JPPIPA 9(10) (2023)

Jurnal Penelitian Pendidikan IPA

Journal of Research in Science Education

http://jppipa.unram.ac.id/index.php/jppipa/index

Stacking Analysis of the Mastery of Science Concepts in the RADEC Learning Model for Grade IV Elementary Students

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Received: May 24, 2023
Revised: September 15, 2023
Accepted: October 25, 2023
Published: October 31, 2023

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DOI: 10.29303/jppipa.v9i10.3999

Abstract: The study analyzes the mastery of science concepts in fourth-grade student' style material using the RADEC (Read, Answer, Discuss, Explain and Create) learning model. This study used a quantitative experiment, and the research method used was the One Group Pretest and Posttest with a sample of 29 students. Students will be given pretest questions first to find out student mastery of concepts in Style material, then given pre-leaming questions that are done outside of class hours and then create work. After working on pre-learning questions, students work on post-test questions to measure students succes in mastering the IPA concept on Style material. After participating in learning with the RADEC learning model, students experienced an increase to an outstanding category of 44.83, good at 48.28%, and enough of 6.90%. Logit values from the pretest and posttest can be used to quantify this rise. The findings demonstrated that studying with the RADEC model improved students' comprehension of science ideas for both low- and high-ability pupils.

Keywords: Mastery of Concepts; RADEC; Rasch; Science Learning.

Introduction

Natural Sciences (IPA) is one of the subjects taught in elementary school education units (SD). Science is a subject that is expected to be an accurate source of facts for students to learn about nature and its relation to students' lives through a scientific attitude (Hill, 2022). Similarly, as stated by (Sarini et al., 2018) that science learning consists of a collection of concepts, principles, laws, and theories, as well as an attitude of determination, curiosity, and perseverance, so that students learn meaningfully. So that in learning science, curiosity is needed in students to learn about nature related to concepts, principles, laws, and theories (Hill, 2022). Therefore, the purpose of learning science is not only to improve learning outcomes or knowledge but also to show the demand for mastery of science concepts and critical thinking skills in students in order to create long-term concepts in students' memory that are useful and can be applied in everyday life (C. Wahyuni et al., 2020).

Natural Science characteristics are useful concepts in everyday life. These science concepts must be mastered well so that if students encounter everyday problems related to these concepts, students can use them in solving existing problems. Instilling the right concept from an early age or in elementary school can be an effort to attract students' interest in learning about learningmaterial (Kurniadi et al., 2020).

Based on research (Awang, 2015), the reality that is happening in Indonesia, science subjects are not very interesting and pay less attention. Moreover, seeing the lack of education that applies the concept of science(Sukmawati et al, 2018; Wahjusaputri et al., 2022). This issue can be seen in how science is taught, and the curriculum that is applied is not appropriate or makes it difficult for the school and students. The problems faced by Natural Sciences education itself are in the form of material or curriculum, teachers, facilities, student equipment, and communication between students and teachers (Astuti, 2017).

In the science learning process, teachers still use conventional models namely lectures which make learning less student participation in the learning process due to a more teacher-centered approach. Students do not find the concept of learning by

How to Cite:
Istiqomah, N., & Sukmawati, W. (2023). Stacking Analysis of the Mastery of Science Concepts in the RADEC Learning Model for Grade IV Elementary Students. *Jurnal Penelitian Pendidikan IPA*, *9*(10), 7993–8000. https://doi.org/10.29303/jppipa.v9i10.3999

themselves(Sukmawati, 2017; Sukmawati et al., 2021). Students only listen, record lessons, and work on questions given by the teacher so that the knowledge obtained is only from the teacher (R. Wahyuni et al., 2016). As a result, students become less active, and students do not master the science concept of what they learn and do not have high enthusiasm for learning. Teachers who seldom conduct perception exercises at the start of lessons contribute to the issue of low knowledge of scientific topics. Less engaged students have an impact on how well they study. Even though the activeness of students in learning is one of the elements that affect how well something is learned, the activeness of students in learning science greatly influences their learning success, whereas if the active learning of the pupils is good, the outcomes will also be good (Fauziah & Sukmawati, 2023; Wati Sukmawati et al, 2020). The instructor should facilitate learning for the pupils to be active in learning activities. However, the teacher still dominates the course of learning by delivering material directly through lectures. This also has an impact on the less optimal learning process achieved by students. The Read-Answer-Discuss-Explain-and-Create (RADEC) learning paradigm is another option presented in this study that is anticipated to give solutions in the learning process (Sukmawati, 2019). In Kuala Lumpur, Malaysia, during an international conference, this concept was initially presented (Sopandi, 2017). This model was created in response to the challenge for teachers in the field to apply innovative learning models that have been known so far, such as inquiry-based, project-based, and cooperative learning paradigms, among others.

The RADEC learning model was developed to overcome the problem of the low quality of student learning processes and outcomes. Research on the RADEC model has been carried out by (Primary, Sopandi, Hidayah, & Trihatusti, 2020) and shows that the RADEC learning model has a positive impact on learning outcomes. A study (Pratama et al., 2020) demonstrates that the RADEC model is a learning strategy suitable for developing critical thinking abilities applied at the primary school level in Indonesia. Additionally, study by Lukmanuddin (2018) shows that the RADEC learning approach can enhance students' conceptual understanding and communication skills. Department of Basic Education Postgraduate School of the Indonesian University of Education. Other studies demonstrate that the RADEC learning paradigm is successful in enhancing primary school pupils' writing abilities and conceptual understanding of explanatory texts (Setiawan et al., 2019). Meanwhile, according to (Jumanto et al., 2018), based on his research, the RADEC learning model is a learning model oriented to learning skills because it can improve students' creative thinking skills.

Based on some of the preliminary studies above, It might be argued that the RADEC application learning methodology improves Concept Mastery (Novianti et al., 2023; Sukmawati, 2023). The RADEC learning paradigm gives students the chance to have hands-on involvement with the educational process. The RADEC model has several advantages, namely the stages of learning that are easy to remember for those who apply it (Aisyah et al., 2023; Maryana & Sukmawati, 2021). RADEC learning helps students gain competency in cognitive, affective, and psychomotor aspects (Sopandi, 2017). Thus, As required by the curriculum, the learning process is made more enjoyable, engaging, and student-centered through the use of RADEC learning.

According to (Sopandi & Handayani, 2019), the RADEC model is able to make students read diligently, improve their understanding of the material and motivate them to pocket the competencies demanded today. The RADEC model has advantages, including (1) providing opportunities for teachers to design models used to make the learning process interesting, (2) improving students' critical thinking performance, (3) increasing students' analytical and reading skills, (4) improving cooperation in groups (Kaharuddin, 2020).

The researcher is interested in undertaking the study described above because quantitative research is to see how the use of the RADEC learning model influences students' mastery of concepts in science material. The title of this study is "Stacking Analysis of Mastery of Science Concepts in the RADEC Learning Model for Grade IV Elementary Students"

Method

Research In this study, the approach used was a quantitative experiment, The Quasi Experiment technique, Pre-Experimental Design type, and One Group Pretest Posttest design were employed in the research. To determine the impact on the reader learning model, the data were examined using the Rasch Stacking model. The technique used to determine the sample is a saturated sample, namely by conducting an experiment on class IV at one of the public elementary schools in Jakarta. This research was carried out in 3 meetings referring to the prepared lesson plans. The RADEC model's application serves as the therapy in this investigation. There are various steps to this therapy, including providing kids pretests, pre-learning. Device Validation Science professionals validated this study to ascertain the applicability of the created student worksheets. HOTS-based questions on style served as the research tool in this study. This instrument consists of 15 multiple-choice questions, namely the Pretest and Posttest. Meanwhile, the Pre-Learning questions consist of 6 questions in essay form. Descriptive analysis and quantitative data analysis utilizing the Winstep 3.73 program are two methods for analyzing research data (Sumintono, 2014). The outcomes of student tests (pre and posttest), that is, tests taken before and after learning, provided quantitative data. To determine how substantial the improvements in the mastery of the science idea were measured from the pretest and posttest scores, the test data were evaluated using the Rasch Stacking model, often known as the stacking technique (Hilala et al., 2023). A method for examining changes at the individual level is stacking analysis. (Sukmawati, 2022).

Result and Discussion

In order to increase students' understanding of science ideas, researchers adopted the RADEC model as a therapy in this study. Students follow the RADEC phases of learning Read, Answer, Discuss, Explain, and Create in their coursework.

The findings of the students' pretest and posttest reveal changes in their understanding of scientific topics. The reliability value for the low-person group had a split value of 1.22 and was equal to 0.60 when the results of the pre- and post-test scores of pupils processed using the Rasch model were taken into account. The data demonstrates that students consistently respond to the questions, and the reliability value of the items included in the good category, with a value of 0.82 and a split value of 2.17, is sensitive for measuring all categories of students (Sukmawati, Sari, 2022). The information demonstrates that the respondents' answers to the questions differed. Table 1 has further information

Table 1. Person and Reliability Value

Person			30 INPUT		30 Measured	Infit		Outfit
Total		Count	Measure	Realse	Imnsq	Zstd	Omnsq	Zstd
Mean	9.9	15.0	1.05	.75	.98	.1	.89	.0
S.D.	2.6	.0	1.24	.24	.28	.9	.47	.8
Real Rmse	.79	True SD	.96	Separation	1.22		Person Reliability	.60
	Item		15 Input		15 Measured	Infit		Outfit
	Total	Count	Measure	Realse	Imnsq	Zstd	Omnsq	Zstd
Mean	19.9	30.0	.00	.52	1.00	.1	.89	.1
S.D.	6.	.0	1.26	.11	.19	.9	.31	.9
Real Rmse	.53	True Sd	1.14	Separation	2.17		Item Reliability	.82

With low item reliability values, it can occur because of the small number of samples, but for the item reliability scores it is categorized as good. It is certain that the instruments used can measure students' mastery of science concepts. Based on these data, pretest and posttest instruments can be used. The students were processed and a stacking analysis using the Rasch model was performed after the results of the pretest and posttest were acquired. These findings are based on changes in logit/measure values as shown in Table 2 and show how students' conceptual competence after attending lectures affected the RADEC model. Initially, students engage in the preliminary phase by extracting information from diverse resources like books, printed materials, and online sources such as the internet. To aid students in grasping this information effectively, they are given pre-teaching questions. These questions are specifically tailored to the teaching materials and serve as a guiding framework. Mastering the answers to these questions is crucial, as they represent fundamental cognitive elements that students need to comprehend upon completing the teaching materials (Yohana, et al., 2022).

Table 2. Changes in the student's measured value from the results of the pretest posttest

	Measures			
Person	Pre-Test	Post-Test	Enhancement	Category
1	1.21	3.01	1.8	good
2	0.49	2.18	1.69	good
3	1.21	2.18	0.97	good
4	1.21	3.01	1.8	good
5	0.17	3.01	2.84	Very Good
6	1.64	4.26	2.62	Very Good
7	1.64	4.26	2.62	Very Good
8	1.64	4.26	2.62	Very Good
9	1.64	2.18	0.54	good
10	0.49	4.26	3.77	Very Good
11	3.01	4.26	1.25	good
12	0.17	2.18	2.01	Very Good
13	1.64	3.01	1.37	good
14	1.21	3.01	1.8	good
15	0.49	3.01	2.52	Very Good
16	1.64	4.26	2.62	Very Good
17	0.49	3.01	2.52	Very Good
18	0.84	-4.28	-5.12	Enough
19	0.17	2.18	2.01	Very Good
20	1.21	3.01	1.8	good
21	-4.28	3.01	7.29	Very Good
22	-0.16	1.64	1.8	good
23	3.01	4.26	1.25	good
24	3.01	4.26	1.25	good
25	1.21	4.26	3.05	Very Good
26	-0.49	1.64	2.13	Very Good
27	0.49	1.64	1.15	good
28	1.21	3.01	1.8	good
29	-4.28	-4.28	0	Enough
			Mean : 1.85	SD : 0.45
Very Good : 44.83%		Good : 48.28%	Enough : 6.90%	

All students improved in their understanding of science ideas after attending lectures utilizing the RADEC model, according to the findings in Table 2. Students' levels of mastery of science topics have an equal impact on low, middle, and high student groups. The effect mastery of science concepts seems to increase very well in the number of students (5, 6, 7, 8, 10, 12, 15, 16, 17, 19, 21, 25, 26), students who experience an increase in mastery of science concepts with good categories occur in the number of students (1, 2, 3, 4, 9, 11, 13, 14, 20, 22, 23, 24, 27, 28), and students who experienced an increase in mastery of the research science concept with the sufficient category occurred in the number of students (18, 29). can be seen in Figure 1

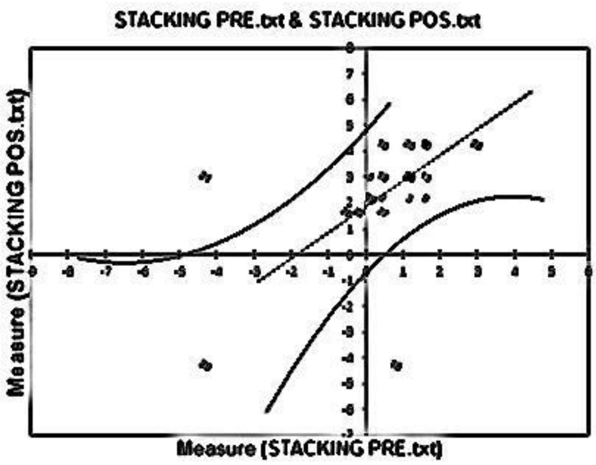

Figure 1. Compile Stacking Graphs influence mastery of science concepts due to Studying the RADEC Model

The RADEC model is used, which teaches students how to apply their conceptual knowledge to solve real-world problems. It also instills in them the independence and teamwork necessary for the learning process, making lectures more student-centered. According to (Pratama et al., 2020). the RADEC learning paradigm has a beneficial effect on students' conceptual understanding. Although the improvements experienced varied from very excellent, good, and sufficient categories, the RADEC learning model improved for all students. The usage of the RADEC learning model syntax, which is in line with the characteristics of students and learning in Indonesia, is what accounts for the improvement in students' knowledge of science topics after taking lectures using the RADEC model. Reading is the first syntactic, which instructs pupils to study independently in order to develop independent reading skills and idea mastery. Lestari et al. (2002) found that students' conceptual competence increased as they studied more reading materials.

The teacher also offers pre-learning questions to guide pupils' reading. The replying stage is the name given to this phase. Students now respond to pre-teaching questions using the information they have learned from reading activities (READ). Worksheets are used to arrange the pre-teaching questions. Before class sessions, they individually respond to questions at home or outside of the classroom. Students will be able to determine on their own which sections of the lesson plan are simple or complex in this way. Additionally, students may identify if they are slack or attentive readers, whether written instructional materials are simple to comprehend or complex, whether they enjoy reading textbooks or not, and more. Aside from that, the instructor may learn about the progress of every student by looking at their work and asking a few simple questions. It's probable that the instructor will be aware of the various demands of each pupil. The teacher may provide each pupil the right help based on this information (Fadhil, 2018).

Figure 2: Activities at the stage of discussing and explaining

Each student has the opportunity to learn in class and is prepared for the subsequent phase, which is the discussion and explanation phase. Students participate actively in small group discussions throughout the discussion stage. In order to receive the finest response that will be provided, this exercise forces students to share thoughts and opinions. Students work on their critical-analytical abilities during discussion activities in addition to their communication skills. Students participate in the small-group discussion stage, then go on to the explanation stage. which trains students to develop mastery of science concepts in response to the results of other group discussions.

Figure 3: Activities at the Create stage

At the creativity stage, the instructor helps students develop the ability to use the knowledge they have gained to generate original ideas or concepts. Questions, issues, or ideas for future creative endeavors can all be expressed as constructive forms of thinking. As was already indicated, the pre-learning questions contain the challenge of coming up with original ideas or concepts. Because pupils were previously given the task of working independently, we are currently simply discussing it in a typical manner. When teachers notice that their pupils are struggling to come up with original ideas, they must motivate them. The instructor might offer instances of study, solutions to problems, or other human creations as sources of inspiration. The kids then talk about additional imaginative ideas that may be organized and carried out. the students are unable to build upon the teacher's suggestions. Depending on the character to be created, ideas might be implemented either singly or in groups. Because of the unique concept, this assignment presents greater difficulty to students. Additionally, ideas may be implemented effectively or badly. Additionally, the implementation of concepts may take place within or outside of the classroom and may be brief or extensive. This stage develops the ability of dominant kids to think, collaborate, and communicate. They learn to find creative ideas, take the ideas to be realized, plan the realization, and implement the plan (Fadhil, 2018).

Conclusion

Based on the findings and Considering the discussion that has been presented, it can be said that students' mastery of concepts after participating in learning with the RADEC learning model has increased to a very good category of 44.83%, good at 48.28%; and enough of 6.90%. This increase can be measured or pretest and posttest logit values. The measurement value or logit value shows the ability of students to answer questions based on the level of difficulty of the questions. Measure or logit values are obtained from raw scores obtained by students and then processed using Rasch. This increase occurred in groups of students who had low or high initial abilities. Even, It was also found that many students with very low initial abilities, after participating in the learning process, entered into groups of students who experienced an increase in the very good category. The treatment carried out during learning using the RADEC model directs students to build mastery of their concepts, starting from independent study and learning from their immediate environment at the stages of reading, answering, discussing, explaining, and creating.

Acknowledgments

Thanks to Muhammadiyah University Prof. Dr. HAMKA and Principal of a state elementary school in Jakarta.

Author Contributions

Conceptualization, NI and WS; methodology, NI.; software, NI.; validation, WS.; formal analysis, WS.; investigation, NI.; resources, NI.; data curation, WS.; writing—original draft preparation, NI and WS.; writing—review and editing, WS.; visualization, NI.; supervision, NI.; project administration, NI, and WS.; funding acquisition, WS.

Funding

This research received no external funding.

Conflicts of Interest

The authors declare no conflict of interes.

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