The Influence of the Integrated TaRL Approach of Fun Multiplication Table Games on Problem Solving Skills in Multiplication Material of Grade III Elementary School Students

Bagas Satrio Kusumawardhana[1], Yuniawatika[2*], Surayanah[3]

[1,2,3]Malang State University

[1.2.3]Primary and Preschool Education, Malang, Indonesia
*email: yuniawatika.fip@um.ac.id

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Abstract
Mathematics lessons in elementary schools are aimed at improving students' problem-solving skills, both in mathematics and other matters that apply mathematics in their solutions. This study aims to see the effect of students' problem-solving skills that apply the TaRL approach integrated with the Fun Multiplication Table Application on multiplication material for grade III elementary schools. The subjects of the study were students of class 3B at Kepanjenlor 2 Elementary School, Blitar City with a population of 25 students consisting of 13 male students and 12 female students.. Based on the results of the Parametric Statistical Test of the Independent Sample T-Test, the sig. 2-tailed value was found to be 0.003, which means 0.003 ≤ 0.05, then it can be converted that Ha is accepted and H0 is rejected, which indicates the influence of the integrated TaRL approach of the Fun Multiplication Table Application on the ability to solve problems in the multiplication material of grade III elementary schools..

1. Introduction

Mathematics lessons are an effort to help students construct mathematical designs through their own abilities, with internalization stages so that mathematical ideas will be built through their own abilities (Nurhana Friantini & Winata, 2019). Improving students' skills in solving problems, both in mathematics and in matters related to routine, is the goal of mathematics lessons (Malikah & Winarti, 2022). This is in accordance with the characteristics of the elements of the mathematical problem-solving process in the mathematics subject which are related to how students apply and adapt various effective strategies in questions which include the construction and reconstruction of mathematical problem solving through problem solving (Kepa, 2019).

Problem solving skills are students' skills in solving problems and applying them in daily activities (Sapoetra & Hardini, 2020). One of the main skills developed in elementary school is problem solving. According to the Regulation of the Minister of Education and Culture Number 58 of 2014, the subject of mathematics has the expectation that students : (1) understand mathematical ideas; (2) solve problems; (3) apply logical mathematical thinking; (4) relate problems sequentially; and (5) have attitudes and behaviors that are in line with the values in mathematics. National Council of Teachers of Mathematics (Maesari & Marta, 2019) describes the purpose of mathematics lessons which consist of five basic mathematical skills that serve as supports, namely problem solving, logical thinking and evidence, networks, communication, and representation.

Problem solving is an important focus in mathematics lessons, according to Cocroft's statement (Maesari & Marta, 2019) convey students should learn mathematics because, (1) it is useful for aspects of life; (2) all domains require appropriate mathematics; 3) it is a powerful, concise and clear communication tool; (4) it presents information in a variety of techniques; (5) it improves logical thinking skills, accuracy, and spatial awareness; and (6) it is satisfying to solve problems. The argument is strengthened by the National Council of Supervisors of Mathematics (NCSM, 1977) that learning to solve problems is the main alibi for studying mathematics and the National Council of Teachers of Mathematics (NCTM, 1980) states that problem solving should be the focus of the curriculum (Mulyati, 2021).

PISA Results 2022 (OECD, 2024) stated that Indonesia rose by 5 rankings in terms of mathematical ability. Indonesia is at a score of 366, getting 106 points from the world average. The results show that the abilities of students in Indonesia, including problem-solving abilities, remain at average values and there are no significant changes.

Mastering multiplication operations does not only mean being good at counting, students are also required to have the ability to do tasks related to multiplication operations. A person's ability to solve problems is very important, because it will later be applied to daily activities. Problem solving skills are students' efforts to implement the skills and knowledge they have in order to find a solution to a mathematical problem (Rahmawati et al., 2022). Basically, multiplication is not easy material, but rather part of the difficult material, the argument is strengthened (Sagita dkk., 2023) that multiplication is a subject that is difficult for some elementary school students to understand. Lack of conceptual understanding is an obstacle for students to learn multiplication. Weak problem-solving skills can affect students in solving their problems.

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Based on the results of interviews with class III teachers, there is a lack of students' ability to solve problems and a lack of students' understanding of the concept of multiplication operations. This happens because one of the factors that influences students is the external aspect.. External factors are aspects of the school environment due to teacher skills in providing learning concepts that tend to be conventional and the absence of digital learning media in implementing learning in the classroom. Learning media is an external aspect that makes it difficult for students to solve problems. Khasanah stated that creative and innovative learning media are the key to successful lessons in the classroom (Khasanah, 2023). There is a learning media in the form of the "Fun Multiplication Table" application which provides games in the form of animations about multiplication.

This game focuses on students being able to solve multiplication problems in each column by paying attention to the available storyline.. Regarding the levels in this game, they vary according to the students' needs. There are 2 levels available in this fun multiplication table game, namely multiplication table level 10 and multiplication table level 12. This is in line with the multiplication material for grade 3 of elementary school which still reaches the 10 multiplication table. Seeing that each student has a different level of problem-solving skills from other students, the right approach for this "Fun Multiplication Table" application is the TaRL approach.

The TaRL approach is a strategy that is not based on class level but on student skills. The goal is to provide increased skills and knowledge for students in the fields of literacy and numeracy. Implementation of the TaRL strategy, there are 4 syntaxes carried out according to learning objectives (Juwono & Sucahyo, 2023) namely assessment, grouping, basic pedagogical skills, and mentoring & monitoring. Seeing the aim of the TaRL approach which focuses on the level of student ability, this is in line with the vision of the approach in the "Fun Multiplication Table" application, namely using intelligent adaptive algorithms to improve memorization. In addition, this game works according to the students' abilities at the previous level in mastering the available questions, and the percentage of errors is explained so that students understand the concept of solving questions at each level. So, if the TaRL approach is integrated with the Fun Multiplication Table Application, it can be implemented effectively when viewed from the objectives of each variable.

Previous research focused on problem-based learning models integrated with the TaRL approach, the aim of which was to see problem-solving skills without using the "Fun Multiplication

Table" application. Given this background, the research produced a TaRL approach integrated with the Fun Multiplication Table Application to observe improvements in problem-solving skills.

2. Method

The type of research applies descriptive research. This type of descriptive research is a form of depiction, explanation and description of each variable to be studied in the form of sentences (Asri & Julisman, 2022). The research approach applies a quantitative approach, data collection mechanisms, data analysis, as well as data presentation and the results obtained in the form of numbers (Jayusman & Shavab, 2020). The research design applies Quasi Experiment or pseudo-experiment in the form of Non-Equivalent Control Group. The following is the research design plan.

Table 1. Research Design Plan

Group	Pre - Test	Treatment	Post Test
Eksperimen	O1	X1	O2
Kontrol	O1	X2	O2

Information:

O1 : Pre - test
O2 : Post – Test
X1 : Treatment of applying the TaRL approach to the integration of Fun Multiplication Table Applications
X2 : Treatment using a contextual approach

The purpose of giving a pre-test is to find out the students' initial skills in multiplication material. After giving a pre-test to each class, there were differences in treatment, the experimental class of learning was carried out by applying the TaRL approach which was integrated with the fun multiplication table game application, while the control class used multiplication table media that was not yet technology-based.

After the two treatments were carried out, at the end of the study, students were again given a post-test to determine the differences in the results of the influence of learning using the integrated TaRL approach with the fun multiplication table application that had been provided. The population of class III B students at SDN Kepanjenlor 2, Blitar City was 25 students, consisting of 13 male students and 12 female students. Saturated sampling is a sample collection technique because this study uses all class III B students as samples.

Activities carried out to collect data include interviews, problem-solving ability tests, and documentation. The first step is to conduct interviews with class teachers regarding obstacles in the classroom, especially in mathematics.

Table 2. Interview Sheet Grid

No.	Indicator	Question Items
1.	Mathematics Learning	a. How are the learning conditions in grade 3?
2.	Learning Approach	a. What learning approaches do teachers usually apply to mathematics lessons? b. Is the learning approach used able to make students active in class?

3.	Instructional Media	a.	What facilities support mathematics learning??
		b.	Are there any tools used in the material on multiplication arithmetic operations? If so, what media is used in the multiplication arithmetic operations material?
		c.	Is the media used considered capable of developing students' problem-solving skills in the material on multiplication operations?
4.	Material in Mathematics Subjects	a.	Are there any problems with mathematics learning materials?
		b.	What material in mathematics subjects is difficult for students to understand?
5.	Multiplication Arithmetic Operation Material	a.	What problems have you encountered while teaching multiplication arithmetic operations to grade III?
		b.	What is your solution to this problem?
		c.	Are there any obstacles in the material of multiplication
		d.	arithmetic operations? If so, what are the factors of the obstacles?
6.	Evaluation	a.	What assessments are given to students in mathematics lessons on multiplication operations?
		b.	What abilities are assessed from learning the material on multiplication arithmetic operations?
7.	Problem Solving Skills	a.	What problem-solving skills do third grade students have as far as you understand as a teacher?

In the second step, after finding the existing problems, carry out a problem-solving skills test to understand and measure students' skills in solving problems. The existence of this test sheet is also to determine whether or not there is an influence of the integrated TaRL approach with the Fun Multiplication Table Game on problem-solving abilities. In the third step, carry out documentation that aims to support the results of the accuracy of the data carried out from the beginning of the research to the end of the research.

All data has been collected, the first stage is to conduct statistical analysis. Interview data is described descriptively, while test data is analyzed descriptively, quantitatively, and inferentially with the help of the IBM SPSS Statistics Version 25 application. Data analysis used two statistical analyses,

(1) descriptive statistical analysis using the N-Gain Score Test, with the following N-Gain criteria guidelines.

Table 3. N - Gain Score Criteria

Percentage (%)	Interpretation
<40	Ineffective
40 - 55	Less Effective
56 - 75	Quite Effective
>76	Effective

(2) Inferential statistical analysis, before carrying out the hypothesis test, first carry out the prerequisite test for normality and homogeneity to determine the appropriate statistical test for the research. The implementation of the prerequisite test is a requirement for conducting parametric statistical tests. Because the requirement for conducting parametric statistical tests requires data that is normally distributed and whose variance is homogeneous, so it requires two prerequisite tests, namely the normality and homogeneity tests.

The prerequisite test has been declared passed, then the next step is to proceed to the parametric statistical test using the Independent Sample T-Test. The Independent Sample T-Test is used to determine the mean of two unpaired copies. This statistical test is conducted to determine the effect of variable x on variable y with a significance level value of 0.000 <0.05. The following is the hypothesis presented.

H_0 : There is no influence of the integrated TaRL approach of the Fun Multiplication Table Game on problem-solving skills in multiplication material for grade III Elementary Schools.

H_a : There is an influence of the integrated TaRL approach of the Fun Multiplication Table Game

on problem-solving skills in multiplication material for grade III Elementary Schools

3. Results and Discussion

Problem solving skills test has been conducted, namely at the Pre-Test and Post-Test. The first step is to carry out a normality test to see whether the data is normally distributed or not. The number of copies is less than 50, so the Shapiro Wilk Test is applied. The level of significance used is 0,05 or 5%, procedural aspects in the education sector. The criteria are if the sig. <0,05 then the data of the subjects and experimental classes are not normally distributed. However, if the sig. ≥ 0,05 then the data of the subjects and experimental classes are normally distributed.

Table 4. Normality Test Result

Statistical Tests	Class	Sig.	Decision
Shapiro Wilk	Pre – Test Eksperimen	0.218	Normal
	Post – Test Eksperimen	0,101	Normal

Table 4. states the sig value produced. in the Pre-Test Experiment class is 0,218. The sig value. 0,218 ≥ 0,05, indicates that the data is normally distributed. Then, the sig value produced. in the Post- Test Experiment is 0,101. The sig value. 0,101 ≥ 0.05, indicates that the data is normally distributed.

The data is declared normal, the next step is to carry out the Homogeneity Test. The purpose of carrying out the homogeneity test is to find out whether the data has homogeneous variance or not. The data is tested using the Lavene Test or F Test with a confidence level of 0,05 or 5%. The benchmark for homogeneity testing is if sig. <0,05, the subject data and experimental class do not have homogeneous variance. Meanwhile, if the sig. ≥ 0,05, the results of the subjects and experimental classes have homogeneous variance.

Table 5. Homogenity Test Result

Statistical Tests	Sig.	Decision
Lavene (Based on Mean)	0,165	Homogen

Table 5. Lavene (based on the mean) produces a sig. value of 0,165, which means that the sig. value of 0,165 ≥ 0.05 means that the data has a homogeneous variance. The data has been normally distributed and the variance is homogeneous, so the next step is to carry out a descriptive statistical analysis test, namely by looking at the value of the N-Gain test results. The purpose of implementing the N-Gain Test is to determine the effect of the integrated TaRL Approach with the Fun Multiplication Table Application on problem-solving skills in the multiplication material of grade III elementary school.

Table 6. N - Gain Test Result

Class	Average	Minimal	Maximal	Category
Experiment	78,22	58	100	Effective

The next step is to conduct an Inferential Statistical Test by applying the Parametric Independent Sample T-Test. Decision making is based on the sig. 2 tailed ≤ 0.05, Ha is accepted and H0 is rejected, it is found that the effect of the integrated TaRL Approach of the Fun Multiplication Table Application on problem-solving skills in the multiplication material of grade III elementary school. If the sig. 2 tailed ≥ 0.05, H_a is rejected and H_0 is accepted, so there is no effect of the integrated TaRL Approach of the Fun Multiplication Table Application on problem-solving skills in the multiplication material of grade III elementary school.

Table 7. Parametric Statistical Test Result Independent Sample T - Test

Statistical Tests	Sig. 2 Tailed	Decision

Independent Sample T - Test	0,003	There is an influence of the integrated TaRL approach of the Fun Multiplication Table Application on problem-solving skills in the multiplication material of grade III elementary school students.

Based on the results of hypothesis testing using the Independent Sample T-Test in Table 7. the sig. 2 Tailed value is 0.003, this result shows 0.003 ≤ 0.05 meaning that Ha is accepted and H0 is rejected. If Ha is accepted, it is stated that the influence of the integrated TaRL approach of the Fun Multiplication Table Application

3.1. Results and Discussion 2

Teaching at the Right Level or TaRL is a strategy that is not based on class level, but focuses on student skills (Listyaningsih et al., 2023). The TaRL approach aims to provide increased skills and knowledge of students in literacy and numeracy. In implementing the TaRL approach, there are 4 syntaxes that need to be implemented, namely assessment, grouping, basic skills pedagogy, and mentoring & monitoring.

This game application called the Fun Multiplication Table is a mobile game that contains missions or tasks that must be completed to complete the story or game script. There are levels or levels in each mission, making it easier for teachers to see children's abilities in multiplication material and how to solve problems using multiplication. This game also provides an explanation or description of the understanding of the concept of multiplication for each mission that is carried out if students misunderstand the questions at their level. Thus, students understand the concept of multiplication more deeply.

The observation results show that students' understanding has increased regarding the arithmetic operations of whole numbers up to 100 by using the Fun Multiplication Table Application which has levels according to students' abilities. The argument is strengthened from (Muhsin, 2023) which states that playing or toys that children like can be applied to develop children's knowledge. Not only that, during learning with the TaRL approach integrated with the Fun Multiplication Table Application, students are more active in their groups, students are more comfortable expressing their opinions if students are at the same level of ability, so that active and enjoyable learning conditions are created. This is in line with Arief S. Sadiman's statement in (Muhsin, 2023) saying that learning becomes flexible, fun, and students are more active in learning are the advantages of implementing games in learning.

The problem solving skill indicators used are (1) understanding the problem; (2) planning problem solving; (3) solving the problem according to plan; (4) checking the accuracy of the results or answers. This is in accordance with Polya's problem solving skill syntax (Rosita, 2019) namely (1) understanding the problem which includes: analyzing known elements, elements that are questioned, examining the adequacy of these elements to solve the problem; (2) connecting known and questioned elements and formulating them in the form of a mathematical model of the problem; (3) designing a solution strategy, elaborating, and carrying out calculations or completing the mathematical model; (4) interpreting the results and reviewing the correctness of the solution.

The TaRL approach is integrated with the Fun Multiplication Table Application to improve students' problem-solving skills better than contextual learning. This is because in the TaRL approach there is a grouping syntax where by grouping students in the experimental class, students are placed in groups according to their level of ability. The groups are divided according to their level of ability, including low, medium and high. This group division aims to improve students' skills and knowledge regarding literacy and numeracy (Fitriani, 2022).

The purpose of dividing groups based on level is so that students with medium or low abilities can discuss and work without feeling awkward or inferior (Endang Lestari et al., 2024) provides reinforcement of the argument, students with high abilities will work on student worksheets while students with medium or low abilities only look at them without participating in working on and discussing them.

The results obtained when students are divided into groups according to their abilities can form students who are more active and work together in working on student worksheets. During the research conducted for three consecutive days, there was quite good student development. At the first meeting, the high-ability group actively worked together independently, although occasionally asking questions related to working on student worksheets. However, at the second and third meetings, students in the high-ability group were able to work together independently actively.

The group of students with moderate abilities at the first and second meetings still received routine guidance regarding the completion of student worksheets and several students were seen actively working on student worksheets. At the third meeting, the group of students with moderate abilities were able to work together actively independently and even solve problems by discussing with each other. The group of students with low abilities at the first meeting still received intensive guidance because their group mates were still awkward and confused in completing student worksheets. Therefore, intensive guidance is needed so that the low-ability student group can understand the technical aspects of working on student worksheets and how to solve problems on the worksheets, and group members have helped each other and collaborated in completing the worksheets. At the third meeting, the low-ability student group was able to collaborate with each member of their group and was seen actively discussing to solve problems. Occasionally, students asked questions about how to solve problems that they found difficult.

Based on the results that have been presented, the existence of group division or syntax of the TaRL approach, namely grouping, students are grouped based on student skills, namely low, medium and high, can indirectly make students active and increase their self-confidence in expressing their opinions. The argument is strengthened from (Azzahra et al., 2024) said, the implementation of TaRL can encourage active student involvement during the learning process by providing facilities that allow students to participate in learning activities. Students' enthusiasm in solving problems increased, as seen from the increasingly good discussion results (Okta et al., 2025). Students feel happy during the learning process because students are grouped according to their ability phase and students enjoy working with their groups so they can complete the tasks given. In line with the statement (Ningrum et al., 2023) which conveys that students feel happy during the learning process because students are grouped according to their level of ability and students enjoy working together with their groups to complete the tasks given.

Students follow the learning well, are active, confident, and can work together (Okta et al., 2025). This happens because during learning, students receive material that is appropriate to their respective skill levels (Yusuf et al., 2024). With these adjustments, students feel more comfortable and motivated to learn. Students also actively ask their peers or teachers during learning. This can help them solve problems and strengthen their confidence to express opinions (Mangesthi et al., 2023; Pebriyanti et al., 2023)

Students are actively involved in discussions with their groups, students appear to be actively solving problems in groups when working on student worksheets. This is because the TaRL approach, especially in the grouping section, makes students active and student-centered so that it can develop students' cognitive abilities (Ningrum et al., 2023). Students are more active in learning if the learning is student-centered (Ningrum et al., 2023;Suharyani et al., 2023). By increasing students' cognitive abilities, learning outcomes will increase, which will have an impact on students' learning motivation (Rahma et al., 2024). Motivational factors also play an important role in encouraging students to solve problems and foster a high intention to learn independently (Patunah & Herman, 2025). Students become motivated and work together to complete the tasks given cooperatively because the students have been grouped according to their respective ability levels (Imah et al., 2022;Ningrum et al., 2023). Not only that, diverse learning makes classes more varied by giving students the opportunity to access materials, think critically about ideas, and improve their own performance to be more efficient (Susila & Aryasuari, 2023).

The facilities provided are in the form of a fun multiplication table application that makes students happy in carrying out learning without feeling burdened by the word "mathematics" in it. During the research conducted for three days, students were very happy in carrying out learning that was integrated with games. Indirectly, this game stimulates students to be able to think critically

about solving problems that students must face in order to move up to the next level. Even though the level is getting higher, students remain challenged and happy to complete each mission. argument (Anjani, 2024) said that the TaRL approach and digital-based learning also open up opportunities to improve thinking skills and problem-solving skills that will be valuable capital for students to face future challenges. The learning approach not only encourages the creation of more active, collaborative, and relevant learning to the needs of the times, but also meets the criteria to help students improve their problem-solving skills (Patunah & Herman, 2025).

Overall, students' experiences during learning using the TaRL approach showed significant improvements (Yusuf et al., 2024). Adapting materials to individual abilities and a student-centered learning approach have a positive impact on students' problem-solving skills (Ahyar et al., 2022;Jauhari et al., 2023). The TaRL approach can be a solution to the learning approach to overcome the problem of gaps in understanding during classroom learning (Ahyar et al., 2022;Pebriyanti et al., 2023;Sanisah et al., 2023).

3.2. Conclusion

The TaRL approach integrated with the Fun Multiplication Table Application has been proven to be able to improve mathematical problem-solving skills in the multiplication material of grade III elementary school. This is proven by the Parametric Statistical Test Independent Sample T-Test, finding a sig. 2-Tailed value of 0,003 which means 0,003 ≤ 0.05. This means, Ha is accepted and H0 is rejected, so the application of the TaRL approach integrated with the Fun Multiplication Table Application has an effect on problem-solving skills in the multiplication material of grade III elementary school.

The TaRL approach is integrated with the Fun Multiplication Table Application and also increases students' activity and self-confidence. This is because students are grouped based on their ability levels so that students are more comfortable in discussing. The growth of student activity can improve students' cognitive abilities which have a positive impact on students' learning motivation.

This study has limitations in the analysis related to the influence of the integrated TaRL approach with the Fun Multiplication Table Application on problem-solving skills in elementary school grade III multiplication material. Of course, there are shortcomings in the implementation of this study. The disadvantage of this study is that not all elementary school students have personal smartphones, so some use 1 device filled by two students. Another disadvantage is that to complete the mission to the most difficult stage, the application requires users to pay $ 4 to be able to proceed to the next session. Therefore, it is hoped that subsequent research can analyze the influence of the TaRL approach on other learning media, both digital and non-digital, which do not involve paid features in them, as well as other subjects with focus indicators according to the needs of further research

Author Contributions

Bagas Satrio Kusumawardhana: Conceptualization, Methodology, Software, Data Curation, Writing, Investigation. Yuniawatika: Reviewing, Editing, Visualization, Mentoring. Surayanah: Reviewing, Editing, Visualization, Mentoring.

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