



THE EFFECTIVENESS OF THE TEACHING AT THE RIGHT LEVEL (TaRL) APPROACH ON LEARNING OUTCOMES IN THE TOPIC OF RELATIONS AND FUNCTIONS AMONG GRADE VIII STUDENTS

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Abstract

This research aimed to evaluate the effectiveness of the Teaching at the Right Level (TaRL) approach on student learning outcomes regarding relations and functions. This experimental study employed a pretest-posttest control group design at State Junior High School 5 Manado. The experimental class was taught using the TaRL approach, while the control class received Direct Instruction. Results indicated that the average learning outcomes of the experimental class (81.80) significantly outperformed the control class (71.48). Hypothesis testing via t -test yielded $t_{count} = 3.619 > t_{tabel} = 2.011$ at a significance level of 0.05, confirming significant difference. Furthermore, TaRL met all effectiveness criteria: 1) the average score exceeded the learning objective attainment threshold (KKTP) of 75; 2) classical mastery was achieved; 3) student responses to the learning process were positive. In conclusion, the TaRL approach is effective in improving student learning outcomes for relations and functions material among eighth-grade students.

Keywords: *Effective, Teaching at the Right Level, Relations and Functions.*

INTRODUCTION

A fundamental system that is essential and inherent in the life of every individual is referred to as education [1]. Education constitutes a primary endeavor to impart knowledge, enhance skills, and provide benefits for individuals in mastering theories, making decisions,

and solving various contextual problems [2]. Therefore, education plays a crucial role in improving the quality of human resources and achieving national aspirations [1]. In line with the objective of enhancing human resource quality, mathematics is regarded as an important subject,



particularly in fostering logical and analytical thinking skills [3].

As an essential discipline, mathematics is a compulsory subject at every level of education in Indonesia, ranging from the most basic to higher education [4]. However, the majority of students perceive mathematics as a difficult and uninteresting subject [5]. Despite these challenges, which often reduce learning interest, they do not diminish the inherent importance of mathematics itself [6]. Mathematics instruction from the primary school level is necessary to improve the quality of education and to develop students' abilities in logical, analytical, systematic, critical, and innovative thinking [7].

Observations and interviews conducted at SMP Negeri 5 Manado revealed the low academic achievement of Grade VIII students in mathematics, particularly in the topic of Relations and Functions, which is perceived as abstract and difficult. The primary difficulties lie in understanding patterns of relationships, representing them in diagrams, and relating the concepts to real-life contexts. This condition is exacerbated by the implementation of predominantly conventional teaching methods and the lack of in-depth instructional support from teachers. Based on interviews with the mathematics teacher, the majority of students' learning outcomes fall below the Minimum Mastery Criteria (KKTP) of 75, with an average recorded score of only 55.

A relation is defined as "a rule that maps elements of set A to elements of set B, which can be represented in arrow diagrams, Cartesian diagrams, or sets of ordered pairs." Meanwhile,

"a function from A to B is a special type of relation that requires each element of A to be mapped to exactly one element of B" [8]. This topic demands strong reasoning abilities; therefore, its mastery is highly important for students [9]. The high level of difficulty underscores the need for an adaptive, comprehensive, and structured approach to effectively internalize the concepts of Relations and Functions [10].

Teaching at the Right Level (TaRL) is an approach oriented toward students' actual abilities, without being constrained by formal grade levels [11]. TaRL emphasizes the adaptation of instructional materials and methods according to students' levels of understanding to optimize their learning progress [12]. The effectiveness of this approach depends on the systematic implementation of two main components, namely grouping students based on their initial ability levels and focusing on skills appropriate to those levels [13]. This student-centered approach also supports the development of each learner's specific competencies [14]. TaRL is considered a solution to the problem of diverse learning paces within the classroom [15], recognizing that each student possesses varying levels of understanding [16]. The TaRL syntax includes: (1) diagnostic assessment to map students' initial abilities, (2) communication of learning objectives, (3) grouping students based on ability levels (high, medium, low), (4) provision of core conceptual understanding to enable students to solve problems independently, and (5) guidance and monitoring throughout the learning

process, followed by reflection and consolidation of the material [17].

Support from previous studies strengthens the rationale for selecting TaRL as a solution. Study [18] demonstrated the effectiveness of TaRL in improving mathematics learning outcomes, evidenced by a significant increase in the average score from 63.21 to 82.14. Study [19] also concluded that TaRL is effective because instruction is tailored to students' levels of understanding and encourages their active participation during the learning process. Therefore, it has the potential to serve as an effective solution to address the issue of low student learning achievement [15].

Based on the foregoing discussion, this study aims to investigate the effectiveness of the Teaching at the Right Level (TaRL) approach on students' learning outcomes in the topic of Relations and Functions at SMP Negeri 5 Manado.

METHOD

This study employed a quasi-experimental design in the form of a pretest-posttest control group with a quantitative approach, conducted at SMP Negeri 5 Manado in the first semester of the 2025/2026 academic year, involving the entire population of Grade VIII students. The sample was selected using a simple random sampling technique, resulting in Class VIII.1 as the experimental group ($n = 25$) and Class VIII.3 as the control group ($n = 25$).

Instruction using the TaRL approach in the experimental class was conducted over two sessions with a time allocation of 3×40 minutes (120 minutes per session). The intervention

procedure included: (1) an initial (diagnostic) assessment; (2) grouping students based on their levels of understanding; and (3) instruction tailored to the ability level of each group.

The primary instruments consisted of an essay test (pretest-posttest) to measure learning outcomes in relations and functions, as well as a student response questionnaire. Instrument validity was ensured through content validity testing conducted by two expert lecturers from the Department of Mathematics at Manado State University (expert judgment). Based on the experts' evaluation, the test items were deemed valid and appropriate for data collection in this study.

Posttest data were analyzed through prerequisite tests, namely the normality test (Liliefors) and the homogeneity test (F-test), followed by hypothesis testing using the Independent Samples t-test. The data were considered normally distributed if $L_{calculated} < L_{table}$ ($\alpha = 0,05$) and were considered homogeneous (equal variances) if $F_{calculated} < F_{table}$ ($\alpha = 0,05$).

Hypothesis testing was conducted at a significance level of $\alpha = 0.05$. The null hypothesis (H_0) states that the mean learning outcomes of the class implementing the TaRL approach are equal to those of the class employing direct instruction. Meanwhile, the alternative hypothesis (H_1) states that the mean learning outcomes of the TaRL class are superior to those of the class using direct instruction. The criterion for rejecting H_0 is if $t_{calculated} > t_{table}$ in which case H_0 is rejected and H_1 is accepted, indicating that the TaRL

approach is proven to yield superior (more effective) learning outcomes compared to direct instruction, and vice versa.

The effectiveness of the TaRL approach in the experimental class was measured using three main criteria. Criterion 1 is individual learning achievement, in which TaRL is considered effective if students' posttest scores exceed the Minimum Mastery Criterion (KKTP) established

by SMP Negeri 5 Manado, namely 75. Criterion 2 is classical learning mastery; this approach is deemed effective if the percentage of students achieving the KKTP reaches at least 80% of the total number of students in the experimental class [20]. Furthermore, Criterion 3 examines students' responses to the instruction. The response questionnaire data were analyzed descriptively and classified as presented in Table 1.

Table 1. Student Response Criteria

Percentage (<i>P</i>)	Criteria
$P \geq 80$	Very Positive
$60 \leq P < 80$	Positive
$40 \leq P < 60$	Moderately Positive
$20 \leq P < 40$	Less Positive
$P < 20$	Very Less Positive

Sumber: [21]

RESULT AND DISCUSSION

The data presented in the following table represent the students' learning outcomes from both classes employing their respective instructional models, serving as the primary data used to analyze and test two effectiveness criteria: Criterion 1

(Individual Learning Achievement), based on the comparison of the average posttest score with the KKTP, and Criterion 2 (Classical Mastery), based on the percentage of students achieving mastery in the experimental class. These data are presented in detail in Table 2.

Table 2. Learning Outcomes of the Experimental and Control Classes

	Experimental Class	Control Class
Number of Students	25	25
Average <i>Pretest</i> Score	58,440	58,640
Average <i>Posttest</i> Score	81,800	71,480
KKTP Score	75	75
Number of Students Achieving Mastery (≥ 75)	20	15
Percentage of Mastery	80%	60%
Number of Students Not Yet Achieving Mastery (< 75)	5	10
Percentage Not Yet Achieving Mastery	20%	40%

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Table 2 illustrates that 20 students (80%) in the experimental class achieved scores exceeding the KKTP (75), while 5 students (20%) scored below the KKTP. Thus, Criterion 1 of TaRL effectiveness is fulfilled, as the average student learning achievement surpasses the KKTP value (75). Furthermore, with a mastery percentage of 80%, the experimental class also meets Criterion 2 (Classical Mastery) required to determine the effectiveness of the TaRL approach.

This success theoretically confirms the effectiveness of instructional grouping. As explained by (Banerjee et al., 2016), the core of TaRL's effectiveness lies not merely in the content, but in the appropriateness of the instructional "dosage" provided according to students' initial ability levels. In the topic of Relations and Functions, which is inherently abstract,

this grouping enables lower-level students to build a foundational understanding of concepts without feeling intimidated by the complexity of Grade VIII material. This approach helps prevent the widening of learning gaps, which often occur in conventional instructional models (Sari et al., 2022).

Practically, these findings indicate that mathematical content perceived as difficult can be made accessible to students if instruction is not rigidly driven by curriculum targets alone, but is instead aligned with learners' cognitive readiness.

Furthermore, the effectiveness of the TaRL approach was also evaluated through Criterion 3, namely students' positive responses to the instruction. The analyzed data from the student response questionnaire are presented in detail in the table 3.

Table 3. Results of the Analysis of Student Response Questionnaires toward the Implementation of Instruction

Indicator	Percentage	Criteria
Grouping based on ability level	82%	Very Positive
Instructional components	90%	Very Positive
Student engagement	85%	Very Positive
Teacher monitoring	71%	Positive
Average	82%	Very Positive

Based on Table 3, it was found that overall, 82 percent of students provided positive responses, indicating that they perceived beneficial impacts and agreed with the instructional method using the TaRL approach. This is supported by qualitative data from student comments, which consistently reinforce improvements in cognitive understanding, the perception that the instructional method is effective and

engaging, and appreciation for the collaborative learning aspect. From the questionnaire results, both in terms of percentage scores and comments, it can be inferred that students responded positively to the implementation of the TaRL instructional model, thereby fulfilling Criterion 3 of research effectiveness. The first stage in the data analysis process began with prerequisite testing to determine the

type of statistical analysis to be used. The normality test of the sample data

distribution employed the Liliefors method, as presented in Table 4.

Table 4. Results of the Normality Test

Posttest Data	N	Mean ($\bar{X}$)	Standard Deviation (S)	L_{hitung}	L_{tabel}	Conclusion
Experimental	25	81,800	10,111	0,096	0,180	Normally Distributed
Control	25	71,480	10,033	0,089	0,180	Normally Distributed

The results of the normality test show that $L_{calculated} = 0,096$ (experimental) and 0.089 (control), both of which are less than L_{table} (0,180). Therefore, based on the testing criteria, it is confirmed that the sample data are normally distributed.

After the normality assumption was satisfied, the analysis proceeded

with the homogeneity of variance test, which aims to examine the equality of variances between the experimental and control groups. If homogeneity is confirmed, statistical comparisons between the two groups can be validly conducted. The results of the homogeneity test are presented in Table 5.

Table 5. Results of the Homogeneity Test

Posttest Data	Variance (S^2)	df	F_{hitung}	F_{tabel}	Significance (Sig.)	Conclusion
Experimental	102,250	24	1,016	1,984	0,485	Homogeneous
Control	100,677	24				

From Table 5, it is observed that $F_{calculated}$ (1,016) < F_{table} (1,984), further supported by the significance value (Sig.) = 0.485 > 0.05. This finding leads to the conclusion that the variances of the data in both classes are homogeneous, indicating that any differences in the final outcomes are

purely influenced by the treatment rather than differences in the initial variance conditions. Hypothesis testing constitutes the final stage to address the research problem, employing the Independent Samples t-test (t-test). The results of the t-test analysis are summarized in Table 6.

Table 6. Results of the Hypothesis Test

Posttest Data	N	Mean	df	t_{hitung}	t_{tabel}	Sig. (2.tailed)	α	Conclusion
Experimental	25	81,800	48	3,622	2,011	0,001	0,05	There is a Significant Effect
Control	25	71,480						

Based on the results in Table 6, the value of $t_{calculated} = 3,622 > t_{table} = 2,011$, at 48 degrees of freedom (df). This is further supported by the significance value Sig. (2-tailed) = $0.001 < 0.05$. Referring to these values, H_0 is rejected and H_1 is accepted, indicating that the implementation of TaRL is more effective than the direct instruction model.

The theoretical implications of these hypothesis testing results reinforce the differentiated instruction model. These findings affirm that the effectiveness of TaRL lies in reducing students' cognitive load; through the segmentation of material according to ability levels, students are able to achieve better mastery of the concepts of Relations and Functions. The results of this study indicate a significant increase in the average student learning outcomes following the implementation of the TaRL approach. This improvement is reflected in students' enthusiasm and participation throughout the learning process. Each student was provided with instruction aligned to their actual level of ability, with teachers facilitating learning activities focused on the mastery of fundamental skills. This demonstrates that the implementation of the TaRL approach is capable of fostering an active and engaging learning environment, as well as enhancing students' confidence in mastering essential competencies. These findings are consistent with [11] and [12], which define TaRL as a method that emphasizes the alignment of instructional material with students'

actual ability levels. The improvement in learning outcomes can be directly associated with the steps embedded in the TaRL instructional syntax that was implemented. The initial diagnostic assessment enabled teachers to classify students into levels (high, medium, low), as explained by [17]. This grouping ensures that each student receives appropriate intervention, thereby addressing the fundamental issue of differing learning paces among students, as highlighted by [15].

Findings from [18] are also relevant, demonstrating the effectiveness of the TaRL approach in improving student learning outcomes. The test results indicate that pretest scores prior to the implementation of TaRL showed a significant increase in the posttest. Specifically, the study reported improvements in both the lowest and highest achievement scores following the implementation of TaRL. Furthermore, the results of study [19] likewise concluded that the TaRL approach is effective in enhancing learning outcomes. This approach facilitates the development of numeracy skills by aligning instruction with students' levels of understanding and encouraging active participation during the learning process. These findings confirm that the implementation of the TaRL approach has a positive and significant effect on students' cognitive achievement, particularly in mathematics.

CONCLUSION

The overall conclusion of this study is that the TaRL approach meets all established effectiveness criteria and demonstrates a statistically

significant difference in learning outcomes. The experimental class achieved an average score of 81.800, exceeding the KKTP (≥ 75), with classical mastery attained and supported by predominantly Very Positive student responses (average of 82%). Furthermore, there is a clear difference compared to the learning outcomes under the direct instruction model, with the control class average recorded at 71.480. The t-test results show that $t_{\text{calculated}} = 3,619 > t_{\text{table}} = 2,011$ leading to the rejection of H_0 and acceptance of H_1 . This indicates that the TaRL approach is statistically significantly more effective than direct instruction, particularly in the topic of Relations and Functions at SMP Negeri 5 Manado.

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