


# The influence of the TaRL approach on the critical thinking ability of Elementary School Students in mathematics subject



Farida Kusumaningrum<sup>a,1, </sup>, Meita Fitrianawati<sup>a,2\*</sup>, Muhammad Taqiyuddin<sup>b,3</sup>

<sup>a</sup> Universitas Ahmad Dahlan, Ki Ageng Pemanahan Street No. 5, Yogyakarta, and 55552, Indonesia

<sup>b</sup> University of Auckland, 34 Princes Street, Auckland CBD, Auckland 1010, New Zealand

<sup>1</sup> farida2000005014@webmail.uad.ac.id; <sup>2</sup> meita.fitrianawati@pgsd.uad.ac.id\*; <sup>3</sup> muhammad.taqiyuddin@auckland.ac.nz;

\* corresponding author

## ARTICLE INFO

## ABSTRACT

Received  
Revised  
Accepted

### Keywords

TaRL Approach  
Critical Thinking Skills  
Mathematics  
Elementary School Students

The results of the PISA study revealed the low critical thinking skills of students in Indonesia, especially in mathematics. This study aims to evaluate the effect of the Teaching at the Right Level (TaRL) strategy on the critical thinking skills of fourth grade elementary school students in solving arithmetic problems in Yogyakarta. This study used a quantitative approach with a nonequivalent control group experimental design. The instruments used included essay tests, observation sheets, and documentation. Data were analyzed through descriptive statistics and t-tests to test the hypothesis. The results of the analysis showed that the TaRL strategy significantly improved students' critical thinking skills in four main aspects. The t-test produced a significance value of 0.000 ( $<0.05$ ), indicating a significant difference between the experimental and control groups. The average posttest score of the experimental group reached 81.5, higher than the control group which obtained an average of 76. Illustrations of this increase are seen in students' abilities to identify problems, analyze information, evaluate solutions, and convey arguments logically. These findings indicate that the TaRL strategy is not only effective in improving learning outcomes but also contributes to strengthening students' critical thinking skills from an early age. Thus, the implementation of TaRL can be an alternative adaptive and transformative learning strategy to improve the quality of basic education in Indonesia.

This is an open-access article under the [CC-BY-SA](#) license.



## 1. Introduction

According to Sherly et al. (2020), the autonomous curriculum uses the notion of "Merdeka Belajar," which is different from the 2013 curriculum and refers to giving teachers, students, and students the ability to learn freely, independently, and creatively. Teachers will be the driving force, and students will learn independently through the implementation of an autonomous curriculum. For example, if students from a diagnostic analysis are struggling with division in a math session, the instructor can move on to other topics, such as addition, before covering new content. One might say that students' mastery of math is at a low level. Strong basic ideas are needed to learn mathematics; memorization alone is not enough. Therefore, since learning math involves thinking, perseverance, and ability, children must be able to think critically. Fauziah et al. (2023: 159) stated that two elements of teacher factors and student factors contribute to the problem of students not understanding the things they learn. In August 2023, observations and question and answer sessions during the mathematics learning process in class IV in school Elementary in Yogyakarta. Although some relevant learning approaches, such as Teaching at the Right Level, had not been applied to the learning

materials delivered, such as lectures and less active student participation in the learning process, mathematics teaching still used traditional methods.

The explanation shows how disinterested students are in educational activities. This is indicated by low interest in learning. According to Musoffa et al. (2020: 299), the majority of primary school students do not show a strong desire to learn mathematics. One of the reasons is the lack of diverse educational approaches when instructors mostly use lecture techniques to impart knowledge. Every student must think critically to solve various real-world situations (Asriningtyas et al., 2018: 28). Critical mathematical thinking is the ability to think logically to solve mathematical problems. So, Every human being should be able to think critically, according to Lieung (2019: 74). However, not every human being is able to use their critical thinking abilities to the fullest to solve problems, recognize, and draw conclusions from the information they have collected. Elementary school students' critical thinking skills are still not at their best. The purpose of practicing this lesson is to apply Ki Hadjar Dewantara's learner-centered teaching philosophy, which improves students' literacy and numeracy skills and ensures that every student meets the learning objectives.

The main problem in this study is the importance of TaRL to be used in learning and to see the influence on students' critical thinking skills, which are still low. There needs to be innovation to address these problems by implementing TaRL in mathematics learning. The literature review shows positive things about critical thinking skills related to the application of TaRL. Thus, this study aims to ascertain whether the TaRL strategy affects the use of critical thinking when dealing with arithmetic problems in grade IV elementary school in Yogyakarta.

## 2. Method

This study utilized experimental techniques and quantitative methodology. Both unequal control group design and quasi-experimental design were used in this investigation. Students from two classes of class IV A, which had twenty students, and class IV B, which had twenty students in class IV of elementary school in Yogyakarta, participated in this study. It established experimental and control classes. In this study, the TaRL technique is the independent variable, and students' critical thinking ability is the dependent variable. The independent variable is the TaRL technique. The instruments used were questions from the pretest and posttest with an essay test, an observation sheet that showed how the learning process was implemented, and a documentation sheet that showed the students' completed tasks. The essay test is specifically designed to measure student understanding and has been validated in terms of content with a Cronbach's alpha reliability of 0.55, thus ensuring the accuracy and consistency of the measurement. The sample was divided into two classes: class IV A, which consisted of twenty students, was the experimental class, and class IV B, which was the control class, also containing twenty students. Both inferential analysis and descriptive analysis were used as data analysis methods. Mean, median, mode, minimum value, maximum value, variance, and standard deviation can all be found by using descriptive analysis. Normality and homogeneity tests came first for prerequisite testing, but the inferential analysis was obtained before hypothesis testing was conducted. The results on the critical thinking skills of grade IV students both before and after treatment were then analyzed as part of the hypothesis test.

## 3. Results and Discussion

In this study, the effect of applying the TaRL approach is the independent variable. The dependent variable is one's ability to use critical thinking when solving math problems. The measure of critical thinking was found in the least common multiple and greatest common factor problems. Students were given pretest questions at the beginning of the experimental and control classes to measure their initial ability. The TaRL approach was used to treat students in the experimental class, while the traditional learning model was used in the control class. Students were given post-test questions at the end of their education to determine their final proficiency level. Before conducting the hypothesis test, the answer checked for normality. If the result shows  $\alpha > 0.05$ , the data is normally distributed; if the result shows  $\alpha > 0.05$  for the homogeneity test, the data is homogeneous.

### Observation Result of Learning Implementation

Both classes used the same material in mathematics found in the student book despite having quite different learning models. While the control class learned conventionally, the experimental class used the TaRL approach to learning.

**Table 1.** Observation Results of Learning Implementation

No	Steps	Experiment Class				Control Class			
		Session I		Session II		Session I		Session II	
		Yes	No	Yes	No	Yes	No	Yes	No
1.	Initial Activity	√	√	√	√	√	√	√	√
2.	Core Activity	√	√	√	√	√	√	√	√
3.	End Activity	√	√	√	√	√	√	√	√
Quantity		15	5	18	2	8	12	11	9
Persentase (%)		75%	25%	90%	10%	40%	60%	55%	45%

The teacher moderately used the TaRL method, according to observations of his activities in the experimental classroom during sessions. The instructor was able to manage 15 out of 20 indicators with a 75% completion rate. Learning activities in the second session of the experimental class were largely the same as those in the first session. The educator observed teacher activities during sessions using the TaRL approach in the experimental class. II. At the end of the activity, 18 out of 21 indicators had a percentage of 90%, indicating a 14% increase in educator activity—observation of educator activities in the control class in sessions. I, the educator, can carry out eight indicators out of 20 indicators with a percentage of 40%. In session II of the control class, the educator carried out 11 indicators out of 20 indicators with a percentage of 55%. The results obtained are different between the experimental class and the control class. The difference is due to a different learning treatment, which encourages experimental students to have more critical thinking skills than the control class.

### Critical Thinking Skills

The following table shows the results of the learning pretest and posttest for the experimental class using the TaRL approach in learning and the control class using conventional learning.

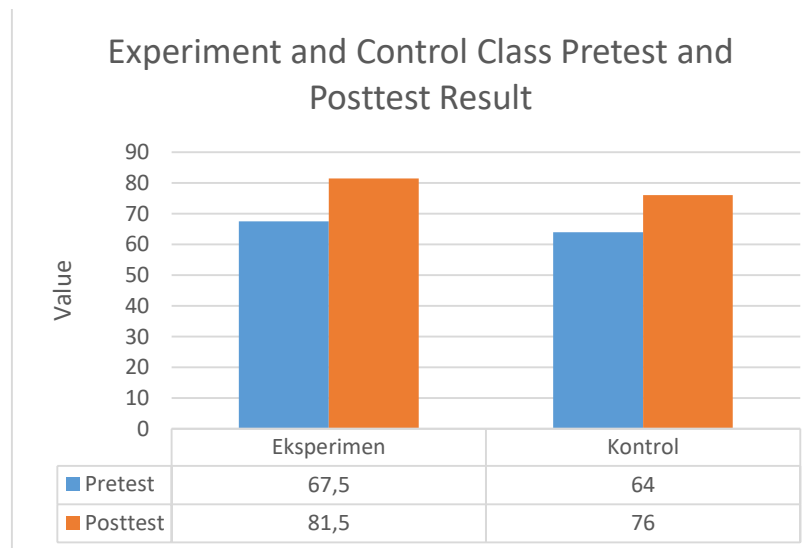
**Table 2.** Critical Thinking Test Results

Name	Aspect/Indicator			
	1	2	3	4
Pretest Experiment	87	71	60	56
(%)	87%	71%	60%	56%
Posttest Experiment	92	89	82	61
(%)	92%	89%	82%	61%
Pretest Control	80	71	56	53
(%)	80%	71%	56%	53%
Posttest Control	90	83	70	62
(%)	90%	83%	70%	62%

The 20 students who got the pretest learning results of critical thinking skills in the experimental class showed that the average in aspect 1 got a good category with a percentage of 87%, aspect 2 got a category less with a percentage of 71%, aspect 3 got a category less with a percentage of 60% and aspect 4 got a category less with a percentage of 56%. Like previous research (Rahmayanti et al., 2023), applying the TaRL learning approach can increase activity and student understanding. The results of the ability to think critically in the context of the experimental class have a fairly high value because teaching and learning activities use the TaRL approach in learning mathematics. Learners totaling 20 get learning outcomes. Critical thinking ability after the experimental class test shows that the average in Aspect 1 gets a very good category percentage of 92%, aspect 2 gets a good category percentage of 89%, aspect 3 gets a good category percentage of 82%, and aspect 4 gets a category less percentage of 61%. This is in accordance with Misnahwati's research (2024), which shows that the TaRL method can not only improve students' critical thinking skills but also improve their math skills. Both the pretest and posttest of the experimental class showed an increase. This shows that the TaRL strategy can improve critical thinking skills in math stories (Hadiawati, 2024).

The 20 students who got the pretest learning results of critical thinking skills of the control class showed that the average in aspect 1 got a good category percentage of 80%, aspect 2 got a sufficient

category percentage of 71%, aspect 3 got a category less percentage of 56%, and aspect 4 got a category less percentage of 53%. (Yanti, et al., 2018) Said that students' critical thinking skills were affected by the problem-solving approach in solving math story problems; the results of pretest and posttest data analysis showed an increase. The 20 students who got the posttest learning results of critical thinking skills in the control class showed that the average in aspect 1 got a good category percentage of 90%, aspect 2 got a good category percentage of 83%, aspect 3 got a category less percentage of 70% and aspect 4 got a category less percentage of 62%.



**Fig. 1: Pretest and Posttest Results of Experimental and Control Classes**

The experimental class's pretest and posttest calculation results increased by 67.5 to 81.5, while the control calculation results increased by 64 to 76. Thus, it can be said that learning with the TaRL approach increases student learning outcomes. The improvement that occurred during this learning process had an impact on students' critical thinking skills. Their capacity to think critically when solving math problems was assessed using the pretest findings. Data analysis showed that the control class pretest and posttest data were better than the average. This conclusion shows that the average increase in the experimental class is greater than the average of the control class. By using the TaRL approach, the average value of students' learning outcomes on the KPK and FPB material stories increased. It also shows that learners better understand the math concepts that have been taught.

### The Effect of the TaRL Approach on Critical Thinking Skills

The pretest and posttest results of the control class obtained a  $t$  of 7.151 with a sig value (2-tailed) of 0.000. The significance value states are smaller than 0.05, so it can be concluded that  $H_0$  is rejected and  $H_a$  is accepted. Student learning activities show this, supporting previous research (Saputra, 2020), which found that using learning models can improve critical thinking skills once again. However, critical thinking skills cannot be automatically improved by all learning models.

**Table 3.** Independent Sample T-Test Results

Independent Samples Test										
		<i>Levenes's Test For Equality of Variances</i>		<i>t-test for Equality of Means</i>						
		<i>F</i>	<i>Sig.</i>	<i>t</i>	<i>df</i>	<i>Sig. (2- tailed)</i>	<i>Mean Difference</i>	<i>Std. Error Difference</i>	<i>95% Confidence Interval of the Difference</i>	
									<i>Lower</i>	<i>Upper</i>
Results	Equal variances assumed	3.058	.883	1.857	38	.001	5.500	2.962	-.497	11.497
	Equal variances not assumed			1.857	32.479	.001	5.500	2.962	-.531	11.531

The comparison test used an independent sample t-test using posttest data of experimental classes using the TaRL approach and control classes using a scientific approach with a conventional learning model. The results of data processing show that sig (2-tailed) is 0.001, then  $0.001 < 0.05$ . So it can be concluded that  $H_0$  is rejected and  $H_a$  is accepted, using the TaRL approach is higher than using conventional learning. The data comparison shows a strong correlation between using TaRL techniques and developing critical thinking skills when dealing with math difficulties. Problem-solving and critical thinking abilities are closely related to previous research (Susilowati, et al., 2020) because these connections help each other. The critical thinking skills of fourth-grade students of SD Muhammadiyah Ngijon 1, who served as the experimental class, were able to solve problems and produce appropriate answers. Critical thinking ability can be improved by problem-solving ability, according to previous research (Lubis, 2017). It becomes the main tool to teach students to engage in critical thinking through the application of the TaRL approach in teaching and learning activities. Students' abilities show how learning involves thinking activities and processes. Since not every student is gifted in the same way, teachers can use the TaRL approach to help students develop their critical thinking skills. The results of several previous studies and research show that learning activities using the TaRL approach can improve learners' critical thinking skills in solving mathematics problems, especially those related to the material of KPK and FPB. This is due to the fact that learners are required to perform activities while thinking to complete the task, which improves their critical thinking ability.

#### 4. Conclusion

The results of the research and discussion show that applying the learning approach at the right level (TaRL) impacts students' critical thinking skills when solving mathematics problems in class IV at SD Muhammadiyah Ngijon 1. The results of the posttest of critical thinking skills in the experimental class showed that aspect 1 understood the question by 92%, aspect 2 made a model by 89%, aspect 3 provided an explanation by 82%, and aspect 4 concluded by 61%. Other results can be seen from the results of hypothesis testing using independent sample t-test data pretest and posttest experimental class, which showed a sig value (2-tailed) of 0.001. The significance value states  $\alpha < 0.05$ ; it can be concluded that  $H_0$  is rejected and  $H_a$  is accepted. In addition, it can also be seen from the average post-test results of the experimental class that applied the TaRL approach of 81.5 percent 82% with a good category, with the highest score of 100 and the lowest score of 55, while the average post-test of the control class that used conventional learning was 76 percentage 76% with a sufficient category with the highest score of 90 and the lowest score of 60. The TaRL method, as an alternative for learning, can be used to improve students' critical thinking skills. The results show that applying this method can significantly affect students' ability to solve math problems in grade IV elementary school.

#### Acknowledgment

Our gratitude goes to Universitas Ahmad Dahlan Yogyakarta, the head of SD Muhammadiyah Ngijon 1, and the fourth-grade teacher of SD Muhammadiyah Ngijon 1, who has provided direction during the research.

#### Declarations

<b>Author contribution</b>	: All authors contributed equally to the main contributor to this paper. All authors read and approved the final paper
<b>Funding statement</b>	: None of the authors have received any funding or grants from any institution or funding body for the research
<b>Conflict of interest</b>	: The authors declare no conflict of interest
<b>Additional information</b>	: No additional information is available for this paper

#### References

- [1] Ariyatun, & Octavianelis, D. F. (2020). The Effect of STEM Integrated Problem Based Learning Model on Students' Critical Thinking Ability. *Journal of Educational Chemistry*, 2(1), 33-39.
- [2] Asriningtyas, A. N., Kristin, F., & Anugraheni, I. (2018). Mathematics of 4th grade students. *JKPM*, 5(1), 23-32.



- 
- [3] Cahyono, S. D. (2022). Through the Teaching at Right Level (TaRL) Model, the Method of Giving Tasks to Increase Motivation and Learning Outcomes of Workshop and Entrepreneurship Subject KD. 3.2/4.2 Topic of Business Planning for Preserved Food Processing from Foodstuffs N. *Tambusai Education Journal*, 6(2), 12407-12418
- [4] Chanifah, M., Relmasira, S. C., & Hardini, A. T. A. (2019). Efforts to Improve Critical Thinking Ability and Learning Outcomes in Mathematics Learning Using Problem Based Learning Model for Grade V Students. *Basicedu Journal*, 3(1), 163-168. <https://doi.org/10.31004/basicedu.v3i1.96>
- [5] Farhana, H. O. H. P., & Hamdu, G. (2016). Application of problem solving strategies in improving students' critical thinking skills on division of fractions. *Scientific Journal of Elementary School Teacher Education Students*, 303-321.
- [6] Fauziah, S., Magdalena, I., & Mawardi. (2023). The Effect of Project Based Learning on Critical Thinking Skills of Fourth Grade Students of SDN Bidara Tangerang Regency. *Journal of Educational Technology*, 8(1), 158-163.
- [7] Hadiawati, N. M., Aulya, N. P., & Ika, P. (2024) Teaching At The Right Level Learning as an Implementation of the Independent Curriculum. *Journal of Educational Technology*, 1(4), 1-8.
- [8] Jauhari, T., Rosyidi, A. H., & Sunarlijah, A. (2023). Learning with the Tarl Approach to Increase Students' Interest and Mathematics Learning Outcomes. *Ptk and Education*, 9(1), 59-74.
- [9] Lieung, K. W. (2019). The Effect of Discovery Learning Model on Critical Thinking Skills of Elementary School Students. *Journal of Primary Education*, 1(2), 73- 82.
- [10] Lubis, J. A. (2017). The Effect of Problem Solving Learning Model on Students' Critical Thinking Skills. *Journal of Biology Education*, 6(2), 291-295. <https://doi.org/10.24114/jpb.v6i2.6548>
- [11] Misnahwati, M., Abdul, R., & Mentari, N. S. (2024) Application of TaRL Approach to Improve Mathematics Learning Outcomes of Grade V Elementary School. *Journal of PGSD Study Program, Makassar State University*, 4(1).
- [12] Musoffa, D. Q., Nurhayati, A., & Chotimah, S. (2020). Analysis of Learning Interest of Third Grade Students on Flat Building Material with VBA. *Journal on Education*, 2(4), 297-302.
- [13] Novitasari, D. (2016). The Effect of Interactive Multimedia Use on Students' Mathematical Concept Understanding Ability. *FIBONACCI: Journal of Mathematics and Mathematics Education*, 2(2), 8. <https://doi.org/10.24853/fbc.2.2.8-18>
- [14] Rahmayanti, S. M., Fida, R. H., & Lilik, S. (2023) Application of PBL Learning Model Using TaRL Approach. *Scientific Journal of Basic Education*, 8(4), 2548-6950.
- [15] Saputra, H. (2020). Mathematical Critical Thinking Ability. *IAI Agus Salim Metro Lampung Library*, 2(4), 1-7.
- [16] Sherly, Dharma, E., & Sihombing, H. B. (2020). Independent Learning: A Literature Review. *UrbanGreen Conference Proceeding Library*, 1.
- [17] Susilowati, E., Hartini, S., Suyidno, S., Mayasari, T., & Winarno, N. (2020). Relationship Between the Problem Solving Ability of Critical Thinking Skills on Series Material. *Proceedings of the National Seminar on Wetland Environment*, 5(4), 119-125.
- [18] Umam, K., & Anti, I. (2017). Analysis of Students' Critical Thinking Skills in Mathematics on Cube and Block Materials in Class VIII of SMP Negeri 19 Pilot Banda Aceh. *Journal of Mathematics Education and Learning*, 1(2), 134-145.
- [19] Yanti, R., Sumardi, & Suryana, Y. (2018). The Effect of Problem Solving Approach on Students' Critical Thinking Ability in Solving Mathematics Story Problems. *PEDADIDAKTIKA: Scientific Journal of Elementary School Teacher Education*, 5(1), 319-337.