JPPIPA 10(3) (2024)

Jurnal Penelitian Pendidikan IPA

Journal of Research in Science Education

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

Treffinger Model on Student Learning Outcomes in Grade IV Science Learning at Elementary School

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Received: September 16, 2023
Revised: January 24, 2024
Accepted: March 25, 2024
Published: March 31, 2024

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DOI: 10.29303/jppipa.v10i3.5342

Abstract: While conducting observations at SD Negeri 022 Rambah, the researcher encountered several problems faced by students and teachers at SD Negeri 022 Rambah during the learning process, the problems encountered were as follows; The science learning process that takes place at school is still not enjoyable, Teachers only use the lecture method, and Low student learning outcomes occur at SD Negeri 022 Rambah among class IV students. The treffinger learning model is a learning model that leads to critical and creative thinking skills. This research is Classroom Action Research. Data collection techniques in this research used observation sheets and tests. Data analysis techniques by analyzing data from observation sheets and tests carried out by students. The research results show an increase in learning outcomes with the application of the Treffinger learning model. In cycle 1, meeting 1, the number of students who completed 8 students became 11 students with an average score of 76.30 with a student learning completion percentage of 55%. Experiencing an increase in cycle 2, the number of students who completed 13 students at meeting 1 became 17 students with a completion percentage of 85% with an average class score of 83. It can be concluded that the application of the treffinger learning model can improve student learning outcomes at SD Negeri 022 Rambah Samo.

Keywords: Learning outcomes; Science learning; Treffinger

Introduction

Education is an important asset to develop interpersonal and intrapersonal intelligence in various fields of life to be able to develop existing potential (Syahril et al., 2021). Every teacher has a different way of conveying knowledge to their students. According to Rosa (2015), science is a science related to finding out about natural phenomena systematically, so that science is not just mastering a collection of knowledge in the form of facts, concepts or principles, but science learning is a process of discovery. Science learning is easy to learn which is done through direct observation. Through Science Learning it becomes a vehicle for learning about the natural surroundings so that students get direct learning experiences that involve everyday life (Pratama & Jumadi, 2023). Therefore, in order to foster student activity, it is best that in the teaching and learning process students be given the opportunity to be directly involved in scientific activities or experiences that have been designed by the teacher using various kinds of learning resources, learning media or using learning models (Johar, 2016).

The learning model is a frame of mind that guides someone to design and implement learning to help students to gain information, ideas, skills, values, ways of thinking, and the meaning of their expressions (Rusmansyah et al., 2019). Learning outcomes are abilities that students acquire after getting a learning experience from the teacher by carrying out certain assessments that explain the criteria that have been achieved (Yanti et al., 2023). Learning outcomes are abilities that students have after receiving their learning experiences (Aristawati et al., 2021).

Student learning outcomes are influenced by two main factors, namely factors from within students (Internal factors) and factors that come from outside students or environmental factors (External factors). This

How to Cite:
Marta, E., Elvina, Efendi, R., Rejeki, Ginda, A. P., & Angreani, S. (2024). Treffinger Model on Student Learning Outcomes in Grade IV Science Learning at Elementary School. *Jurnal Penelitian Pendidikan IPA*, *10*(3), 1375–1382. https://doi.org/10.29303/jppipa.v10i3.5342

factor has a huge influence on the learning outcomes to be achieved. Another internal factor that affects learning outcomes is learning activities (Hardiansyah & Mulyadi, 2022).

The Basic Sciences learning objective is to provide students with a broader understanding and insight into the sciences. It is assumed that science is very important for students to under-stand themselves and their surrounding phenomena as well as to examine the possibility of applying science in everyday life (Suyitno, 2019).

Learning science (Natural Science), is process of studying events that occur in nature by carrying out observations, experimentations, inferences, preparation of theories so that students' knowledge increases, as well as organized ideas and concepts about the natural surroundings, which are obtained from experience through the scientific process of inquiry (Hakim, 2023).

Often science learning is even carried out in the form of exercises to solve problems, solely in order to achieve the target learning outcome evaluation value as the main measure of student achievement and teacher success in managing learning. Science learning should emphasize mastery of basic scientific work abilities or science process skills (Utomo, 2023). Learning model play an important role in the acquisition of knowledge (Jeong et al., 2019).

A learning model is a framework used as a guide during the learning process to achieve goals. According to Joyce & Weil, they (Khoerunnisa & Aqwal, 2020) argue that a learning model is a plan or pattern that can be used to form a curriculum (long-term learning plan), design learning materials, and guide learning in class or otherwise. Model comes from the Greek "Methodos" which means the way or path taken (Lahir et al., 2017). According to Sugiono, (Kaban et al., 2020) the learning model is a design that describes the process of detailing and creating environmental situations that allow students to interact so that changes or developments occur in students. One of the efforts taken to improve student learning outcomes is to improve the teaching and learning process in schools by designing interesting and effective learning models (Hilmi & Harjono, 2017).

The learning outcome is an indicator of success achieved by students after following learning activities where it can be stated or defined in the form of a number or alphabet. Learning outcome can be known through some evaluations which can describe the cognitive, affective and psychomotor domain (Anggreani et al., 2020). This research, however, focused on the cognitive domain since the limitation of time on doing the research. As the problems explained, one of the solutions to overcome issues regarding the process of learning and to increase learning outcomes was by applying the learning model. From the previous research, Treffinger model could also increase students' understanding of the concept and so does the learning outcome. Treffinger model is a learning model that refers to critical thinking on finding new concepts. To find out the comparison of learning outcomes cycle 1 and cycle 2, with of Treffinger model on learning.

Treffinger learning model is a learning model that leads to critical and creative thinking skills (Annuuru et al., 2017). This model was introduced by Donald J. Treffinger in 1980. According to Munandar, the Treffinger model is one of the few models that addresses creativity directly and provides practical suggestions on how to achieve integration (Grasella et al., 2018). Based on this opinion, it can be concluded that the Treffinger model is a learning model designed to train critical and creative thinking skills to solve problems which makes students act more actively and express their creative ideas.

The Treffinger model is a model that encourages creative thinking and is one of the few models that addresses creativity issues directly (Dewi, 2020). Thus, for both cognitive and affective skills at each level of this model, Treffinger shows the interconnection and dependence between the two in encouraging creative learning (Rifa et al., 2020).

This model deals with creativity directly and gives practical advice on how to achieve integration. By involving cognitive and affective abilities at every level of this model, Treffinger shows the mutual relationships and dependencies between them in encouraging creative learning (Elvita et al., 2020).

Treffinger model emphasis the development of students' creativity through three stages of learning. The stages in the model are basic tools, that cover a number of techniques that are regarded as the basics in creative learning: real problems posing to the students that are suitable with their experiences and levels of knowledge so that they will immediately engage in meaningful learning with more than one answer to a problem (Ndiung et al., 2021).

Treffinger learning model consists of three important components, namely understanding challenges, generating ideas, and preparing for action (Lestari et al., 2022). Treffinger learning model is one of the learning models specially designed with the learning stages to trigger students' creative thinking ability involving both cognitive and affective skills (Handayani et al., 2018).

The important steps in Treffinger creative learning model are (1) accommodating a variety of new ideas and seeing as many ways as possible to solve problems; (2) using ideas that involve thinking process and feeling; (3)

using the creative feeling and thinking to solve problems (Mustafa, 2022). The use of Treffinger model in learning has been supported by two study findings. Treffinger learning model gives a positive contribution to the development or improvement in the students' creative thinking and mathematical problem solving. In addition, Treffinger creative learning model can be implemented in education, starting from elementary to university. Improved learning outcomes are reflected in the successful acquisition of qualifications in a subject, which depends on several aspects (Sudirman, 2023).

In this new education system, an instructor's knowledge of the subject matter is critical, but not sufficient. Although in theory the teacher is withdrawn from the center, it is not easy to abandon the traditional teacher-centered approach in practice (Aksoy, 2021). This might lead to a lack of student engagement and it might hamper students to actively construct knowledge (Alten et al., 2019). Accuracy in choosing an approach to learning is the key to success actualize learning outcomes that have been formulated previously. that approach developed with reference to the learning outcomes that will be actualized (Marta et al., 2023).

Teachers are too often relegated to passive consumers of research, encouraged to implement its fndings without understanding how these were generated or participating in research themselves (Wright, 2021). When conducting observations at SD Negeri 022 Rambah, the researcher encountered several problems faced by students and teachers at SD Negeri 022 Rambah during the learning process, the problems encountered were as follows; (1) The science learning process that takes place in schools is still not fun and boring, making students less interactive, where students are always filled with a ton of theory without paying attention to their psychological condition, as a result very few students are able to absorb the learning material well, (2) Teachers only using the lecture method, students only learn by listening to what the teacher says then students are given assignments, and (3) Low student learning outcomes that occur at SD Negeri 022 Rambah in class IV students. The shift is from a model focused on the teacher to a model in which the student takes an active role in the learning process, learning to learn while acquiring abilities and skills, and at the same time, truly assimilating concepts (García et al., 2018).

This research aims to determine whether the application of the Treffinger model can improve student learning outcomes in Class IV science learning at SD Negeri 022 Rambah.

Method

This research is Classroom Action Research which is carried out in class in order to provide changes or improvements in the learning process that can be carried out by teachers or researchers. In classroom settings, action research is a form of research that is conducted to improve teaching and learning. (Nodoushan & Ali, 2023). The action given is the implementation of the teaching and learning process by applying and developing outdoor activities learning methods (Djajadi & Rauf A, 2020).

Iskandar is of Yasri (2017) the opinion that Classroom Action Research (PTK) is a scientific research activity carried out rationally and systematically on various actions carried out by teachers (educating staff), collaboration (research team), from the preparation of a plan to the assessment of real actions in the classroom. in the form of teaching and learning activities, to improve and enhance the learning conditions carried out.

The subjects in this research were fourth grade students at SD Negeri 022 Rambah, with a total of 20 class students, 15 women and 5 men.

This research uses the Kemmis and Mc Taggarat model which consists of 4 action components, namely: (1) Planning, (2) Implementation of Action, (3) Observation, and (4) Reflection. It can be seen in figure 1.

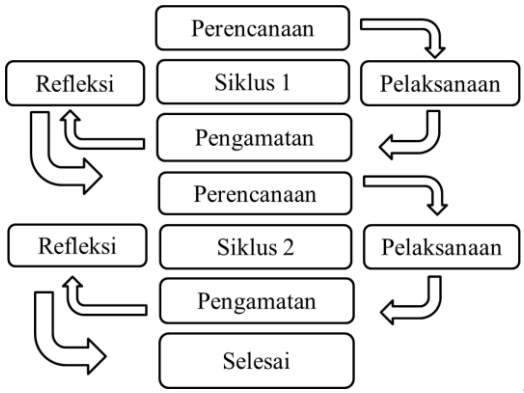

Figure 1. Classroom action research

The Planning stage is the initial stage in Classroom Action Research after obtaining a general overview of the problems that occur during the learning process. Implementation Stage Actions are carried out in implementing learning in accordance with the Learning Implementation Plan (RPP), holding test questions and carrying out evaluations. At the observation stage, direct observation activities are carried out by the observer regarding the ongoing learning process to obtain information data in the form of numbers and writing. The data obtained is used as an object of study. The Reflection Stage is the final activity in a series of Classroom Action Research (CAR) activities. Reflection is

carried out to obtain the results of the actions that have been carried out, then the results of the observations are collected and analyzed to find out whether the learning activities that have been carried out are as expected. If the observation results have not progressed *or* improved, improvements will be made in the next cycle. Instead, action research has lost its critical edge and become work that teachers do in the privacy of their classrooms. We concur with Kemmis notion that action research has a double task of the development of individual persons and the development of good societies and the good for the human (Miskovic et al., 2012).

The instruments in this research used observation sheets and written tests. The data collection techniques used in this research are as follows:

Observation Sheet

Observation is an activity carried out to record and observe all events and activities that occur. Observation activities are carried out at each meeting during the learning process by filling in the observation format provided. In this study, the observation instruments used included teacher and student observation sheets.

Question Sheet

Question sheet are used to obtain data on student learning outcomes in implementing the Treffinger learning model. That are given to students to see whether the student's abilities have improved or not changed at all. Tests are here considered to measure cognitive features such as knowledge and understanding of science concepts and topics (Taber, 2018).

The data analysis techniques that researchers used in this research were qualitative data and quantitative data. Quantitative data is data presented in the form of numbers, so quantitative data is not far from mathematical and statistical analysis. The source of the quantitative data used by researchers was obtained from students' learning results in taking tests. Qualitative data is data whose source is obtained from teachers and students in the form of data from observations in the learning process observed by the observer, namely the homeroom teacher for class IV at SD Negeri 022 Rambah through observation sheets.

The technique used to analyze data and determine the percentage of activity level and learning completion using equation 1:

1. Individual student absorption capacity

$$DSI = \frac{x}{y} \times 100\% \quad (1)$$

Information:
DSI = Student Absorption Capacity
x = Score obtained by the student
y = Maximum score on the question

2. Completeness of classical student learning outcomes

$$KBK = \frac{N}{S} \times 100\ \% \quad (2)$$

Information:
KBK = Classical Learning Completeness
N = Number of students who completed
S = Total number of students

3. Frequency distribution table

$$K = 1 + 3.3 \log n \quad (3)$$

Information:
K = Number of Interval Classes
n = Number of Observation Data
log = Logarithm

Qualitative data analysis uses data from student activities obtained from observation sheets, then analyzed in the form of percentages calculated using the formula:

$$\text{Percentage of Average Value} = \frac{Jumlah\ skor\ perolehan}{Skor\ maksimal} \times 100\% \quad (4)$$

Assessment category:
90 % ≤ NR < 100% = Very Good
80 % ≤ NR < 80% = Good
70 % ≤ NR < 79% = Fair
60 % ≤ NR < 69% = Less

This research is declared successful if the results obtained are in the good or very good category.

Result and Discussion

Before the research was carried out, the researcher had validated the questions, made observations and conducted interviews with the class IV teacher at SD Negeri 022 Rambah. From the results of the question validation, 18 valid questions were obtained. Researchers can analyze the results of observations and interviews conducted on student learning outcomes before taking action with the aim of being able to find out the problems that exist during the learning process. The following are the results of the Final Semester Assessment (PAS) of students for the 2022/2023 Academic Year before implementing learning using the Treffinger model in science learning can be seen in the table 1.

Table 1. Initial Observations of Elementary School

Interval class	F	Category	Amount and percentage	Average value
85-100	1	Complete	5 (25%)	61
74-84	4			
63-73	3	Not Completed	15 (75%)	
52-62	5			
41-51	3			
30-40	4			
Amount	20		20	

Source: Classroom teacher of Class IV SD Negeri 022 Rambah

Based on this table, it can be seen that the learning outcomes of class IV students at SD Negeri 022 Rambah in science lessons have not reached the classical completeness criteria so that there are still many students who have not reached the specified Minimum Completeness Criteria (KKM).

The success of teachers in educating students can be seen when students are able to achieve optimal results.This success does not only cover one subject, students are able to master and understand all the subjects that have been given by the teacher (Samsudin et al., 2023).

After applying the Treffinger learning model, the following results were obtained:

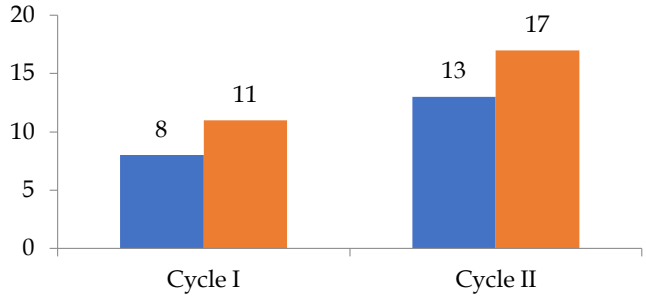

Figure 2. Completeness of student learning results

Treffinger model in science learning can also increase student activity significantly through the results of observations made in cycle 1 and cycle 2. The following is a recapitulation of observations of student activity in cycle 1 and cycle 2.

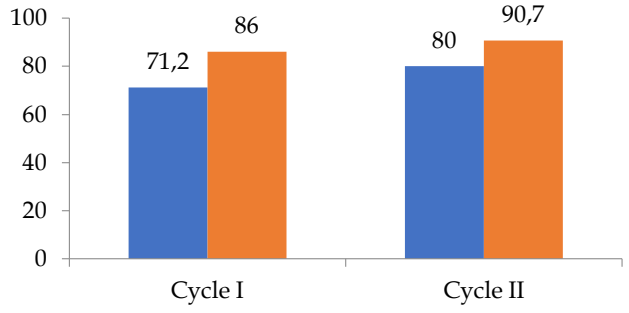

Figure 3. Results of student activity observations

Apart from that, the application of the Treffinger model in science learning can also increase teacher activity when in the classroom to become more active which can be seen from the data from observations of teacher activity in cycle 1 and cycle 2.

Treffinger model is a learning model designed to train critical and creative thinking skills to solve problems that make students act more actively and express their creative ideas. According to Muna (2017) science learning, it will be easier if the learning process is carried out through direct observation. Then Ulfah (2018) he said that in the teaching and learning process students should be given the opportunity to engage directly in scientific activities or experiences. From these two opinions, researchers collaborated on the use of the Treffinger learning model in science learning. In its implementation, researchers use experiments to make students act more actively so that students gain direct scientific experience and are able to express their creative ideas about what students observe through this scientific experience. Then get an explanation and problem solving for the phenomenon being studied.

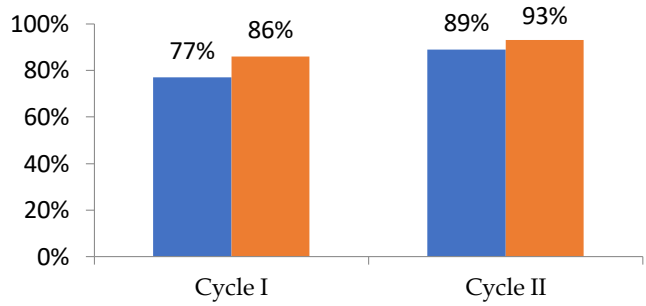

Figure 4. Observation results of teacher activities

These scholars also suggested that an effective and enjoyable science learning process must be student-centered in which students keenly take part in the learning process (Suhartono, 2019). Therefore, learning in schools, including science, is expected to be a tool so that students are not only able to master knowledge well but also be able to apply what they have learned in school to the community and use the community as a learning resource (Annisa & Subiantoro, 2022). Apart from the factors that can affect students' attitudes towards learning which is the level of understanding, the anxiety, the presence, the workload of teachers, school discipline and time management (Sumarni et al., 2016).

Assessment during the studies mainly consists of guidance of learning through feedback (Rissanen et al., 2019). Good learning outcomes obtained by students certainly cannot be separated from the achievements of teachers in managing learning in the classroom. Managing learning in the classroom is one of the jobs of a professional teacher who is oriented to the needs of

students. Therefore, teachers are expected to be able to plan their lessons well, up to the preparation of learning evaluation tools (Tanta et al., 2023).

Conclusion

Based on the results of classroom action research conducted on fourth grade students at SD Negeri 022 Rambah which was carried out using the Treffinger model in science learning, it can be concluded that there has been an increase. In cycle 1, meeting 1, the number of students who completed 8 students became 11 students with an average score of 76.3 with a student learning completion percentage of 55%. Experienced an increase in cycle 2, the number of students who completed 13 students at meeting 1 became 17 students with a completion percentage of 85% with an average class score of 83. Apart from that, the application of the treffinger model in science learning can also increase student activity through the results of observations in the cycle 1 meeting 1 got results of 71.2% at meeting 2 to 80%. Experienced an increase in cycle 2, meeting 1, getting results from 86% to 90.7% at meeting 2. Meanwhile, the results of observing teacher activities in cycle 1, meeting 1, got results from 77% to 86%, experiencing an increase in cycle 2, meeting 1, from 89% to 93% at meeting 2.

Author Contributions

The author's contributions include Eni Marta and Elvina, focus on methodology, and review of writing. Rinja Efendi and Rejeki collecting data, Abdul Putra Ginda and Sari Angreani analyzing data, writing original drafts, and so on.

Funding

This research was independently funded by researchers.

Conflicts of Interest

The authors declare no conflict of interest.

References

Aksoy, M. (2021). An action research on improving classroom communication and interaction in social studies teaching. *Education Research International,* 1-19. https://doi.org/10.1155/2021/9943194

Alten, D. C. D. Van, Phielix, C., Janssen, J., & Kester, L. (2019). Effects of flipping the classroom on learning outcomes and satisfaction: A meta-analysis. *Educational Research Review*, *28*. https://doi.org/10.1016/j.edurev.2019.05.003

Anggreani, W., Maskur, R., Susanti, A., Suryani, A., Safitri, W. D., & Susilowati, N. E. (2020). The Comparison of Concept Attainment Model and Treffinger Model on Learning Outcome of Al-Kautsar Senior High School Bandar Lampung. In *Journal of Physics: Conference Series* (Vol. 1467, No. 1, p. 012009). IOP Publishing. https://doi.org/10.1088/1742-6596/1467/1/012009

Annisa, D., & Subiantoro, A. (2022). Mobile Augmented Reality In Socioscientific Issues-Based Learning : The Effectiveness On Students' Conceptual Knowledge and Socioscientific Reasoning. *Jurnal Pendidikan IPA Indonesia, 11*(4), 611–625. https://doi.org/10.15294/jpii.v11i4.38993

Annuuru, T. A., Johan, R. C., & Ali, M. (2017). Peningkatan Kemampuan Berpikir Tingkat Tinggi dalam Pelajaran Ilmu Pengetahuan Alam Peserta Didik Sekolah Dasar Melalui Model Pembelajaran Treffinger. *Edutcehnologia*, *3*(2), 136–144. Retrieved from https://ejournal.upi.edu/index.php/edutechnologia/article/view/9144

Aristawati, I. V., Wiyanto, W., & Astuti, B. (2021). Implementation of Modified Problem Based Learning (PBL) in Improving Learning Outcomes of Physics Vocational School for Optical Materials. *Jurnal Penelitian Pendidikan IPA*, *7*(SpecialIssue), 244–249. https://doi.org/10.29303/jppipa.v7ispecialissue.869

Dewi, S. H. (2020). Pengaruh Model Pembelajaran Treffinger Terhadap Kemampuan Berpikir Kreatif Matematis Siswa. *Seminar Nasional Pendidikan FKIP UNMA*, *20*, 251–261. Retrieved from https://prosiding.unma.ac.id/index.php/semnasfkip/article/view/329

Djajadi, M., & Rauf A. (2020). Learning Physics of Motion and Force Using the Outdoor Activities : An Effort To Increase Students' Interest and Achievement At Secondary School. *Jurnal Pendidikan IPA Indonesia 9*(160), 208–218. https://doi.org/10.15294/jpii.v9i2.24001

Elvita, A., Johar, A., & Abidin, T. F. (2020). The development of learning tools using treffinger model assisted by geogebra to enhance students ' creativity The development of learning tools using treffinger model assisted by geogebra to enhance students' creativity. *Journal of Physics: Conference Series*. https://doi.org/10.1088/1742-6596/1460/1/012045

García, C. R., García, O. B., & Touron, J. (2018). The Flipped Learning Model in Online Education for Secondary Teachers. *Journal of Technology and Science Education*, *9*(2), 109–121. https://doi.org/10.3926/jotse.435

Grasella, P., Adriana, S., Gaol, Y. D. L., & Sahnan, M. (2018). Efektivitas Model Pembelajaran Treffinger Terhadap Hasil Belajar Dan Kemampuan Berpikir

Kreatif Siswa Pada Materi Ekologi. *Jurnal Pelita Pendidikan,* *6*(4), 211–217. https://doi.org/10.24114/jpp.v6i4.10583

Hakim, D. L. (2023). The Relationship between Science and Mathematics Student Learning Outcomes. *Jurnal Penelitian Pendidikan IPA*, *9*(5), 3890–3898. https://doi.org/10.29303/jppipa.v9i5.3684

Handayani, R., Hajidin, Duskri, M., & Maidiyah, E. (2018). Development of learning tools using Treffinger learning model to improve creative thinking. *Journal of Physics: Conference Series*, *1088*, 012090. https://doi.org/10.1088/1742-6596/1088/1/012090

Hardiansyah, F., & Mulyadi. (2022). Improve Science Learning Outcomes for Elementary School Students Through The Development of Flipbook Media. *Jurnal Penelitian Pendidikan IPA*, *8*(6), 3069–3077. https://doi.org/10.29303/jppipa.v8i6.2413

Hilmi, N., & Harjono, A. (2017). Pengaruh Model Pembelajaran Discovery Dengan Pendekatan Saintifik Dan Keterampilan Proses Terhadap Hasil Belajar Fisika Peserta Didik. *Jurnal Penelitian Pendidikan IPA*, *3*(2). https://doi.org/10.29303/jppipa.v3i2.95

Jeong, J. S., González-gómez, D., & Cañada-cañada, F. (2019). Effects of active learning methodologies on the students' emotions, self-efficacy beliefs and learning outcomes in a science distance learning course. *JOTSE: Journal of Technology and Science Education,* *9*(2), 217-227. https://doi.org/10.3926/jotse.530

Johar. (2016). *Strategi Belajar Mengajar*. Deepublish.

Kaban, R. H., Anzelina, D., Sinaga, R., & Silaban, P. J. (2020). Pengaruh Model Pembelajaran PAKEM terhadap Hasil Belajar Siswa di Sekolah Dasar. *Jurnal Basicedu*, *5*(1), 102–109. https://doi.org/10.31004/basicedu.v5i1.574

Khoerunnisa, P., & Aqwal, S. M. (2020). Analisis Model-model Pembelajaran. *FONDATIA*, *4*(1), 1–27. https://doi.org/10.36088/fondatia.v4i1.441

Lahir, S., Ma'ruf, M. H., & Tho'in, M. (2017). Peningkatan Prestasi Belajar Melalui Model Pembelajaran Yang Tepat Pada Sekolah Dasar Sampai Perguruan Tinggi. *Jurnal Ilmiah Edunomika*, *1*(01), 1–8. https://doi.org/10.29040/jie.v1i01.194

Lestari, S., Waluya, B., & Dewi, N. R. (2022). Kemampuan Penalaran Matematis Siswa Smk Dalam Model Pembelajaran Treffinger Berbasis Filosofi. *Jurnal Ilmiah Pendidikan Matematika*, *7*, 113–121. https://doi.org/10.26877/jipmat.v7i2.12057

Marta, E., Hasrijal, Anggreani, S., & Yuliawati, N. (2023). STEM Tingkatkan HOTS (Higher Other Thinking Skills) Mahasiswa PGSD pada Matakuliah Konsep Dasar IPA Fisika. *El-Ibtidaiy: Journal of Primary Education*, *6*(1), 9–17. https://doi.org/10.24014/ejpe.v6i1.22006

Miskovic, M., Efron, E. S., & Ravid, R. (2012). Action Research in Action: From University to School Classrooms. *Hindawi Publishing Corporation*, *2012*. https://doi.org/10.1155/2012/389736

Muna, I. A. (2017). Model pembelajaran POE (predict-observe-explain) dalam meningkatkan pemahaman konsep dan keterampilan proses IPA. *El-Wasathiya: Jurnal Studi Agama,* *5*(1), 73-92. https://doi.org/10.35888/el-wasathiya.v5i1.3028

Mustafa, S. (2022). Implementation of Treffinger Model assisted by Color Card Media to Enhance Students' Mathematical Creativity Skills. *Jurnal Pendidikan MIPA*, *23*(3), 804–815. https://doi.org/10.23960/jpmipa/v23i3.pp804-815

Ndiung, S., Sariyasa, Jehadus, E., & Apsari, R. A. (2021). The effect of treffinger creative learning model with the use rme principles on creative thinking skill and mathematics learning outcome. *International Journal of Instruction*, *14*(2), 873–888. https://doi.org/10.29333/iji.2021.14249a

Nodoushan, S., & Ali, M. (2023). EFL classroom, petri dish, panopticon, and free world: How do they merge through action research? *International Journal of Language Studies,* *17*(1), 97–116. https://doi.org/10.5281/zenodo.7513355

Pratama, D. H., & Jumadi, J. (2023). Analysis the Implementation of Ethnoscience Approach in Learning Science. *Jurnal Penelitian Pendidikan IPA*, *9*(4), 1615–1620. https://doi.org/10.29303/jppipa.v9i4.2721

Rifa, R., Sujana, A., & Romdonah, I. (2020). Penerapan model pembelajaran treffinger untuk meningkatkan kemampuan berpikir kreatif matematis siswa. *Jurnal Analisa,* *6*(1), 1–9. https://doi.org/10.15575/ja.v6i1.4365

Rissanen, I., Kuusisto, E., Tuominen, M., & Tirri, K. (2019). In search of a growth mindset pedagogy : A case study of one teacher ' s classroom practices in a Finnish elementary school. *Teaching and Teacher Education*, *77*, 204–213. https://doi.org/10.1016/j.tate.2018.10.002

Rosa, F. O. (2015). Pengembangan Modul Pembelajaran Ipa Smp Pada Materi Tekanan Berbasis Keterampilan Proses Sains. *Jurnal Pendidikan Fisika*, *3*(1), 49–63. https://doi.org/10.24127/jpf.v3i1.21

Rusmansyah, Yuanita, L., Ibrahim, M., & Prahani, B. K. (2019). Innovative Chemistry Learning Model: Improving The Critical Thinking Skill And Self-Efficacy Of Pre-Service. *Journal of Technology and Science Education*, *9*(1), 59–76.

https://doi.org/10.3926/jotse.555

Samsudin, A., Raharjo, T. J., & Widiasih. (2023). Effectiveness of Contextual Teaching Learning (CTL) and Problem Based Learning (PBL) Models in Class VI Science Subjects on Creativity and Learning Outcomes. *Jurnal Penelitian Pendidikan IPA*, *9*(11), 9324–9331. https://doi.org/10.29303/jppipa.v9i11.5290

Sudirman, S. (2023). Influence of Listening Team Learning (LTL) Model on Students' Learning Outcome in Science. *Jurnal Penelitian Pendidikan IPA*, *9*(3), 1085–1091. https://doi.org/10.29303/jppipa.v9i3.3161

Suhartono. (2019). A Comparison Study: Effects Of The Group Investigation Model And The Direct Instruction Model Toward Science Concept Understanding. *Jurnal Pendidikan IPA Indonesia*, *8*(2), 185–192. https://doi.org/ 10.15294/jpii.v8i2.18135

Sumarni, W., Wardani, S., & Gupitasari, D. N. (2016). Project Based Learning (PBL) to Improve Psychomotoric Skills: A Classroom Action Research. *Jurnal Pendidikan IPA Indonesia 5*(2), 157–163. https://doi.org/10.15294/jpii.v5i2.4402

Suyitno, I. (2019). A Comparison Study : Effects Of The Group Investigation Model And The Direct Instruction Model Toward Science Concept Understanding. *Jurnal Pendidikan IPA Indonesia, 8*(2), 185–192. https://doi.org/10.15294/jpii.v8i2.18135

Syahril, Nabawi, R. A., & Safitri, D. (2021). Students' Perceptions Of The Project Based On The Potential Of Their Region : A Project-Based Learning. *Journal of Technology and Science Education, 11*(2), 295–314. https://doi.org/10.3926/jotse.1153

Taber, K. S. (2018). The Use of Cronbach's Alpha When Developing and Reporting Research Instruments in Science Education. *Research in Science Education*, *48*, 1273–1296. https://doi.org/10.1007/s11165-016-9602-2

Tanta, Megawati, R., & Akobiarek, M. (2023). Analysis of Difficulties of Science Teachers in Jayapura City in Conducting Class Action Research. *Jurnal Penelitian Pendidikan IPA*, *9*(10), 8772–8783. https://doi.org/10.29303/jppipa.v9i10.5094

Ulfah, M. (2018). The Effect of Scientific Inquiry Learning Model for Student's Science Process Skill and Self Efficacy in The Static Fluid Subject. *3rd Annual International Seminar on Transformative Education and Educational Leadership*, *200*, 446–449. https://doi.org/10.2991/aisteel-18.2018.96

Utomo, D. S. (2023). Development of A Guided Discovery Learning Model Based on E-Learning in Thematic Learning. *Jurnal Penelitian Pendidikan IPA*, *9*(12), 11625–11640. https://doi.org/10.29303/jppipa.v9i12.5309

Wright, P. (2021). Transforming mathematics classroom practice through participatory action research. *Journal of Mathematics Teacher Education*, *24*(2), 155–177. https://doi.org/10.1007/s10857-019-09452-1

Yanti, N. L. I. M., Redhana, W., & Suastra, W. (2023). Multiple Scaffolding STEAM Project-Based Learning Model In Science Learning. *Jurnal Penelitian Pendidikan IPA*, *9*(8), 6493–6502. https://doi.org/10.29303/jppipa.v9i8.4470

Yasri, B. (2017). Pengembangan Profesionalisme Widyaiswara Melalui Penelitian Tindakan Kelas. *Jurnal Edukasi*, *5*(1), 49–60. https://doi.org/10.25157/je.v5i1.262