The Effect Of RADEC Learning On Students' Ability To Understand Statistics Topics

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Abstract. This observation is based on the low numeracy skills reflected in the need for more student understanding of the problem and the learning strategy applied. The purpose of this observation is to see the effect of the RADEC learning model on the ability to understand statistics topicsl. This research was conducted at Pasirkareumbi elementary school with a sample of 22 students using the saturated sampling method. This quantitative observation uses an experimental method, a quasi-experimental model of one-group pretest-posttest design. This research uses a description test with statistical elements (mean, median, modus). A Normality test, homogeneity test, and paired t-test hypothesis test are used to analyze the test data. The results showed that students could understand the problem with an average score of 47.39 on the pretest, then increased to 79.78 on the posttest after applying the RADEC learning approach. There was an increase of 0.944 in the N-Gain value. The magnitude of the average N-Gain value is classified as high. This indicates effective learning or an increase in student understanding from before. With this data, applying the RADEC learning model impacts student competence in understanding statistical material.

Keywords: statistics RADEC model, learning outcomes, understanding of concept, critical thinking

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INTRODUCTION

One of the skills that students must have when learning mathematics is mathematical conceptual ability. These skills provide the foundation students need to avoid math mistakes. According to NCTM (2000), understanding mathematical concepts means understanding mathematical ideas in an integrated and functional way so that students can avoid many mistakes, including measurement errors, when solving problems. Students with a good understanding of mathematics can explain, give examples, compare, solve problems, draw conclusions, and see the relationship between mathematics and other subjects (Radiusman, 2020). Therefore, elementary school students need to understand mathematical concepts to prepare them for further learning at the next level. Many studies have been conducted on the understanding of elementary school mathematics concepts, for example (Annisah et al., 2021) the results showed that the ability of elementary school students to understand mathematical concepts weakened after the Covid-19 pandemic. The decline in understanding concepts can hinder students' mastery of mathematics and other subjects. Other research shows that students have difficulty learning math because they do not understand the basic concepts of some mathematics materials. Findings from scientific studies (Kusumaningpuri et al., 2022) show that students at the primary school level have a high error rate in answering questions related to statistics. One of the factors is that elementary school students need to understand the basic statistics concepts clearly. Not only at the elementary level a similar situation is also found at the junior high school level. Research results from Dewi et al (2020) argue that one of the reasons for the difficulty of junior high school students in solving statistics problems is their need for more understanding of the basic concepts of statistics. The findings of the previously mentioned research confirm that elementary school student's understanding of mathematical concepts has not reached an optimal level.

Elementary school students also need critical thinking skills to learn math. Supriano, who serves as the Director General of Teacher and Education Personnel (Dikjen GTK) at the Ministry

of Education and Culture, emphasized that the 4Cs, one of which is critical thinking, is very important to prepare for the 21st century (Sekertariat GTK, 2019). He stated that children need to be taught about the 4C skills, namely critical thinking, effective communication, cooperation, and creativity, and innovation. Critical thinking skills help children train to think logically and mathematically to draw conclusions and analyze various problems faced (Setiawan et al., 2021). Critical thinking skills can guide the thinking process and work activities and help recognize the relationship between material and another (Husnaeni, 2016).

Mathematics learning at the elementary level covers a variety of materials, including statistics. In the material, students face three topics: data collection, presentation, and interpretation (Syaifuddin, et al, 2018; Cahyanti, 2018). Before entering the secondary education level, students should be familiar with collecting, organizing, and displaying data. One recommended way is to provide opportunities for students to present information in various formats, such as tables, line graphs, bar graphs, and charts (Long et al., 2015). Similar concepts include things that are comparable to them (NCTM, 2000) in the performance standards for the five mathematical process standards from kindergarten through high school, there is an emphasis on expressing mathematical ideas through a variety of representations, including pictures, concrete objects, tables, graphs, symbols, displays of numbers and letters in the worksheet, and other means of presentation. According to Allen ... & Robinson (1982), the presentation method of mathematical concepts becomes an essential foundation for students to understand and use these concepts. One of the mathematical contents from kindergarten to high school launched by NCTM is data analysis and probability. Focusing on data analysis and probability requires students to ask questions, collect data, and organize and display the data needed to answer those questions. In the Indonesian curriculum, the topic of statistics is included in the grade VI semester two curriculum (Kemdikbud, 2018).

The RADEC learning model is an alternative learning model to improve the quality of learning processes and achievements (Sopandi, 2017) and the name is adjusted to the learning stages, namely Read, Answer, Discuss, Explain, and Create. Referring to the syntax of the RADEC learning model, the stages of learning mathematics data presentation material are explained as follows:

1. Read (before learning):
    a. Teacher activities: organize reading materials on data presentation accompanied by questions
    b. Student activity: reading the reading material made by the teacher and reading other sources if needed.
2. Answer (before learning):
    a. Teacher activity: ask students randomly according to the questions on the reading materials distributed earlier.
    b. Student activity: answering the questions given by the teacher.
3. Discuss:
    a. Teacher activities: making LKPD with group work format, motivating students who can solve the problem correctly to teach their friends who can't yet, motivating students who cannot or do not understand the material to ask their friends who can, ensuring communication between students, and observing which students or groups have not and have mastered the material being studied.
    b. Student activities: students discuss the answers to pre-learning questions or tasks that have been done in groups.
4. Explain/explain:
    a. Teacher activity: ensure that what is conveyed or explained by the student who plays the role of presenter is scientifically correct, ensur that other students understand the explanation given by of the presenter, motivate students to ask questions, add or refute what has been explained by presenters from other groups, and explaining the part of statistical material that has not been mastered by all students.
    b. Student activities: representative students explain the statistical material they have mastered in front of the class.

5. Create/create
    a. Teacher activities: appreciate students to create work in the form of diagrammatic presentations with the data collected, and guiding students to realize their creative ideas to make work.
    b. Student activities: discussing ideas for making diagrams with their groups, and discussing ideas for realizing the work.

In understanding the concept there are several indicators According to (NCTM, 2000) the main indicator of concept understanding is being able to present mathematical situations in different ways that are useful for different purposes. This can be indicated by the following: Knowing a concept, Combining concepts, Connecting the concept with the method used, and Providing a reason for using the concept. According to (Greene & Shorter, 2017) that made a weighting system to measure the ability to understand concepts. they analyzed 5 types of tasks according to Swan and 8 types of tasks according to Pointon & Sangwin. There are 4 levels in concept understanding ability, namely:

1. Level 0: This level is given a weight of zero (0). The indicator at this level is that students can memorize facts without understanding them.
2. Level 1: At this level is given a weight of one (1). The indicator is that students can use methods taught by the teacher or developed by students before.
3. Level 2 and 3: Level 2 is given a weight of 2 with the criteria that students understand the concept. At level 3 is given a weight of 3 with the criteria that students can mention the reasons for understanding the concept. The following are the indicators: Interpret the meaning of mathematical characteristics in new settings, Make connections between different representations (numerical, graphical, symbolic, or narrative) of mathematical characteristics, Evaluate mathematical statements and provide relevant examples or appropriate counterexamples, Analyze problem work on assignments and identify deficiencies with accompanying reasons, and Proving or justifying.

According to (Rittle-Johnson, 2017) measuring the ability to understand a concept can be done implicitly and explicitly. Here are the types of tasks:

Implicit: Evaluate unknown procedures, Evaluate an example of a concept, Evaluate the quality of answers given by others, Interpret a system of representation, Compare quantities, Find quick and precise procedures, Code key features, and Sort examples into a strategy

Explicit: Describe the assessment, Create or choose a definition of a concept, Explain how a procedure works, and Create a concept map.

Referring to the three sources above, the indicators need to be analyzed and adapted to elementary school-age students. The results of the analysis are as follows:

1. Students can mention a concept
   Mentioning a concept is included in the level of remembering (level) in Bloom's taxonomy. There are 2 indications of the level of remembering and retrieving existing knowledge in long-term material (Anderson, L, W., Krathwohl, D. R., Airasian, P.W., Cruikshank, K. A., Mayer, R. E., Pintrich, P. R., Raths, J., &Wittrock, 2001). In this indicator, students are asked to write the kinds of data presentation correctly according to the picture provided.
2. Students can give examples of a concept
   Providing examples is included in the level of understanding (level 2) in Bloom's taxonomy. There are several indications of the level of understanding, namely: interpret, give examples, summarize, conclude, classify, compare, and explain (Anderson, L, W, Krathwohl, D. R., Airasian, P.W., Cruikshank, K. A., Mayer, R. E., Pintrich, P. R., Raths, J., &Wittrock, 2001). In this indicator, students are asked to give an example of a set of data and present the data in the form of a picture diagram.
3. Students can translate a concept
   Translating a concept is included in the level of understanding (level 2) in Bloom's taxonomy. Translating is included in the indication of interpreting (Anderson, L, W., Krathwohl, D. R., Airasian, P.W., Cruikshank, K. A., Mayer, R. E., Pintrich, P. R., Raths, J., &Wittrock, 2001). In this indicator students are asked to interpret the data presented appropriately.
4. Students can evaluate examples of a concept

Evaluating examples of concepts fall into the level of mastery (level 5) in Bloom's taxonomy. Indications of the level of evaluation are examining and criticizing (Anderson, L, W., Krathwohl, D. R., Airasian, P.W., Cruikshank, K. A., Mayer, R. E., Pintrich, P. R., Raths, J., &Wittrock, 2001). In this indicator, students are asked to determine the correct and incorrect data in the data presentation appropriately.

From the previous information, it can be seen that until now, the mathematical concepts and critical thinking skills of students at the elementary school level still need to be improved, especially in the subject of statistics, which is an important area. Many solutions have been proposed to improve students' understanding of mathematical concepts and critical thinking skills. Among them is the selection of learning models considered capable of improving these abilities, such as the RADEC model. The selection of this learning model is based on the advantages it has in improving the quality of the learning process and result(Sopandi et al., 2021). From the previous information, it can be seen that until now, the mathematical concepts and critical thinking skills of students at the elementary school level are still not optimal, especially in the subject of statistics, which is an important area. Many solutions have been proposed to improve students' understanding of mathematical concepts and critical thinking skills. The selection of this learning model is based on its advantages in improving the quality of the learning process and result (Ramadhani & Gustimal, 2023). From the previous information, it can be seen that until now, the mathematical concepts and critical thinking skills of students at the elementary school level are still not optimal, especially in the subject of statistics, which is an important area. Many solutions have been proposed to improve students' understanding of mathematical concepts and critical thinking skills. The selection of this learning model is based on its advantages in improving the quality of the learning process and result (Nurnaningsih et al., 2023) the RADEC learning model can teach students critical and creative thinking skills. Based on the research's assumption that the low understanding of mathematical concepts in statistical material, some problems need attention, so the author solves the problem by conducting research activities: "The Effect of RADEC Learning on Students' Ability to Understand Statistical Material".

METHOD

This type of research is quantitative research with the method used, namely experimental research. Experimental research is characterized by the absence of a comparison group and randomization. The research design used in this research is a pre_experiment design in the form of a one group pretest-posttest design.

Researchers used a one group pretest-posttest design. This research design means that there is treatment in one or more groups and then the data results are observed (Sugiyono, 2015).

Tabel 1. Model *pre-experiment* dengan *one group pretest-posttest design*

Kelompok	***Pretest***	***Treatment***	***Posttest***
Eksperimen	O_1	X	O_2

Information:
X : *treatment*
O_1 : *pretest*
O_2 **:** *posttest*

At this stage, the implementation of learning uses the RADEC learning model. Meanwhile, the results analyzed are the learning outcomes of students in class VI elementary school on statistical material. In this review, the research tool used to collect information is a test. The test used is the knowledge perspective used in this review in the form of a description, with the number of questions, with a total number of questions namely 5. To obtain instrument information, several techniques are used, more specifically: Test instruments are used to determine the fulfillment of student learning outcomes based on the pretest and student posttest.

Population and Sample

The subjects in this research were 6th grade students consisting of 22 students. There were 10 male students and 12 female students. This research took place in one of the elementary schools in Subang Regency which was carried out in the first semester of the 2022/2023 academic year.

Research Instrument

The research instrument used in this research is a test instrument. The test instrument is designed in such a way as to be based on cognitive aspects at levels C3 to C4 in statistical material. The test instrument grid to see student learning outcomes is made as follows:

Tabel 2. Learning Outcome Test Instrument Grid

Lesson Content : Mathematics
Teaching Materials : Statistic
Class/Semester : VI (Six / 2 (odd)
Academic Year : 2023-2024

Topics	Basic Competencies	Question Indicator	Qeustion Form	Question Number	Grade
Data Statistical	3.8 Explain and compare the mode, median, and mean of single data to determine which value best represents the data	Presented with questions, students are able to understand the median of single data problems	Essay	1	10
		Presented with questions, students are able to understand the median of even data questions	Essay	2	10
		When presented with questions, students are able to understand the questions on average	Essay	3	15
		Presented with questions, students are able to understand the mode questions	Essay	4	25
		Presented with questions, students are able to calculate the mean correctly	Essay	5	40

Data Analysis Technique

After the data was collected, analysis was carried out using descriptive analysis techniques. Validation data analysis is used to analyze each of the learning tools. The results of this analysis are used as an initial discussion without being used as a research conclusion. Next, this research uses a description test containing six tests with statistical elements such as mean, median, and modus. Normality test, homogeneity test, and paired t-test hypothesis test were used to analyze the test data.

RESULTS

Analysis Descriptive

Researchers measure the ability to understand concepts through tests in the form of essays with indicators and given points as follows: Students can mention a concept, Students can give examples of a concept, Students can translate a concept, and Students can evaluate Information on students' pre and post-test scores in statistical learning outcomes is presented in Table 1 below.

Table 4. Data on the achievement of student study results in understanding the statistical material of a concept.

Descriptive Statistics

	N	Range	Minimum	Maximum	Mean	Std. Deviation
Pretest	22	33	67	100	90.05	11.169
Posttest	22	33	67	100	96.18	9.000
Valid N (listwise)	22					

Table 4 shows 22 students participating in the pretest. In the pretest results, the minimum score is 67, and the maximum score is 100. The distance between the smallest and largest scores in the posttest is 33, with an average score of 90.05. In the final test (posttest) that was carried out, the results of students who took the posttest were as many as 22. The posttest results were that the minimum value was 67, and the maximum tscore was 100. The distance between the smallest and largest values in the pretest was 33, with an average score of 96.18.

In this case, it can be seen that there is an increase in learning outcomes on tests carried out before and after using the mastery learning model. The following is a visualization of the increase in pretest results in the posttest in the graph below

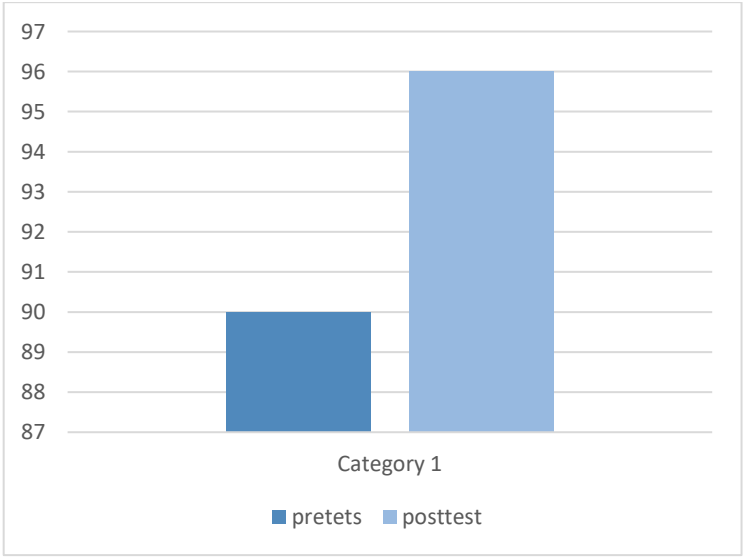

Figure 1. Pretest and posttest Mean

Analysis Inferential

Analysis statistics is inferential on the part for the testing hypothesis that has formulated and before to do inferential statistical analysis, especially formerly prerequisite test.

Prerequisite Test

After analyzing students' pretest and posttest. Furthermore, the prerequisite analysis consisting of the normality test and homogeneity test the results of the two tests are presented in Table 2 and Table 3.

Table 5. Normality Test Results

Tests of Normality

	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	Df	Sig.	Statistic	Df	Sig.
Posttest	.405	44	.000	.661	44	.000
Pretest	.339	44	.000	.637	44	.000

a. Lilliefors Significance Correction

Table 5 proves that the posttest and pretest values and significance < 0.05, then obtained a conclusion that means the data is not distributed with a normal pattern. After that, it continued to use the Lavena homogeneity test.

Table 6. Homogeneity Test Result

		Levene Statistic	df1	df2	Sig.
Skor	Based on Mean	5.310	1	42	.026
	Based on Median	8.281	1	42	.006
	Based on Median and with adjusted df	8.281	1	32.059	.007
	Based on trimmed mean	6.545	1	42	.014

Table 6 shows that the significance value < 0.05 so that it can be concluded that the data is not homogeneous, because it does is not meet the prerequisite test or not normally distributed and not homogenous,

Hypothesis Testing

The next step is to use the Mann-Whitney non-parametric test, as in table 4 below.

Table 7. Mann-Whitney Non-Parametric Test Result

Hypothesis Test Summary

	Null Hypothesis	Test	Sig.	Decision
1	The distribution of skor_pemahaman is the same across categories of pembelajaran_Radec.	Independent-Samples Mann-Whitney U Test	.033	Reject the null hypothesis.

Asymptotic significances are displayed. The significance level is .050.

Independent-Samples Mann-Whitney U Test Summary

Total N	44
Mann-Whitney U	317.500
Wilcoxon W	570.500
Test Statistic	317.500
Standard Error	35.477
Standardized Test Statistic	2.128
Asymptotic Sig.(2-sided test)	.033

Table 7 shows that the data is significantly different between the mean value of the pretest before RADEC method learning and the mean value of the posttest after RADEC method learning.

The data results, and hypothesis testing from table 7 mann-whitney non-parametric test, The results of the data and hypothesis testing show that Asymp.Sig. The value of 0f is 0.033 So we can keep that Asymp.Sig. 0.05 so that based on the existing basis for decision making, it can be said that H0 is rejected while Ha is accepted. This assumption draws the conclusion: "The application of the model in RADEC learning has an effect related to student competence in understanding statistical material at Pasirkareumbi Elementary School." Based on the above results, learning using the RADEC learning model has a better learning value in the pretest and post-test, meaning that the model in RADEC learning is successful in identifying learning outcomes based on understanding statistical material. Analyze the difference in results by looking at the mean pretest and post-test scores to see if there is a difference between the two results before utilizing the RADEC learning model and after applying the RADEC model. Besides that, (Pratama et al., 2020) mentioned that the RADEC learning model can inspire students to come up with ideas and think creatively to apply the knowledge learned. Likewise, students' concern and desire to actively participate in learning is needed to get various things for themselves and others.

Implementing the RADEC learning model in statistics education aids students in grasping challenging concepts by emphasizing real-world applications. This approach enhances students' interest in statistics by showcasing the practical relevance and benefits of the material. Furthermore, it provides teachers with a more engaging and effective curriculum delivery method. The RADEC model's focus on everyday life facilitates a deeper understanding of statistical concepts and promotes student enthusiasm for the subject matter through its tangible connections to the real world.

DISCUSSION

The analysis results show significant conclusions: rejection of the null hypothesis (H0) and acceptance of Ha. This indicates a real difference in the impact of implementing the RADEC learning model on students' acquisition of conceptual understanding in statistics material. Rejection of the null hypothesis (H0) implies that there is a noteworthy effect from using the RADEC model. These results strengthen the hypothesis that the RADEC learning model has a different and positive influence on student's ability to understand statistical concepts. Acceptance of the alternative hypothesis (Ha) underlines the claim's validity that the RADEC model contributes significantly to improving students' conceptual understanding of statistics education.

After being given treatment, the RADEC learning model can be used to improve students' understanding of learning material and RACEC is also effectively used in mathematics learning at the elementary school level (Sukmawati et al., 2020). Therefore, the RADEC learning model is said to have an effect on students so that it has increased because it encourages students to master the material they are studying so that it makes students gain an understanding of the material and can improve students' reading habits in pre-learning activities which encourage students to learn independently and express it through making work that improves students' thinking abilities. As stated by (Zandvakili et al., 2018) that student involvement will encourage students in the learning they do with various learning activities that will give students a sense of ownership of responsibility. Other research, namely from Ramadhani et al (2023), revealed that the RADEC learning model influences mathematics learning outcomes through syntax that is easy for teachers and students to understand through the steps read, answer, discuss, explain and create.

CONCLUSION

The comprehensive analysis established a clear outcome: rejection of the null hypothesis (H0) and acceptance of Ha. This significant result highlights the contrast seen in the impact facilitated by the RADEC learning model regarding students' assimilation of statistical concepts. The rejection of the null hypothesis (H_0) indicates the existence of a significant effect brought about by using the RADEC model. This finding supports the idea that the RADEC learning approach clearly and positively influences students' understanding of statistical concepts. The validation of the alternative hypothesis (H_a) significantly underscores the credibility of the assertion that the

RADEC model substantially contributes to enhancing students' conceptual understanding of statistical learning materials, especially in grade 6.

This conclusion, derived from careful analysis, reinforces the understanding that the RADEC model is essential in enhancing students' ability to understand complicated statistical principles. The rejection of the null hypothesis demonstrates the tangible impact of applying the RADEC model, validating the hypothesis that this methodology significantly enhances students' proficiency in understanding the intricacies of statistical materials at the primary school level. In essence, validating the alternative hypothesis emphasizes the pivotal role of the RADEC model in furthering students' conceptual understanding of statistics in their educational journey. Showing students' understanding of learning activities will also impact the grades that students will get, which will have an impact on achieving the learning objectives that have been made in the lesson plan previously by the teacher.

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