

The Effect of Reciprocal Teaching, Student Facilitator and Explaining and Learning Independence on Mathematical Learning Results by Controlling the Initial Ability of Students

Dodik Mulyono ^{1*}, Moch Asmawi ¹, Tuti Nuriah ¹

¹ State University of Jakarta, INDONESIA

* CORRESPONDENCE: ✉ dodikmulyono@stkippgri-lubuklinggau.ac.id

ABSTRACT

This study aims to determine; (1) Differences in mathematics learning outcomes between learning with reciprocal teaching learning models and facilitator student models and explaining after controlling students' initial abilities; (2) Effect of interaction between learning models and learning independence on mathematics learning outcomes after controlling students' initial abilities; (3) Differences in mathematics learning outcomes between those who used the reciprocal teaching learning model with high learning independence and who studied using student facilitator and explaining model with high learning independence after controlling students' early ability; (4) Differences in mathematics learning outcomes between those who used the reciprocal teaching learning model with low learning independence and who studied using student facilitator and explaining model with low learning independence after controlling students' early ability. The research method used is an experimental method. Data analysis used descriptive analysis and statistical analysis using two-way covariate analysis. The result of hypothesis 1 testing shows that H₀ is rejected based on F-Test, line A with value $F_c = 4.47$ is greater than $F_{table} (0.05; 1; 59) = 4.00$. The result of hypothesis 2 testing shows that H₀ is rejected based on F Test statistic, interaction row value $F_{count} = 14.94$ bigger than $F_{table} (0.01; 1; 59) = 7.08$. The results of the hypothesis 3 testing analysis show that H₀ is rejected based on the t-test statistic, the value of t count = 4.90. This value is greater than t table $(0.01; 59) = 2.39$. The results of the analysis of testing hypothesis 4 shows that H₀ is rejected based on the t-test statistic, the value of t count = 1.83. This value is greater than t table $(0.05; 59) = 1.67$.

Keywords: reciprocal teaching, student facilitator and explaining

INTRODUCTION

Based on the results of a preliminary study at the New Public High School, information was obtained that students' mathematics learning outcomes were low. One of the factors of low student learning outcomes is that the learning model has not varied. As a teacher, it is expected to choose a learning model according to the characteristics of students. According Mulyono, Purwasih, and Riyadi (2018) some problems that often arise in the use of conventional that is: 1) in the teaching and learning process students are less active in expressing his opinion; 2) reduced student interest in learning mathematics; 3) students tend to be passive so that students' understanding of the material becomes slow because they only wait for information from the teacher without any effort to find information needed to solve the problems faced; 4) students' learning independence is low. To overcome these problems, it is necessary to do research with the title of the influence of learning

Article History: Received 3 April 2018 ♦ Revised 25 July 2018 ♦ Accepted 12 August 2018

© 2018 The Author(s). Open Access terms of the Creative Commons Attribution 4.0 International License (<http://creativecommons.org/licenses/by/4.0/>) apply. The license permits unrestricted use, distribution, and reproduction in any medium, on the condition that users give exact credit to the original author(s) and the source, provide a link to the Creative Commons license, and indicate if they made any changes.

models and learning independence on mathematics learning outcomes by controlling the students' initial abilities.

Learning Reciprocal Teaching Model

Ostovar-Namaghi and Shahhosseini (2011) state the theoretical basis of reciprocal teaching that is the proximal development zone, proactive teaching and scaffolding, focusing on constructing meaning in the dialogical process of interaction between teachers and learners. According to Freihart and Al-Makhzoomi (2012) Reciprocal Teaching is a model by guiding students to interact with text in a more sophisticated way, resulting in significant improvements in summary quality and inquiries. According to Salehi and Vafakhah (2013) reciprocal teaching is an instructional style that was originally developed for readers who struggle. It is in a category called interactive learning. Interactive learning is a style in which teachers and students share information and lead discussions. According to Aderonke and Akinsola (2013) reciprocal teaching is student-centered learning in which students and teachers switch roles in a lesson. Lori (2010) stated that reciprocal teaching as reinforcement by reading guarantees the success of reading and strengthening comprehension instruction as a whole, reading programs provide reinforcement of understanding, and they become more understanding. Whereas according to Gillies (2003) reciprocal teaching is a form of learning group and is based on the premise that social interaction of led experts has an important role to play in learning and can provide a major boost for cognitive growth. According to Raslie, Mikeng, and Ting (2015) Reciprocal Teaching can improve understanding skills of struggling readers whose skills are compromised due to social and intellectual circumstances. According to Arend (2012) reciprocal teaching is conveying to all students that they can learn, that all students can contribute to the learning process, and that all perspectives are valued. According to Oczkus (2013) in reciprocal teaching the teacher asks the students to take the role of predictor, questionnaire, clarifier, and summarizer as they read the assigned readings. Each team gives their responses, and individuals mark their text. The teacher clarifies difficult concepts and how to ask relevant questions.

Based on the explanation of these experts, it can be concluded that the reciprocal teaching model of learning has benefits so that learning objectives are achieved through independent learning activities and students are able to explain all of them to others, studied step by step, indirect knowledge is given at once to students. Students are given an initial stimulus, with the stages in reciprocal teaching such as, summarizing, making questions, clarifying, predicting and responding to what is read. Students are directed to be able to develop the initial stimulus to get ideas and mathematical knowledge in accordance with their needs for the achievement of learning goals.

Student Facilitator and Explaining Model

According to Muslim (2014) Student Facilitator and Explaining learning is one type of cooperative learning that emphasizes specific structures designed to influence student interaction patterns and aims to improve academic mastery. Imas and Berlin (2015) argue that this model of student facilitator and explaining is a learning model that trains students to be able to present their ideas or ideas to their friends. According to Setiawan, Budiretnani, and Utami (2017) Student Facilitator and Explaining learning models are learning models that encourage students to dare to argue in explaining the material learned to other students. Bayuaji, Hikmawati, and Rahayu (2017) argue that Student Facilitator and Explaining provides opportunities for students to give their opinions or ideas in understanding a problem. Based on the above explanation can be concluded Student Facilitator and Explaining model is how students are able to present or demonstrate the material in front of other students based on working in small groups in order to exchange opinions from each student. This kind of learning will train students to talk to convey ideas.

Learning Independence

According to Nagpal, Priyamakhija, James, Gyanprakash (2013) learning independence is a process, method and an educational philosophy: in which a student acquires knowledge with his own efforts and develops the capacity for critical inquiry and evaluation. According to Rusman (2011) the level of student learning independence of students is related to the selection of programs: (1) choosing program whose opportunities for dialogue are higher and less structured, or (2) programs that lack opportunities for dialogue and are highly structured. According to Grover, Miller, and Porter (2017) Individuals take the initiative, with or without the help of others, in diagnosing their learning needs, formulating learning goals, identifying human and material resources for learning, choosing and implementing appropriate learning strategies, and

evaluating learning outcomes. Fisher in Williams (2003) discusses ways to create effective communities for learning and shows that an independent learning environment must develop a climate in which important communities and groups respect generate trust, support and communication. Independent people can make their own choices responsibly when they will learn or want to learn what. According to Herod and Kop (2017) learning independence is not only seen as a process but also related to personal tendencies and as an environmentally determined phenomenon. Like the opinion of Harvey and Louise (2007) the first important step before independent learning skills can be developed for students is to understand the need to change. Unless they see this need and desire for change, students have no reason to change their approach or any motivation to overcome old habits. Johnson (2002) says that independent learning frees students to use their own learning styles, advance at their own pace, explore personal interests, and develop their talents by using the multiple intelligences they like. According to Bartholomew (2017) learning independence is the ability of students to self-assess their own learning needs to do activities to ask and find out about things they want to know, learning independence combines understanding of what is unknown with an understanding of what activities need done to get the knowledge needed.

Based on the above explanation, learning independence is to liberate students to use student learning styles, advance in their own pace, explore their personal interests, and develop their talents using the multiple intelligences they like.

Initial Ability

According to Mariotti (2009) the initial ability is to refer to the information that will be studied which is already known to students throughout the previous learning outcomes and individual experiences. According to Dick, Johnson, and Carey (2015) the initial ability is a set of skills that students should have before they follow a new learning process.

Based on the explanation above, the initial ability is learning outcomes obtained before continuing the next level and is the basic capital of students to learn each new subject matter that will be presented by the teacher.

METHOD

The research was conducted with a quantitative approach, using quasi-experimental research methods with a design of anakova design treatment by level 2x2. The results of the trial of Mathematics Learning Outcomes instruments have 47 valid questions with reliability of 0.91, the results of the trial of the learning independence instrument there are 50 valid statement items with reliability of 0.90, and the results of the trial of the initial math ability are 46 valid questions with reliability of 0.91. Data analysis used in this study consists of two parts, namely descriptive analysis and statistical analysis.

RESULTS AND DISCUSSION

Differences in Mathematics Learning Outcomes between Students Learning Using Reciprocal Teaching Learning Models and Student Facilitator Learning Models and Explaining by Controlling Initial Skills

The results of the analysis testing hypothesis 1 shows that H_0 is rejected based on Test-F, row A with the value of $F_{count} = 4.47$ higher than $F_{table} (0.05; 1; 59) = 4.00$. Thus it can be concluded that there are significant differences in mathematics learning outcomes between groups of students who study with reciprocal teaching models with groups of students who study with the student facilitation model and explaining after controlling the initial ability, to find out which group is higher can be seen from the average value while corrected the two groups. In the group of students who study with the reciprocal teaching model, the average mathematics learning outcomes are corrected by 64.71 while the group of students who study with the student facilitation and explaining model is 59.29. The calculation results show that the mathematics learning outcomes between groups of students who study with the reciprocal teaching model are higher than the group of students who study with the student facilitation model and explaining after controlling the initial ability.

Effect of Interaction Learning Model and Learning Independence on Mathematics Learning Outcomes by Controlling Initial Ability

The results of the hypothesis 2 testing analysis show that H0 is rejected based on F Test statistic, the interaction row value F count = 14.94 higher than Ftable (0.01; 1; 59) = 7.08. Thus it can be concluded that there is a very significant interaction effect between learning models and learning independence on students' mathematics learning outcomes after controlling the initial ability. The interaction between the learning model and the learning independence of students' mathematics learning outcomes after controlling the initial ability can be seen in the following figure.

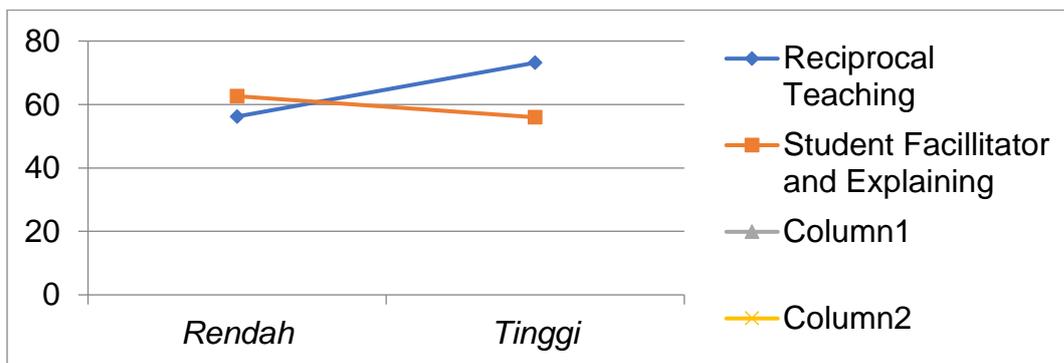


Figure 1. Visualizing the Interaction between Learning Models and Learning Independence in Influence on Mathematics Learning Outcomes After Controlling Early Capabilities

By testing the interaction, then further testing is needed. Further test is intended to know about: (1) difference of learning result of mathematics learning with reciprocal teaching model and student facilitator and explaining specially for group of students having high learning independence after controlling initial ability; and (2) differences in learning outcomes of mathematics learning with reciprocal teaching models and student facilitators and explaining specifically for groups of students who have low learning independence after controlling initial ability. Summary of further test results can be seen in **Table 1**. The calculation can be seen in the attachment.

Table 1. Summary of Advanced Test Results after Controlling Initial Capabilities

No	Compared Groups	dk	T _{count}	t _{table}	
				α = 0,05	α = 0,01
1	A ₁ B ₁ with A ₂ B ₁	59	4,90 **	1,67	2,39
2	A ₁ B ₂ with A ₂ B ₂	59	-1,83 *	-1,67	-2,39

Differences in Mathematics Learning Outcomes between those who Learn Using Reciprocal Teaching Learning Models with High Learning Independence and those who Learn to Use Facilitator Student Models and Explaining with High Learning Independence after Controlling Students' Initial Abilities

The results of the hypothesis 3 testing analysis show that H0 is rejected based on the t-test statistic, the value of t count = 4.90. This value is higher than t table (0.01; 59) = 2.39. Thus it can be concluded that for groups of students who have high learning independence, there are differences in mathematics learning outcomes that are very significant between groups of students who study with reciprocal teaching models and those who learn with student facilitation and explaining models after controlling the initial abilities, to know which groups the higher can be seen from the average value corrected by both groups. In the group of students who have high learning independence, students' learning outcomes of mathematics with reciprocal teaching models have averaged corrected by 73.18. While the learning outcomes of students who study with the student facilitation and explaining models have an average correction of 55.97. The calculation results show that for groups of students who have high learning independence, the results of mathematics learning between groups of students who study with reciprocal teaching models are higher than the group of students who study with the student facilitation model and explaining after controlling the initial abilities.

Differences in Mathematics Learning Outcomes between those who Learn Using Reciprocal Teaching Learning Models with High Learning Independence and those who Learn to Use Facilitator Student Models and Explaining with High Learning Independence after Controlling Students' Initial Abilities

The results of the analysis of testing hypothesis 4 shows that H_0 is rejected based on the t-test statistic, the value of t count = -1.83. This value is smaller than t table (0.05; 59) = -1.67. Thus it can be concluded that for groups of students who have low learning independence, there are differences in mathematics learning outcomes that are very significant between groups of students who learn with reciprocal teaching models and those who learn with student facilitation and explaining models after controlling the initial ability, to know which groups the higher can be seen from the average value corrected by both groups. In groups of students who have low learning independence, students' learning outcomes of mathematics with reciprocal teaching models have averaged corrected by 56.22. While the learning outcomes of groups of students who were given student facilitation and explaining lessons had an average correction of 62.63. The calculation results show that for groups of students who have low learning independence, the results of mathematics learning between groups of students who study with the reciprocal teaching model are lower than the group of students who study with the student facilitation model and explaining after controlling the initial ability.

DISCUSSION

Mathematics Learning Outcomes of Students who Study with Reciprocal Teaching Learning Model is Higher than the Value of Mathematics Learning Outcomes of Students who Learn to Use the Student Facilitator Model and Explaining after Controlling the Students' Initial Abilities

Based on the calculation results obtained Fcount is greater than Ftable, this shows that students' mathematics learning outcomes there are significant differences between learners and reciprocal teaching models with those learning with student facilitation models and explaining after controlling the students' initial abilities. This difference is indicated by the average value corrected by the learning outcomes of students who study mathematics with reciprocal teaching models of 64.71 and students' learning outcomes of mathematics with a student facilitation and explaining model of 59.29. This means that the learning outcomes of students learning mathematics with reciprocal teaching learning model is higher than the value of mathematics learning outcomes of students who learn to use the facilitator student model and explaining after controlling the initial ability of students.

There is an Effect of Interaction between Learning Models and Learning Independence on Students' Mathematics Learning Outcomes after Controlling the Students' Initial Abilities

The calculation results obtained Fcount is greater than Ftable. This means that there is a very significant interaction effect between learning models and learning independence on students' mathematics learning outcomes after controlling the initial ability. The value of mathematics learning achievement using learning model of reciprocal teaching with higher learning independence is higher than the value of student learning outcomes using student facilitator and explaining model with high learning independence after controlling students' early ability.

The Results of Learning Mathematics Learning Using Reciprocal Teaching Learning Model with Higher Learning Independence is Higher than the Value of Student Learning Outcomes Using Student Facilitator and Explaining Model with High Learning Independence after Controlling Students' Early Ability

The result of the calculation of the group of students who were taught using a reciprocal teaching learning model with high learning independence with a corrected average of 73.18. While the group of students who were taught by using student facilitation and explaining learning with high learning independence average corrected by 55.97. It shows that the result of learning of mathematics of group of students that is taught using the learning model of reciprocal teaching with higher learning independence is higher than the result

of learning mathematics group of students which is taught using student learning model facilitator and explaining with high learning independence after controlling the initial knowledge.

The Value of Mathematics Learning Outcomes that Learn Using Reciprocal Teaching Learning Models with Low Learning Independence is Lower than the Value of Student Learning Outcomes that Use Facilitator Student Models and Explaining with Low Learning Independence after Controlling the Students' Initial Abilities

The results of the calculation of the group of students who were taught using reciprocal teaching learning models with low learning independence were lower than the mathematics learning outcomes of the groups of students who learned using student facilitation learning models and explaining with low learning independence after controlling the initial knowledge. This means that the use of student facilitation and explaining learning models conducted in this study can improve students' mathematics learning outcomes better than the use of reciprocal teaching learning models in students with low learning independence by controlling initial abilities.

CONCLUSION

Based on the results of the research data it can be concluded that the learning outcomes of students learning mathematics with reciprocal teaching learning model is higher than the value of mathematics learning outcomes of students who learn to use the facilitator student model and explaining after controlling the initial ability of students, there is an influence of interaction between learning models and learning independence on results learning mathematics students after controlling the initial ability of students, learning outcomes of mathematics who learn to use reciprocal teaching learning models with high learning independence is higher than the value of student learning outcomes using student facilitator model and explaining with high learning independence after controlling the students' initial abilities, learning outcomes of mathematics who learn using reciprocal teaching learning model with low learning independence is lower than the value of student learning outcomes using student facilitator model and explaining with humanity self-learning is low after controlling students' initial abilities.

Disclosure statement

No potential conflict of interest was reported by the authors.

Notes on contributors

Dodik Mulyono – State University of Jakarta, Indonesia.

Moch Asmawi – State University of Jakarta, Indonesia.

Tuti Nuriah – State University of Jakarta, Indonesia.

REFERENCES

- Agoro, A. A., & Akinsola, K. M. (2013). Effectiveness of Reflective- Reciprocal Teaching on Pre-Service Teachers' Achievement and Science Process Skills in Integrated Science. *International journal of education and research*, 1(8), 1-20.
- Arend, R. I. (2012). Learning to Teach, 9th Editions, *New York: McGraw-Hill Companies*, 58.
- Bartholomew, S. R. (2017). Middle School Student Technology Habits, Perceptions, And Self-Directed Learning. *International Journal of Self-Directed Learning*, 14(2), 27-44.
- Bayuaji, P., & Hikmawati, S. R. (2017). Pengaruh Model Pembelajaran Kooperatif Tipe Student Facilitator and Explaining (Sfae) Dengan Pendekatan Saintifik Terhadap Hasil Belajar Fisika. *J. Pijar MIPA*, 12(1), 15-18. <https://doi.org/10.29303/jpm.v12i1.328>
- Freihat, S., & Al-Makhzoomi, K. (2012). The Effect of the Reciprocal Teaching Procedure (RTP) on Enhancing EFL Students' Reading Comprehension Behavior in a University Setting. *International Journal of Humanities and Social Science*, 2(5), 279-291.
- Gillies, M. R., & Ashman, A. F. (2003). *Co-operative Learning: the social and intellectual outcomes of learning in groups*. New York: Routledge Falmer, 47.

- Grover, K. S., Miller, M. T., & Porter, S. A. (2017). Mature Adult Learners, Self-Directed Learning Practices, and Quality of Life. *International Journal of Self-Directed Learning*, 14(2), 1-12.
- Harvey, V. S., & Chickie-Wolfe, L. A. (2007). Fostering independent learning: practical strategies to promote student success. *New York: The Guilford Press*, 6.
- Herod, L., & Kop, R. (2017). It's Not Just About Support: Self-Directed Learning In An Online Self-Help Group. *International Journal of Self-Directed Learning*, 14(2), 13-26.
- Johnson, E. B. (2002). Contextual Teaching & Learning. *Mizan Learning Center*, 83.
- Kurniasih, Imas dan Sani. Berlin. (2015). Ragam Pengembangan Model Pembelajaran. *Jakarta: Kata Pena*, 79.
- Mariotti, A. P. (2009). Creating Your Teaching Plan: A Guide for Effective Teaching. *Indiana, Author House*, 115.
- Mulyono, D., Purwasi, L., & Riyadi, A. (2018). Penerapan Metode Penemuan Terbimbing pada Pembelajaran Matematika Siswa SMP. *Journal of Education and Instruction (JOEAI)*, 1(1), 51-58. <https://doi.org/10.31539/joeai.v1i1.240>
- Muslim, S. R. (2014). Pengaruh Penggunaan Metode Student Facilitator and Explaining Dalam Pembelajaran Kooperatif Terhadap Kemampuan Pemecahan Masalah Matematik Dan Kemampuan Berpikir Kritis Matematik Siswa SMK Di Kota Tasikmalaya, *Jurnal Pendidikan dan Keguruan*, 1(1). 1-9.
- Nagpal, K., Priyamakhija, J., & Leena, G. (2013). Independent Learning and Student Development, *International Journal of Social Science & Interdisciplinary Research*, 2(2), 27-35.
- Oczkus, L. (2013). Reciprocal Teaching Powerful Hands-on Comprehension Strategy. *The Utah Journal of Literacy*, 16(1), 34-38.
- Oczkus, L. D. (2010). Reciprocal teaching at work: Powerful Strategies and Lessons for Improving Reading Comprehension. *New York: International Reading Association*, 4.
- Ostovar-Namaghi S. A., & Shahhosseini M.-R. (2011). On the Effect of Reciprocal Teaching Strategy on EFL Learners' Reading Proficiency. *Journal of Language Teaching and Research*, 2(6), 1238-1243. <https://doi.org/10.4304/jltr.2.6.1238-1243>
- Raslie, H., Mikeng, D., & Ting, S.-H. (2015). Reciprocal Teaching and Comprehension of Struggling Readers. *International Journal of Education*, 7(1), 131-142. <https://doi.org/10.5296/ije.v7i1.7027>
- Rusman. (2011). Model-Model Pembelajaran: Mengembangkan Keprofesionalisme Guru *Jakarta: PT Raja Grafindo Persada*. 365.
- Salehi, M., & Vafakhah, S. (2013). A Comparative Study of Reciprocal Teaching Only (RTO) and Explicit Teaching of Strategies before Reciprocal Teaching (ET-RT) On Reading Comprehension of EFL Learners. *Australian Journal of Basic and Applied Sciences*, 7(2), 148-155.
- Setiawan, M. A., Budiretnani, D. A., Utami, B. (2017). Pengaruh Model Pembelajaran *Problem Based Learning* Dipadu *Student Facilitator and Explaining* Terhadap Kemampuan Berpikir Kritis Siswa Kelas X Sman 6 Kediri Pada Pokok Bahasan Fungi. *Jurnal Florea*, 4(1), 1-4. <https://doi.org/10.25273/florea.v4i1.1167>
- Walter, D., Carey, L., & Carey, J. O. (2015). The Systematic Design of Instruction. *New Jersey: Pearson Education, Inc*, h. 97.
- Williams, J. (2003). *Promoting independent learning in the primary classroom*. *Buckingham: Open University Press*, 101.

<http://www.iejme.com>