



# Racking Analysis Instrument Mastery Test Concepts in Learning Science Using the RADEC Model in Elementary School Students

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**Abstract:** The study's objective was to assess the content's validity, reliability, and degree of difficulty for third-grade students in one of the East Jakarta elementary schools utilizing the RADEC learning model by analyzing the pre-test and post-test items using the Rasch Racking model of analysis. The results of the Radek learning model showed that students with low and high abilities experienced a change in the concept of student effectiveness for the better. This research is a quantitative study, namely the evaluation of learning outcomes using descriptive quantitative methods with data collection techniques using pre-test and post-test questions. In early 2023, The learning activity was conducted using data from 32 student respondents. The result indicated the validity of the suitability level of the item, with ten questions found to be valid. The difficulty level of the questions, in general, is in the medium category, meaning that they are excellent because they are relatively straightforward. The conclusion is that the analysis of the items using the Rasch model in the learning evaluation activities through the pre-test and post-test is valid with excellent categories of 50% and good 50%. The question's difficulty level is excellent.

**Keywords:** Concept Mastery; Effectiveness; Item Analysis; Racking

## Introduction

Concept mastery is the ability to understand concepts theoretically and apply these concepts to solve a problem (Astuti & Fauziah, 2021). In learning science, all problems can be solved if the concepts are understood correctly and completely. Good mastery of science concepts is based on a good process of conveying information. Concept mastery is interpreted as the ability of students to understand both concepts in theory and their implementation in everyday life (Ramayanti et al., 2018; Safira et al., 2021). Student's difficulties in understanding the concepts implemented during direct learning and students' difficulties in understanding the differences between the concepts that have been explained. So, students need a learning model that is effective and not

monotonous and can make students understand concepts properly and correctly. The RADEC learning model (Read, Answer, Discuss, Explain, and Create) is an appropriate learning model for mastering concepts (Pratama et al., 2019). The RADEC learning model (Read, Answer, Discuss, Explain, and Create) is a learning model that uses the stages as the name of the model itself, namely read or read, answer or answer, discuss or discuss, explain or explain, and create or create (Ramadini et al., 2021). In applying the RADEC learning model (Read, Answer, Discuss, Explain, and Create) for mastering concepts in a matter of changing the shape of objects, maturity and thoroughness in teaching are required (Maulana et al., 2022). *Read*, students carry out reading activities the day before learning takes place or what is commonly called pre-learning using PowerPoint media material on

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changes in the shape of objects that have been prepared by the researcher; *Answer*, Students are then able to work on the questions in the pre-learning activities. The goal is to find out the results they read in reading activities through PowerPoint material on changes in the shape of objects. This is done to hone students' abilities to understand and master concepts correctly and completely; *Discuss*, his activity is carried out when learning takes place, and each group discusses material changes in the shape of objects; *Explain*, In this activity, group representatives present the results of discussions in front of other groups, then they carry out discussions and ask questions with other groups about what was presented; and *Create*, In the last activity, students do free work according to the material being studied, namely changing the shape of objects according to the wishes of students. RADEC (Read, Answer, Discuss, Explain, and Create) supports the growth of students' reading motivation, trains students' reading comprehension, and encourages students to understand a concept properly and correctly. In this activity, group representatives presented the results of discussions in front of other groups, then they held discussions and asked questions with other groups about what was presented.

From the learning activities carried out with the RADEC learning model (Read, Answer, Discuss, Explain, and Create), the researcher provides instruments in the form of a pre-test which is given at the beginning of learning, and a post-test which is given at the end of learning. Then the instrument was analyzed using Excel. The activity of analyzing the items is carried out to improve the quality of the questions and identify deficiencies in the test items that have been made in order to improve learning (Palimbong et al., 2019). The quality of the question instrument greatly determines the final outcome of learning in the form of the student's mastery of the formulated learning objectives (Sukmawati et al., 2020).

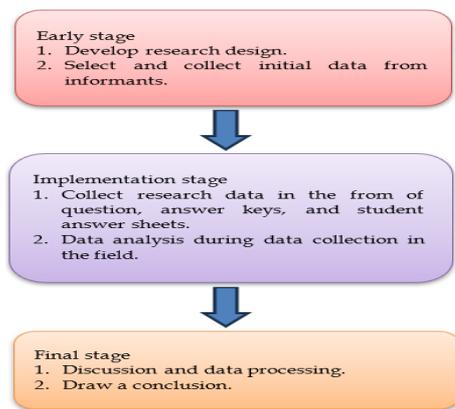
The process of item analysis is an activity carried out to examine and study each item by gathering information from student answers in order to obtain quality questions before the questions are used (Fauziah & Sukmawati, 2023; Sukmawati et al., 2023). Analysis of the items can be done quantitatively, namely, those related to their statistical characteristics. This quantitative analysis includes an analysis of the validity, reliability, level of difficulty, differentiating power of the questions, and level of deception that the questions have (Palimbong et al., 2019). Valid items mean that the instrument can be used to measure what you want to measure. Meanwhile, a reliable instrument is an instrument that, when tested several times on the same object at different times, will produce the same data (Palimbong et al., 2019). The level of difficulty of the

question relates to the ability of students to be able to answer or be able to solve the question properly and correctly. In this study, to analyze the pre-test and post-test results, students used the Rasch Racking Analysis model to test the validity, reliability, and items simultaneously. Rasch modeling can be used to measure validity and reliability directly based on the principle of probability (Lestari et al., 2022; Palimbong et al., 2019).

The advantages of the Rasch model include: being able to predict missing data, which is based on a systematic response pattern, being able to produce standard error measurement values for the instruments used, which can increase the accuracy of calculations, and calibration, which is carried out simultaneously in three respects, namely the measurement scale, respondents, and item questions (Istiqomah & Sukmawati, 2023; Palimbong et al., 2019). The advantages of the Rasch model are very suitable for use in this research because it evaluates the ability of the pre-test and post-test item items on Changes in the Form of Objects to help students in mastering the concept. The use of Rasch model is more effectively applied than the classical analysis (Barus et al., 2021). This research was carried out with pre-test and post-test instrument questions compiled by researchers and validated by science lecturers, and these questions had never been tested on students, so the quality of the questions could not be known. The problem of how the Racking Analysis results on the effectiveness of the Rade Learning Model in Elementary School Students in Mastering Science Concepts is the main topic of this study.

## Method

This research is a descriptive research design with a quantitative approach (Erny Febriyanti et al., 2023). This method has the goal of describing events that occur by using statistics. Data analysis techniques use the Rasch Racking Analysis model. The study's main focus was on the ten multiple-choice questions from the pre- and post-tests on the subject Changes in the Form of Objects for grade 3 elementary pupils in the East Jakarta region, with 32 respondents. The discourse text contained in the items includes changes in the form of objects and examples of changes in the form of objects. Data analysis uses quantitative descriptive analysis techniques. The data studied were analyzed using the Rasch model using the Winstep® application version 3.73. The following are the stages of the research in brief, as shown in Figure 1.



**Figure 1.** The stages are based on the Rasch model ranking analysis approach

The validity analysis produced with the Winstep program is an analysis in the form of construct validity and content validity (Yudha, 2023). Content validity analysis includes the level of suitability of the items, which serves to see the quality of the level of suitability of the items with the model the information given takes the form of details about how well the objects meet the requirements, namely by looking at the values of the outfit mean square, outfit z-standard, and point measure correlation. Items are said to be valid or accepted if they meet at least two criteria and are corrected if they meet one of the three criteria, and are discarded if none meet these criteria. The suitability value of the item is greatly influenced by the amount of data, the larger the sample used, the better the level of conformity. Accepted Outfit Mean Square (MNSQ) value:  $0.5 < MNSQ < 1.5$ ; Accepted Outfit Z-Standard (ZSTD) value:  $-2.0 < ZSTD < +2.0$ . Value of Point Measure Correlation (Pt MeasureCorr):  $0.4 < Pt Measure Corr < 0.85$

**Result and Discussion**

In this study, the application of the RADEC Learning model (Read, Answer, Discus, Explain and Create) in students' mastery of concepts was carried out so that researchers were able to achieve a goal. By implementing the RADEC Learning Model in SD, students must follow the following steps: Read,

Answer, Discuss, Explain and Create. The validation test as seen in Table 1.

**Table 1.** Data Validation Results

No. Question	Mnsq	Zstd	PT. Corr	Valid	Follow - Up
P6	1.10	0.7	0.43	Valid	Used
P1	1.29	1.1	0.18	Valid	Used
P3	1.04	0.2	0.33	Valid	Used
P5	1.04	0.2	0.33	Valid	Used
Q7	0.82	-0.4	0.36	Valid	Used
P4	0.97	0.1	0.24	Valid	Used
P2	0.76	-0.2	0.31	Valid	Used
Q8	0.76	-0.2	0.31	Valid	Used
Q9	1.00	0.2	0.18	Valid	Used
P1	0.44	-0.7	0.40	Valid	Used

The influence of elementary school student's mastery of concepts can be seen from the results of the pre-test and post-test done by students. Judging from the results of the pre-test and post-test done by students and then processed using the Rasch model. The reliability value of the low category of people is 0.0, with a split value of 0.0. The data shows that students are consistent in answering questions, and the quality of questions is sensitive for measuring all categories of students (Tulljanah & Amini, 2021). The reliability value of sufficient questions has a value category of 0.45 with a separate value of 0.91. The data shows that the respondents varied in responding to the questions given. Table 2 has further information.

The low reliability of people, this can happen because the sample used is small, namely 32 people, but if you look at the reliability value of the items that are sufficient, you can be sure that the instrument used can measure students' understanding in mastering the concept properly (Mulyanti et al., 2022). Based on these data, the question instruments were used for the pretest and posttest. After the students' pretest and posttest results were obtained, they were processed, and an array analysis was performed using the Rasch model. Following are the results of changes in students' higher-order thinking skills after participating in the RADEC model joint learning (Damayanti et al., 2023) when viewed from changes in logit/measure values, as shown in Table 3.

**Table 2.** Items and Reliability Value

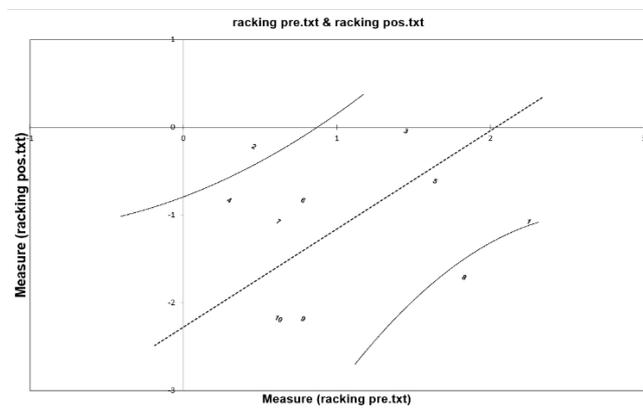
Person	28 Input		28 Measured			Infit		Outfit
	Total	Count	Measure	Realse	Imnsq	Zstd	Omnsq	
Mean	8.1	10.0	1.85	1.36	0.99	0.2	0.92	0.1
S.D.	1.2	0.0	0.99	0.36	0.31	0.7	0.41	0.7
Real Rmse	1.12	True Sd	0.00	Separation	0.00	Person Reliability		0.00
Item	10 Input		10 Measured			Infit		Outfit
	Total	Count	Measure	Realse	Imnsq	Zstd	Omnsq	
Mean	22.8	28.0	0.00	0.57	0.99	.2	.92	0.1
S.D.	3.3	0.0	0.78	0.09	0.09	.3	.22	0.5
Real Rmse	0.58	True Sd	0.53	Separation	0.91	Item Reliability		0.45

**Table 3.** Changes in the student's measured value from the results of the pretest posttest

Pre-Test Logit Value	Post-Test Log Values	Logit Value Changes	Category
2.25	-1.07	3.32	Very good
0.46	-0.22	0.68	Good
1.45	-0.04	1.49	Good
0.3	-0.83	1.13	Good
1.64	-0.61	2.25	Very good
0.78	-0.83	1.61	Good
0.62	-1.07	1.69	Good
1.83	-1.71	3.54	Very good
0.78	-2.18	2.96	Very good
0.62	-2.18	2.8	Very good

It is clear from Table 3's data that all students improved in their conceptual comprehension and competence as a result of employing the RADEC approach for instruction. Low, medium, and high school pupils all experience changes in their conceptual comprehension and conceptual mastery. Changes in understanding mastery of concepts can increase the number of questions by a total of 5 (1, 5, 8, 9, 10), which occurs extremely well. Five questions (2, 3, 4, 6, and 7) in total include students who have an improvement in comprehending mastery of ideas with a good category. Figure 2 shows more specifics.

The increase in students' understanding of mastery of concepts is due to the use of the RADEC model (Asmara, 2022; Wandani et al., 2022), which trains students to use their knowledge to solve existing problems in the field as well as in the learning process and trains students to be independent and collaborate so that direct learning is student-centered. RADEC learning is an alternative to looking at students' abilities to master concepts in science learning in elementary schools (Fuadi et al., 2021; Putri & Amini, 2023). The RADEC learning model provides improvements for all students, although the improvements experienced vary from very good, good, and moderate categories (Harun et al., 2022; Nurdiansyah et al., 2022). The thing that underlies the increase in students' ability to understand a concept after attending learning with the RADEC model is the use of the RADEC learning model syntax according to the characteristics of students and learning in Indonesia. The initial stage of reading instruction involves guiding students to study independently, enabling them to acquire reading skills and develop conceptual knowledge without relying on external support. Furthermore, to direct students in reading, the teacher gives pre-learning questions.



**Figure 2.** Graph of Changes in Understanding Mastery of Concepts

Students are given contextual-based essays to train students abilities, and then students can answer independently (Sukmawati, 2023; Suryana et al., 2021). The questions given to students are questions that are in accordance with learning objectives and indicators, including determining materials and their characteristics, classifying materials, analyzing changes in materials, and being able to determine how to separate materials. With reading and answering activities carried out by students before participating in the learning process, the learning process can then be focused on things that are not understood by students, and this is what is called effective learning (Nurliana & Sukmawati, 2023; Setiawan et al., 2019).



**Figure 3.** Proving Changes in Form of Objects

Each student has the provision to learn in class and is ready for the next stage, namely discussion and explaining the stages. At the discussion stage, students actively discuss in small groups. This activity makes students exchange ideas and express opinions so that they get the best answer that will be

presented. In addition to practicing communication, during the discussion stage, students practice critical thinking skills during discussion activities (Aryani et al., 2022; Rahayu & Saud, 2022). After participating in the discussion stage in small groups, students follow the explaining stage, which trains students to develop students abilities in responding to the results of other group discussions.

Then the last stage is the stage of making, in which students are trained to apply knowledge of material concepts to solve problems or create works (Sukmawati, 2023). In this activity, students are trained to develop creative ideas, design a work or provide solutions to solve problems they face so that they are trained to be insightful. If, in other learning models, students focus on mastering the material or compiling solutions to problems that have been prepared, for the RADEC model, students actively and creatively compile or create solutions to existing problems that arise independently with the conceptual knowledge that students have.

## Conclusion

Considering the research and discussion presented, using the RADEC model in learning has significantly improved students' proficiency in understanding concepts. Specifically, 50% of students achieved an excellent level of mastery, while another 50% attained a good level of proficiency. This increase can be measured by the logit values obtained from the pre-test and post-test. The measurement value or logit value shows the ability of students to answer questions based on the difficulty level of the questions. Measuring or logit scores are obtained from the raw scores obtained by students and then processed using Rasch. This increase occurred in groups of students who had low or high initial abilities. It was also observed that the learning process involved the participation of many students with limited initial abilities, who were grouped.

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## Author Contributions

This article was prepared by two authors, namely N.M.M and W.S. Each stage is carried out in collaboration.

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## Conflicts of Interest

The authors declare no conflict of interest.

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