were unsatisfactory. This statement can be seen from the absence of students who successfully complete or have a value of more than 75.

One of the factors that causes the low achievement of students in learning mathematics is mathematical anxiety. According to Skagerlund *et al* (2019) the definition of anxiety is a condition that occurs in a person with an unpleasant effective feeling followed by a bodily reflex as a warning that a danger is coming. Math anxiety is defined as a feeling of fear when someone is faced with mathematics (Luttenberger *et al*., 2018). Mathematical

anxiety is a factor causing a negative relationship in student achievement (Gunderson *et al*., 2018). This can be seen based on research conducted by Zakaria *et al* (2012). The results of this study showed a significant difference where students with low levels of anxiety had good achievements and vice versa. This is because students who have good achievements have better self-confidence, so that their mathematical abilities will be better than students who are less accomplished. If mathematical anxiety is not stopped, it will certainly have an impact on mathematics learning performance in the future. If students do not master math skills well, it will interfere with future students' math skills (Ramirez *et al*., 2018), where math skills are needed in various aspects of life including in everyday life (Fouryza *et al*., 2018). Therefore, it is important for students to reduce their level of math anxiety so as not to interfere with learning achievement (Schillinger *et al*., 2018). Efforts that can be made by educators to reduce the level of mathematical anxiety is to use appropriate learning models. The reciprocal teaching learning model can be used as an alternative to reduce the level of mathematical anxiety. According to Agoro & Akinsola (2013)reciprocal teaching is a learner-centered learning model, in which educators and students exchange roles or positions in the learning process. According to Awaliah & Idris (2015) reciprocal teaching can provide opportunities for students to improve various cognitive skills by building interesting and fun learning experiences.

Reciprocal teaching (reversed ability) is a teaching procedure developed by Brown and Palinscar ((McTiernan *et al*., 2016). According to him, the learning model using reciprocal teaching can train metacognition skills with four strategies, namely; 1) formulate questions and answers, 2) re-explain the knowledge that has been obtained, 3) make predictions for the next question, and 4) summarize the information obtained (Hovland, 2020). The solution that can be given to reduce the level of anxiety that students have is to apply the reciprocal teaching learning model. This is reinforced by research conducted by Guita & Tan (2018)which states that the learning process in the Philippines in mathematics subjects using the reciprocal teaching model can have a positive impact on learning mathematics. The learning process carried out using the reciprocal teaching model is able to provide changes regarding the way of learning where students are required to play an active role in class (Mafarja *et al*., 2022). Therefore, students do not need to be afraid or worried about learning mathematics, be afraid of solving problems in the field of mathematics, not be confident in speaking or expressing opinions (Aslam *et al*., 2021). If students are used to learning, this can reduce the level of math anxiety. Recognizing the importance of innovative learning models to reduce math anxiety, it is necessary to conduct research on the effect of the Reciprocal Teaching Model on the Mathematics Anxiety of Class VIII Students of MTsN 3 Kampar. The problem formulation of this research is whether the reciprocal teaching learning model can reduce the mathematical anxiety of class VIII students of MTsN 3 Kampar. The purpose of this study was to find out that the reciprocal teaching learning model can reduce the mathematical anxiety of class VIII students of MTsN 3 Kampar.

METHOD

This type of research is a quasi-experimental research. The research design used was nonequivalent control group design. Before being given a treatment the experimental class and the control class were first given a test, namely the *Pre-test* with the aim of knowing the state of the class before being given treatment. After being given treatment, the experimental class and control class were given a test, namely the *Post-test* with the aim of

knowing the state of the class after being given treatment.

This research was conducted at MTs Negeri 3 Kampar which is located in Naumbai Village, Kampar Regency, Riau Province. This research was conducted in the odd semester of the 2022/2023 school year in July-August 2022. The population in this study were all students of class VIII MTsN 3 Kampar. The sample in this study consisted of two VIII classes, namely VIIIC with a total of 18 people and VIIID with a total of 18 people. The sampling technique used in this study is a purposive sampling technique, which is a sampling technique from members of the population based on certain criteria (Campbell *et al*., 2020). In this study, the criteria were class VIII students who had almost the same average class achievement results. Collecting data in this study used a questionnaire consisting of 10 positive questions. The questionnaire was adopted from research conducted by Freedman (2012), the data obtained were analyzed using prerequisite tests and hypothesis testing. The prerequisite test consists of a normality test using the *Shapiro Wilk test* and a homogeneity test using the *Levene's test*. The hypothesis test used consisted of paired *t-test*, independent *t-test*, and left side test. The test was carried out with the help of SPSS 24 software.

RESULT AND DISCUSSION

The control class applies the conventional learning model while the experimental class applies the reciprocal teaching learning model. The material taught in both classes is number patterns. The subjects used consisted of 36 students. The control class consisted of 18 students and the experimental class consisted of 18 students. The data obtained was in the form of a math anxiety test before being given a treatment (*Pre-test*) and after being given a treatment (*Post-test*) in the control class and the experimental class. Data collection was obtained using a questionnaire consisting of 10 questions. Based on the results of the research that has been done, the acquisition of *Pre-test* scores shows that there is no significant difference between the control class and the experimental class. The results of *Pre-test* data calculations in the control class and experimental class were calculated using the SPSS 24 program. These results can be seen in Table 1 below.

Table 1. *Pre-test* and *Post-test* value data for control class and experimental class

Data	Control Class	Experimental Class
Pre-test		
Mean	26,2222	28,4444
Median	26,0000	30,0000
Minimum	14,00	13,00
Maximum	36,00	40,00
Standard Deviation	4,67227	6,96396
Varians	21,830	48,497
Post-test		
Mean	24,5000	20,4444
Median	25,5000	21,0000
Minimum	14,00	10,00
Maximum	36,00	28,00
Standard Deviation	5,60724	5,57539
Varians	31,441	31,085

Students in the control class have a lower anxiety level than the experimental class. This statement is evidenced by the average score of math anxiety in the control class of 26.2222 while in the experimental class of 28.4444. The results obtained indicated that mathematics anxiety in the experimental class was higher than the control class. Therefore, to reduce math anxiety, a treatment is given in the form of a reciprocal teaching learning model. The *Post-test* scores show that there is a significant difference between the control class and the experimental class. After being given a treatment in the form of a conventional learning model in the control class and reciprocal teaching in the experimental class, students' math anxiety decreased. This is evidenced by the results of the average score of math anxiety in the control class 24.5000 while the experimental class is 20.4444.

From the acquisition of *Pre-test* and *Post-test* scores, both the control class and the experimental class experienced a decrease in math anxiety. However, the decrease in students' math anxiety in the experimental class was better when compared to students' math anxiety in the control class. After the *Pre-test* and *Post-test* values are obtained, the values are processed by conducting analytical tests using the SPSS 24 program. The analytical tests carried out are normality test, homogeneity test, hypothesis testing (independent *t-test*, paired *t-test*, and one tail). The data analyzed in this normality test are the *Pre-test* and *Post-test* value data of the control class and the experimental class. The normality test uses the Shapiro-Wilk test. The following is the data from the *Pre-test* and *Post-test* normality test results in the control class and the experimental class in Table 1 below.

Table 2. Control class and experiment class normality test results

Class	Sig. Value.	Information
Pre-test		
Control Class	0.285	Data is normally distributed
Experiment Class	0.067	Data is normally distributed
Post-test		
Control Class	0,972	Data is normally distributed
Experiment Class	0,192	Data is normally distributed

Based on Table 3 above, it can be seen that the results of the *Pre-test* data normality test in the control class obtained sig = 0.285 > 0.05, while in the experimental class it was obtained sig = 0.067 > 0.05 so that the data is normally distributed. In the *Post-test* data the normality test results in the control class obtained sig = 0.972 > 0.05, while in the experimental class it was obtained sig = 0.192 > 0.05 so that the data was normally distributed. The homogeneity test used is *Levene's test*. The following is the data from the *Pre-test* and *Post-test* homogeneity test results in the control class and the experimental class in Table 3 below.

Table 3. Homogeneity test results for control class and experiment class

Class	Sig. Value.	Information
Pre-test		
Control Class and Experiment Class	0.227	Homogeneous data
Post-test		
Control Class and Experiment Class	0,790	Homogeneous data

Based on Table 3 above, it can be seen that the results of the *Pre-test* homogeneity test

in the control class and experimental class with a significance of 0.227 > 0.05 so that the data is homogeneous. In the *Post-test* data homogeneity test in the control class and experimental class with a significance of 0.790 > 0.05, so the data is homogeneous. After the data obtained is normally distributed and homogeneous, then a hypothesis test is carried out (paired *t-test*, independent *t-test* and left-hand test). The paired *t-test* is used to compare a class before and after being given a treatment (*Pre-test* and *Post-test*) (Rinaldi *et al*., 2020). The hypothesis used with a significance level of 0.05 is as follows:

- $H_0 : \mu_1 \geq \mu_2 =$ The average mathematical anxiety obtained by students before the treatment is not lower than the average mathematical anxiety obtained by students after the treatment
- $H_a : \mu_1 < \mu_2 =$ The average mathematical anxiety obtained by students before the treatment was lower than the average mathematical anxiety obtained by students after the treatment

The following is the data from the paired *t-test* results in the control class in Table 4 below.

Table 4. Paired *t-test* results in the control class and experiment class

Class	Sig. Value.	Information
Control Class	0.147	There is no significant difference
Experiment Class	0.000	There are significant differences

Based on Table 4 above, it can be seen that the test results in the control class were obtained with a sig (2-tailed) value > 0.05, namely 0.147, where $\boldsymbol{H_a}$ was rejected and $\boldsymbol{H_0}$ was accepted. So the average mathematical anxiety obtained by students before the treatment was not lower than the average mathematical anxiety obtained by students after the treatment. This shows that there is no significant difference in the control class before and after using the conventional learning model. While the data from the paired *t-test* results can be seen that the test results in the experimental class were obtained with a sig (2-tailed) value <0.05, namely 0.000, where $\boldsymbol{H_0}$ was rejected and $\boldsymbol{H_a}$ was accepted. So the average mathematical anxiety obtained by students before the treatment was lower than the average mathematical anxiety obtained by students after the treatment. This shows that there are significant differences in the experimental class before and after using the reciprocal teaching learning model. The independent *t-test* is used to compare *Pre-test* and *Post-test* in certain classes (Rinaldi *et al*., 2020). The hypothesis used with a significance level of 0.05 is as follows:

- $H_0 : \mu_1 = \mu_2$ there is no difference in the average math anxiety between students who get conventional learning models compared to students who get reciprocal teaching learning models
- $H_a : \mu_1 \neq \mu_2$ there is a difference in the average math anxiety between students who get the conventional learning model compared to students who get the reciprocal teaching learning model

Information:

- μ_1 =the average mathematical anxiety of students who receive conventional learning models
- μ_2 =average math anxiety of students who get the reciprocal teaching learning model

The following is data from the independent *t-test Pre-test* and *Post-test* results in the control class and experimental class in Table 5 below.

Table 5. Independent *t-test* results *Pre-test* and *Post-test*

Treatment	**Sig. Value.**	**Information**
Pre-test	0.269	There is no significant difference
Post-test	0.037	There are significant differences

Based on Table 5 above, it can be seen that the results of the *Pre-test* data test from the control class and the experimental class with a sig (2-tailed) value > 0.05, namely 0.269, where $\boldsymbol{H_a}$ is rejected and $\boldsymbol{H_0}$is accepted. So there is no difference in the average math anxiety between students who get the conventional learning model compared to students who get the reciprocal teaching learning model. This shows that there is no difference in the average math anxiety between students who receive the conventional learning model compared to students who receive the reciprocal teaching learning model.

While the data from the independent *t-test Post-test* results can be seen that the *Post-test* data test results from the control class and the experimental class with a sig (2-tailed) value <0.05, namely 0.037, where $\boldsymbol{H_0}$ is rejected and $\boldsymbol{H_a}$ is accepted. So there is a difference in the average math anxiety between students who get the conventional learning model compared to students who get the reciprocal teaching learning model. This shows that there is a difference in the average math anxiety between students who receive the conventional learning model compared to students who receive the reciprocal teaching learning model.

The left-hand test is used to test research hypotheses that involve a treatment (Sugiyono, 2021). The treatment in question is after being given a treatment (*Post-test*). The hypothesis used is as follows:

- $H_0: \mu_1 \geq \mu_2$The mathematics anxiety of students who use conventional learning models is higher than students who use reciprocal teaching learning models
- $H_a: \mu_1 < \mu_2$The math anxiety of students who use conventional learning models is not higher than students who use reciprocal teaching learning models

The test results for the data in the control class and the experimental class after being given a treatment were 0.0185. Based on the research hypothesis where if the sig value (2-tailed) <0.025 then $\boldsymbol{H_0}$is rejected. Based on these results, it can be concluded that the math anxiety of students who use the reciprocal teaching learning model is lower than that of students who use conventional learning models.

The results of this study are in line with research conducted by Purwanti (2016) with the title "Improving Understanding and Problem Solving Capabilities and Reducing Students' Mathematical Anxiety Through the Reciprocal Teaching Learning Model". The results of this study indicate that there is a significant difference. The results of data analysis showed a significance value of 0.0035 <0.05. So it can be concluded that the mathematics anxiety of students who study using the reciprocal teaching learning model is lower than that of students using conventional learning models in class VIII students on

circle material. According to Guita & Tan (2018) the reciprocal teaching model has a positive effect on anxiety in learning mathematics. This research was conducted in the Philippines, where students' achievements increased after being given treatment in the form of a reciprocal teaching model. This was proven during the discussion process, students became more active than before and the tests given increased compared to the previous one.

In contrast to research conducted by Santoso (2017) that math anxiety has been reduced by playing logic games. This is because when learning mathematics, it provides distractions about mathematical logic games. The atmosphere in the learning process is not tense so that students feel comforTable in learning mathematics.

The reciprocal teaching model is a learning model that is applied in groups (Oo *et al*., 2021). The learning process by means of groups is an interesting and fun learning process for students so that it can reduce math anxiety (McTiernan *et al*., 2016). This statement is proven through research conducted by Rendri Muligar (2016)that students think to be more critical which is marked by frequent communication between students which causes them to feel comforTable and happy so that learning material is more easily accepted. In line with research conducted by Farid (2020)that math anxiety with group study has decreased by 30.61%. Based on the research that the researchers have done and the various studies that have been done before, it can be concluded that the reciprocal teaching learning model has an influence on students' math anxiety. In this study, the reciprocal teaching model had an effect on reducing the mathematics anxiety of Grade VIII students at MTs Negeri 3 Kampar in the matter of number patterns.

CONCLUSIONS

Based on the results of the research and discussion that have been described, it can be concluded that the reciprocal teaching learning model can reduce the math anxiety of class VIII students of MTs Negeri 3 Kampar. This statement can be proven through the results of the left side test with a significance level of 2.5%. Then a sig (2-tailed) value is obtained, namely 0.0185 <0.05, which means $\boldsymbol{H_0}$ is rejected. So it can be concluded that using the reciprocal teaching learning model can reduce the math anxiety of class VIII students of MTs Negeri 3 Kampar in the matter of number patterns.

REFERENCES

Agoro, A. A., & Akinsola, M. K. (2013). Effectveness of Reflective-Reciprocal Teaching Technique on Pre-Service Teachers' Achievement and Science Process Skill in Integrated Science. *International Journal of Education and Research*, *1*(8), 1–20.

Aslam, S., Saleem, A., Hali, A. U., & Zhang, B. H. (2021). Promoting Sustainable Development in School Classrooms: Using Reciprocal Teaching in Mathematics Education. *TEM Journal*, *10*(1), 392–400. https://doi.org/10.18421/TEM101-49

Awaliah, R., & Idris, R. (2015). Pengaruh Penggunaan Model Reciprocal Teaching Terhadap Hasil Belajar Matematika Siswa Kelas VIII MTsN Balang-Balang Kecamatan Bontomarannu Kabupaten Gowa. *Matematika Dan Pembelajaran*, *3*(1), 59–72.

Campbell, S., Greenwood, M., Prior, S., Shearer, T., Walkem, K., Young, S., Bywaters, D.,

& Walker, K. (2020). Purposive sampling: complex or simple? Research case examples. *Journal of Research in Nursing*, *25*(8), 652–661. https://doi.org/10.1177/1744987120927206

Farid, D. A. M. (2020). Efektivitas Konseling Kelompok dengan Teknik Desentisasi Sistematik Untuk Mereduksi Kecemasan Belajar Matematika Siswa Madrasah Aliyah. *Quanta*, *4*(2), 69–72.

Fouryza, D., Amin, S. M., & Ekawati, R. (2018). Review of learning materials development procedure based on fun and easy math (FEM). *AIP Conference Proceedings*, *2014*(September). https://doi.org/10.1063/1.5054452

Freedman, E. (2012). Do You Have Math Anxiety? A Self Test. *Retrieved August*, *10*(1), 1–11. https://www.ucmo.edu/offices/learning-commons/digital-learning-commons/math-anxiety-test.pdf

Guita, G. B., & Tan, D. A. (2018). Mathematics Anxiety and Students' Academic Achievement in a Reciprocal Learning Environment. *International Journal of English and Education*, *3*(7), 112–124.

Gunderson, E. A., Park, D., Maloney, E. A., Beilock, S. L., & Levine, S. C. (2018). Reciprocal relations among motivational frameworks, math anxiety, and math achievement in early elementary school. *Journal of Cognition and Development*, *19*(1), 21–46. https://doi.org/10.1080/15248372.2017.1421538

Hardianti, S., & Zulkardi, Z. (2019). Students mathematical literacy abilities in solving PISA type math problem with LRT context. *Journal of Physics: Conference Series*, *1315*(1). https://doi.org/10.1088/1742-6596/1315/1/012016

Hartik, S., Utaminingsih, S., & Madjdi, A. H. (2021). A Need Assessment of Integrated Science Teaching Material Based Higher Order Thinking Skills (HOTS). *Journal of Physics: Conference Series*, *1823*(1), 1–7. https://doi.org/10.1088/1742-6596/1823/1/012078

Juniati, D., & Budayasa, I. K. (2020). The mathematics anxiety: Do prospective math teachers also experience it? *Journal of Physics: Conference Series*, *1663*(1), 1–8. https://doi.org/10.1088/1742-6596/1663/1/012032

Lestari, W., Pratama, L. D., & Jailani, J. (2018). Implementasi Pendekatan Saintifik Setting Kooperatif Tipe STAD Terhadap Motivasi Belajar dan Prestasi Belajar Matematika. *AKSIOMA : Jurnal Matematika Dan Pendidikan Matematika*, *9*(1), 29–39. https://doi.org/10.26877/aks.v9i1.2332

Luttenberger, S., Wimmer, S., & Paechter, M. (2018). Spotlight on math anxiety. *Psychology Research and Behavior Management*, *11*, 311–322.

Mafarja, N., Zulnaidi, H., & Mohd. Fadzil, H. (2022). Using Reciprocal Teaching Strategy to Improve Physics Students' Critical Thinking Ability. *Eurasia Journal of Mathematics, Science and Technology Education*, *18*(1), 1–14. https://doi.org/10.29333/EJMSTE/11506

McTiernan, A., Holloway, J., Healy, O., & Hogan, M. (2016). A Randomized Controlled Trial of the Morningside Math Facts Curriculum on Fluency, Stability, Endurance and Application Outcomes. *Journal of Behavioral Education*, *25*(1), 49–68. https://doi.org/10.1007/s10864-015-9227-y

Oo, T. Z., Magyar, A., & Habók, A. (2021). Effectiveness of the reflection-based reciprocal teaching approach for reading comprehension achievement in upper

secondary school in Myanmar. *Asia Pacific Education Review*, *22*(4), 675–698. https://doi.org/10.1007/s12564-021-09707-8

Purwanti, I. (2016). Meningkatkan Kemampuan Pemahaman dan Pemecahan Masalah serta Mengurangi Kecemasan Matematis Siswa melalui Model Pembelajaran Reciprocal Teaching. *Repository*.

Ramirez, G., Shaw, S. T., & Maloney, E. A. (2018). Math Anxiety: Past Research, Promising Interventions, and a New Interpretation Framework. *Educational Psychologist*, *53*(3), 145–164. https://doi.org/10.1080/00461520.2018.1447384

Rendri Muligar. (2016). Penerapan Model Pembelajaran Accelerated Learning Cycle untuk Meningkatkan Kemampuan Berpikir Kritis dan Representasi Matematis serta Mengurangi Kecemasan Matematis Ditinjau dari Perbedaan Gender Siswa SMP. *Repository*.

Rinaldi, A., Novalia, & Syazali, M. (2020). *Statistika Inferensial untuk Ilmu Sosial dan Pendidikan*. IPB Press.

Santoso, E. (2017). 2015/2016), Mengurangi Kecemasan Matematika dengan Bermain Game Logika (Studi Kasus pada Siswa Sekolah Menengah Kejuruan Galuh Rahyau Kabupaten Ciamis Tahun Pelajaran. *Jurnal Theorems (The Original Research of Mathematics)*, *1*(2), 31–41.

Schillinger, F. L., Vogel, S. E., Diedrich, J., & Grabner, R. H. (2018). Math anxiety, intelligence, and performance in mathematics: Insights from the German adaptation of the Abbreviated Math Anxiety Scale (AMAS-G). *Learning and Individual Differences*, *61*(November 2017), 109–119. https://doi.org/10.1016/j.lindif.2017.11.014

Skagerlund, K., Östergren, R., Västfjäll, D., & Träff, U. (2019). How does mathematics anxiety impair mathematical abilities? Investigating the link between math anxiety, working memory, and number processing. *PLoS ONE*, *14*(1), 1–17. https://doi.org/10.1371/journal.pone.0211283

Sugiyono. (2021). *Statistika Untuk Penelitian*. Bandung: Alfabeta.

Zakaria, E. Z., Ahmad, N. ., & Erliana, A. (2012). Mathematics Anxiety and Achievement Among Secondary School Students. *Journal of Applied Sciences*, *9*(11), 1828–1832.