Research Article

# Development of Understanding the Concept of Opportunity Through Kulibia Game with Teaching at the Right Level (TaRL) Approach

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**Abstract.**
Learning mathematics with a mechanistic approach results in being difficult for students to understand. Opportunity, as one of the mathematics contents, requires a learning process, which involves hands-on activities in teaching. Students were grouped according to their abilities based on the differences in students' understanding through diagnostic assessment in the concept of differentiated learning, and through differentiation of content. Teaching at the right level (TaRL) is a differentiated learning technique, considered appropriate, to be applied in an effort to control student activities by utilizing Kulibia media as a learning context. Kulibia is one of the marine biota usually found by people on the coast and is used as one of the traditional games for children in Maluku. Through this game, students' understanding of the concept of chance can be developed. The participants of this study were 8th grade students in Phase D, a total of 28 students. The data analysis technique used was one sample mean difference test. The results of data analysis prove that H0 is accepted meaning that the average understanding of the concept of chance exceeds the minimum completeness criteria of 70. Analysis of understanding shows that high-group students have a better understanding than students in other groups.

**Keywords:** comprehension, Kulibia, TaRL, differentiated learning

## 1. Introduction

Mathematics is one of the sciences that has an abstract object of study, so what if taught formally will be difficult for students to understand [1,2]. Formal learning proves that the mathematical material learned by students is not in sync with what is experienced daily, meaning that they do not find the benefits of mathematics in everyday life. The teaching of mathematics in schools is too formal so that the mathematics that students find in everyday life is sometimes different from what they find in school [3].

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Abstract mathematical objects need to be introduced to children through context as their daily activities. Understanding the context related to mathematics will provide motivation for children in learning mathematics. Students will be motivated and interested in learning mathematics if learning begins with the use of context [4]. This directs them that math is a human activity and math provides benefits in various aspects. Therefore, teachers as learning designers need to know the connection between mathematics content and children's daily contexts.

Teachers can carry out several activities that can increase children's motivation in learning mathematics through the use of context, including, (1) providing examples of real problems around children that show the benefits of mathematics, (2) using appropriate learning methods, techniques and approaches according to the content or topic being taught, (3) using variations in the use of these methods, techniques and approaches in learning [5,6].

One of the contexts that teachers can use in teaching mathematics is traditional games where game activities simultaneously provide knowledge and understanding of local culture and wisdom. Traditional games or often called traditional sports are types of folk games that grow and develop in a particular community, passed down from generation to generation [7]. One of the benefits of traditional games is to sharpen the ability of motoric and cognitive [8,9].

*Kulibia* as a traditional game has a form that can be used for learning opportunities. The *kulibia* game uses one ball and 6 or more clam shells or called *kulibia*. Children playing *kulibia* can find the number of open and closed *kulibia*. This is related to the probability of the kulibia being open and the kulibia being unopened.

In addition to using the traditional player approach, in learning, students are also placed according to their abilities through diagnostic assessments. By paying attention to differences in knowledge, the teacher groups children according to their abilities, making it easier to provide scaffolding for children.

Learning that accommodates learners' abilities is known as the Teaching at the Right Level (TaRL) learning approach [10]. This approach aims to ensure that students understand the material taught because it focuses on the individual needs of students and adjusts learning according to their level of understanding. TaRL is a learner-oriented approach so that learning is carried out according to the abilities of students, not based on age or grade level [11,12]. This approach groups learners according to their interests and aptitudes for the material and focuses on learners' needs, which are identified through an initial test or diagnostic test. This test can be used as information to group learners according to their skills.

The implementation of the TaRL approach used by teachers begins with conducting diagnostic tests on students so that teachers can find out the character and abilities of students, so that teachers can determine the development of abilities that must be possessed by students.12 The problems studied in this study are: How is the understanding of the concept of chance through kulibia game with Teaching at the Right Level (TaRL) approach.

## 2. Research Methods

This research uses mixed methods, namely a mixture of quantitative methods and qualitative methods. Quantitative methods are used to test hypotheses and qualitative methods are used to describe the verbal representation of students' thinking processes in completing LKPD and tests. The results of the LKPD analysis were carried out based on the results of the initial diagnostic test to see the grouping of the readiness of the research sample of 29 students. The results of the diagnostic test are the basis for grouping subjects into 3 categories of learning readiness, namely those who are considered advanced and ready to learn (advanced group), those who are ready to learn (advanced group) and those who are not ready (group that needs guidance). There were 5 discussion groups, namely 1 very proficient group, 3 proficient groups and 1 group needing guidance. The hypothesis proposed is: learners' understanding of the concept of chance is less than the minimum completeness criteria of 70. This hypothesis was tested using t test analysis for one sample. LKPD data and students' test results were analyzed based on learning styles and readiness levels through the content analysis method.

The steps in conducting this research are:(1) Students conduct kulibia game experiments in groups and write the results in the table provided by the teacher, (2) Determine the relative frequency of the appearance of 3 open kulibia, (3) Draw the results on the graph and, (4) Summarize the relative frequency formula in their own words.

## 3. Results and Discussion

a. Data on Hypothesis Testing results.

Based on the results of the test of understanding the concept of chance and relative frequency after the use of kulibia games in learning with the TaRL approach, the hypothesis tested is that the average understanding of students of chance and probability material through kulibia games with the TaRL approach exceeds the minimum

mathematics completeness criteria. To prove the truth of this hypothesis, a test was conducted on 29 students and it was found that the lowest score was 5 and the highest score was 100.

From the calculation of the average test results, the mean score is 37.5 and the standard deviation is 40.15. The minimum completeness criterion used as the average population value is 70. The results of hypothesis testing are based on a one-sample t test [13].

The formula in question is :

$$t = \frac{\overline{x} - \mu_0}{s/\sqrt{n}}.$$

By substituting the values of s = 40.15, x̄ = 37.5 and $\mu\_0$ = 70, the calculated t value is obtained:

$$t = \frac{\overline{37,6} - 60}{40,2/\sqrt{29}} = -3,9$$

At the 5% significance level with db = 29, the t table value is -2.9. Based on the criteria for hypothesis testing, H0 is rejected because the calculated t value is outside the hypothesis acceptance area, meaning that the average understanding of students of the concept of chance and relative frequency by using the quibia game with the TaRL approach is below the minimum completeness criteria. If confirmed, the average value of the test results with the PAP conversion table obtained a value of 37.5 is in the low category, meaning that students' understanding of the concept of chance is in the low category.

b. Data from the completion of the Learner Worksheet.

Group 1 (Highly prepared group).

This group consisted of 5 members with 2 visual learning styles, 2 auditory learning styles and 1 kinaesthetic learning style. The group's work showed that they were wrong in determining the relative frequency, they wrote the number of games or *kulibia* throws divided by the number of 3 open *kulibia* and they could not draw a graph.

Here are the results of group 1's work.

Based on the results of individual work, it turned out that none of the members answered the questions correctly, even though their group work was generally correct.

Group 2 (Advanced Group)

This group consists of 5 members, 1 of whom has a kinesthetic learning style and the other 4 have a visual learning style. The results of the group work showed that: (1)

Figure 1: Group activity results Very Ready (Highly Proficient).

they can correctly determine the result of the calculation of the relative frequency of the emergence of 3 open kulibia from 5 times the game, (2) can correctly conclude the probability formula and relative frequency, but cannot draw the graph. The following are the results of the work of group 1. From the scores obtained, the average score of this group is 85, which is in the high category

From the results of the individual test analysis, it can be seen that on average this group can understand the concept of chance and relative frequency. This can be seen from their average individual score of 58 which is dominated by children with visual learning styles. Here are the results of the work of 2 group members.

Group 3 (Group that needs guidance).

This group consists of 6 members, 1 of whom has a kinesthetic learning style and 2 others have an Auditory learning style and 3 have a visual learning style. The results of the group work showed that: (1) they could not correctly determine the result of the calculation of the relative frequency of the appearance of 3 open kulibia from 5 times

Figure 2: Activity results in the Advanced group.



Figure 3: Results of individual activities in the Advanced group.

the game, Determining the value of the frequency is done by dividing the number of kulibia games with the frequency of the appearance of 3 open kulibia in 5 throws. (2) can correctly deduce the relative frequency formula, but cannot deduce the definition of probability, (3) can draw a graph but the graph does not match the data obtained.

From the scores obtained, the average score of this group is 35, which is in the medium category.

Here are the results of group 3's work.



1. Cobalah melakukan permainan kulibia dengan menggenggam 6 kulibia kemudian melepaskannya ke atas meja.
2. Perhatikan dan hitunglah berapa banyak kemunculan 3 kulibia dengan posisi terbuka sebanyak 5 kali pelemparan.
3. Isilah tabel di bawah ini berdasarkan hasil pengamatan kamu dan perhatikan juga banyak pelemparan yang diminta.

| Banyak lemparan kulibia | 5 | 8 | 10 | 12 | 15 |
|---|---|---|---|---|---|
| Banyaknya muncul 3 kulibia terbuka | 3 | 4 | 4 | 5 | 6 |

4. Selidikilah frekuensi relatif munculnya 3 kulibia terbuka dalam setiap kali pelemparan berdasarkan tabel di atas.

$$(\text{Frekuensi Relatif Muncul 3 Kulibia Terbuka}) = \frac{(\text{Banyaknya muncul 3 kulibia terbuka})}{(\text{Banyaknya percobaan melempar kulibia})}$$

| Banyak lemparan kulibia | 5 | 8 | 10 | 12 | 15 |
|---|---|---|---|---|---|
| Banyaknya muncul 3 kulibia terbuka | 3 | 4 | 4 | 5 | 6 |
| Frekuensi relatif 3 kulibia terbuka | 1,6 | 2 | 2,5 | 2,4 | 2,5 |

5. Gambarkan grafik hasil percobaan tersebut dengan memperhatikan contoh pada buku cetak Matematika halaman 174.
6. Sajikanlah hasil pekerjaan pada bagian (4) dan (5) pada media yang telah diberikan oleh guru dengan kreatif dan menarik.

Percobaan yang telah kamu lakukan adalah contoh penerapan konsep peluang dalam kehidupan sehari-hari. Apakah yang dapat kamu simpulkan dari materi ini?

**Kesimpulan:**

Rumus Frekuensi Relatif adalah (Banyaknya muncul 3 kulibia terbuka) / (Banyaknya percobaan melempar kulibia)

Peluang adalah _____

**Figure** 4: Results Groups that need guidance.

From the results of the individual test analysis, it can be seen that on average this group cannot understand the concept of chance and relative frequency, but the results of individual work have 2 children with visual learning styles having the highest score while the lowest score is for auditory children. In general, the average score of this group is 47.5 above the average score but below the KKM score. Here are the results of the work of 2 learners

Group 4 (Advanced Group).

This group consists of 4 members, of which 2 have kinesthetic learning styles and 2 others have visual learning styles. The results of group work show that (1) the group can determine the value of frequency, can determine the relative frequency formula but cannot formulate the definition of odds and cannot draw a graph. From the work
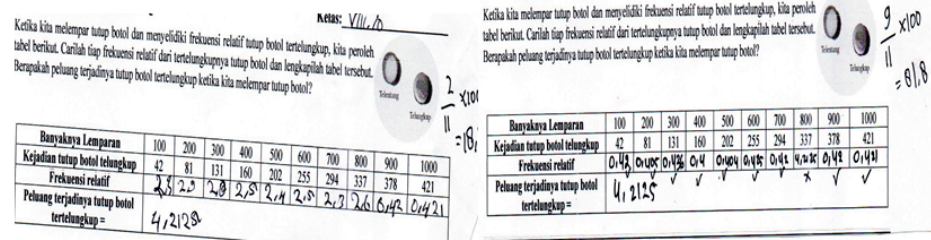
**Figure** 5: Individual test work of 2 group members with learning readiness who need guidance.

of group 3, it can be seen that from 5 times the kulibia game they can determine the relative frequency correctly but not draw the graph properly.

Here are the results of group 3's work.
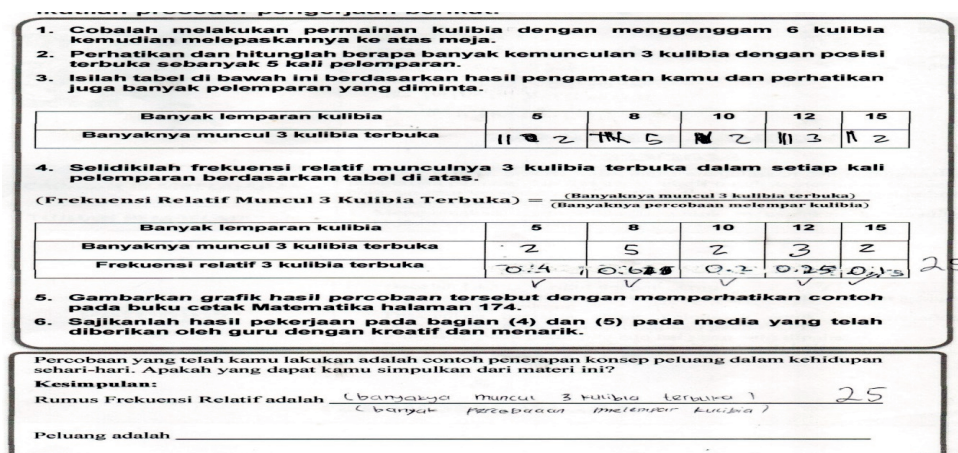


**Figure** 6: Individual test work which 2 have kinesthetic and 2 visual learning styles.

From the results of the individual test analysis, it can be seen that on average this group can understand the concept of chance and relative frequency, but the results of individual work show that there are 2 children with visual learning styles who have the highest scores while the scores around the average value are dominated by children with kinesthetic learning styles. In general, the average score of this group is 60 above the average score but below the KKM score. Here are the results of the work of 2 learners.

Group 5 (Advanced Group)

This group of 4 consisted of 3 people with visual learning styles and 1 person with auditory learning styles.

From the discussion, it can be seen that they understand the concept of relative frequency. Another interesting thing is that they tried to show their understanding in their own words of the concept of chance although not very precise. They also tried to write the formula symbolically although it was not precise.
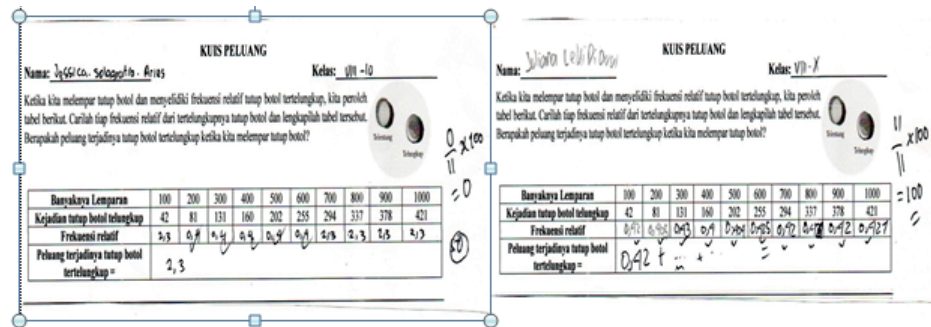
**Figure** 7: Individual work who have the highest scores.
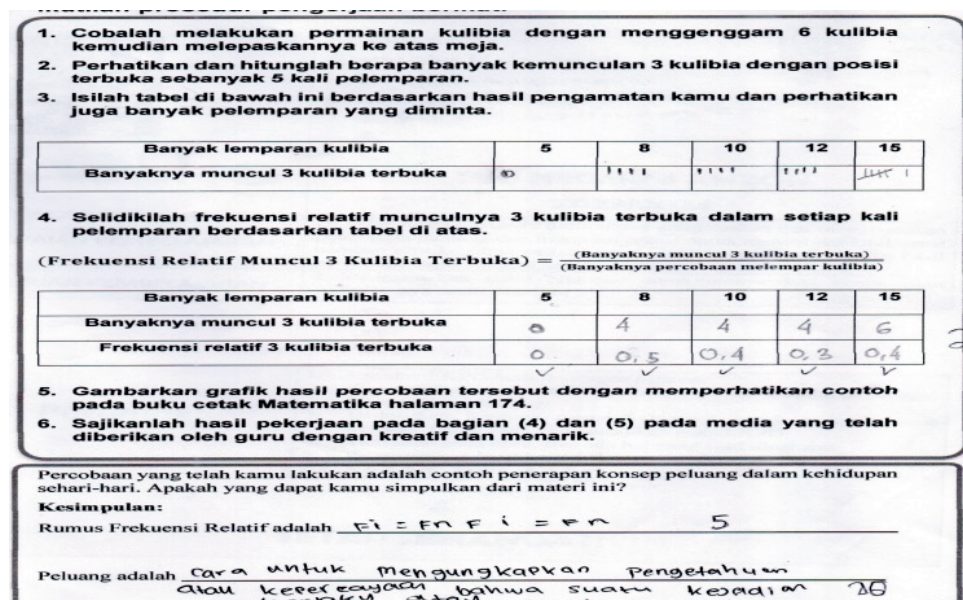


**Figure** 8: Individual test work which 3 have visual and 1 auditory learning styles.

The individual test results showed that this group understood the concepts of chance and relative frequency through kulibia game. This can be seen from the average test results of the four members is 73, above average and above the KKM. Here are the test results of 2 group members
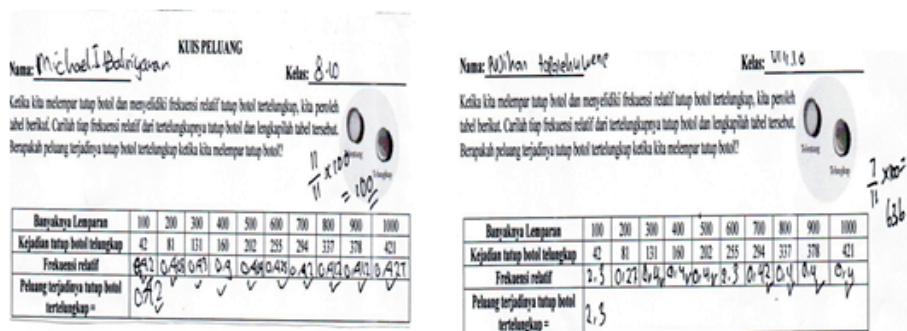


**Figure** 9: The average test results of the group.

# 4. Discussion

The rejection of the hypothesis shows that the average understanding of students on the concept of chance and relative frequency by using kulibia game with TaRL approach is below the minimum standard criteria.

The average learning outcomes that are below the minimum completeness criteria indicate that students' mastery of the content studied is not good. The standard deviation data shows that there is a lot of variation in the test scores. This can be seen from the wide range of values from 5 to 100 which shows the variation of data away from the average value. The distribution of the data shows that the data variation is diverse, meaning that the greater the standard deviation, the more diverse the values on the test results. The higher the standard deviation, the wider the range of variation, on the contrary, the lower the standard deviation, the closer to the average value [14].

In addition, the results of the analysis of LKPD worksheets and individual tests, there are students in groups who are very prepared (advanced) can answer questions correctly but individually cannot answer the same questions correctly. This shows that the activities carried out in group discussions do not contribute to each individual. Group discussion is an activity of sharing information within the group to correct each other and provide input [15].

The weakness of the discussion method is that the implementation of the discussion takes quite a long time to discuss a material, and only a few students dominate the discussion.This certainly causes the information obtained is also not maximized [16,17]. Group discussions can help learners explore and interpret a topic, encourage deeper understanding of a topic and improve long-term retention [18]. In relation to learning readiness and learning styles, it can be seen that the highest scores are dominated by students who have a visual learning style with moderate learning readiness. This shows that a person's readiness and learning style affect their learning outcomes [19].

The results of data analysis showed that there were several factors that caused the rejection of the hypothesis, including factors related to the implementation of the learning process and learning outcomes, including the use of the kulibia context and the TaRL approach that was not optimal. These factors include, among others, the factor of mastery of the TaRL approach by the teacher, the factor of students who are not familiar with the approach used. Not all teachers utilize the context well due to lack of knowledge about how to utilize the context and the selection of appropriate learning methods or approaches according to the content and learning concepts greatly affects the ultimate goal of using the context [20]. In addition to these factors, there are some challenges

in implementing the TaRL approach. Some of the challenges in implementing the TaRL approach include teacher, student and school readiness factors [21]. Teachers are the key to the successful implementation of various learning methods and strategies, so teachers must be able to change the learning atmosphere by actively involving students in learning [22].

In the TaRL approach teachers need to understand the characteristics of learners from the beginning to be able to group learners according to their abilities. Teachers need to encourage learners to focus, ensuring each child understands the correct basic skills through what is learned in the TaRL class. This model is more oriented towards ability level-based learning [23]. One of the weaknesses in implementing learning with the TaRL approach is controlling learners' activities.This is due to the variation of learners' readiness and learning styles, so it is not enough for subject teachers to implement it. The weakness of using the TaRL approach is that it requires more than one teacher for effective learning and good collaboration and interaction [24]. The unpreparedness of students in participating in learning and the strategies, methods and media used by teachers also contribute to the achievement of learning objectives. The non-achievement of learning objectives due to several factors such as the method used may not be in accordance with the learning style so that it has difficulty absorbing the material. In addition, the learning environment and cognitive and engagement factors also affect concept understanding.

## 5. Conclusion

Based on the discussion above, it can be concluded that the understanding of the concept of chance material using kulibia in learning with the TaRL approach has not met the minimum completeness criteria as a hypothesis testing standard. This can be caused because the instrument used to place students has not been validated properly or the learning strategy using kulibia is not carried out optimally. In addition, the placement of students according to learning readiness is not optimal so that students who are grouped in high learning readiness or very proficient in their initial knowledge cannot solve the problems given. Learning outcomes with the highest scores were dominated by learners with visual learning styles and were in the ready to learn position or advanced group. These results provide opportunities for further research by developing strategies and approaches that are more in line with the characteristics of learners.

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