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Optimizing Students' Critical Thinking and Communication Skills Through Discovery Learning

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Abstract

This study aims to describe the implementation of the Discovery Learning model and its impact on the development of students' critical thinking and communication skills in the topic "Understanding Animal Life Cycles" for third-grade students at SD Negeri Kampung Besar. This research employed a descriptive qualitative approach, collecting data through observations, interviews, and documentation. All data were systematically analyzed using NVivo software to strengthen the coding process and thematic interpretation. The findings show that Discovery Learning creates a more active and meaningful learning environment through exploration, discussion, concept discovery, and reflection. Students became more engaged in independently constructing their understanding of animal life cycle stages, resulting in better comprehension and retention. Additionally, the model enhanced students' critical thinking skills, particularly in distinguishing types of metamorphosis and providing logical, independent reasoning. Communication skills also improved through group discussions and presentations. Overall, Discovery Learning effectively increased students' motivation, active participation, and learning effectiveness while strengthening essential 21st-century skills in elementary school learners.

Keywords: *Discovery Learning, Critical Thinking, Communication*

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INTRODUCTION

Education in the 21st century era demands a fundamental transformation in the learning paradigm, where the main focus shifts from passive mastery of material to the development of high-level competencies. At the primary school level, the foundation of education is no longer enough with basic literacy alone, but must include critical thinking skills and effective communication skills. Critical thinking skills allow learners to analyze information deeply and solve complex problems, while communication skills become a crucial means of conveying ideas logically. These two competencies are the main pillars in the modern curriculum that aims to produce human resources that are adaptive and able to compete globally from an early age[1].

The reality on the ground shows that there is a significant gap between the demands of the curriculum and instructional practices in the classroom. The learning process at the elementary school level is often still dominated by conventional teacher-centered methods. In this context, students tend to be passive recipients of information, who only memorize facts without understanding the essence or relationship between concepts [2]. Limited space for students to explore leads to low motivation to learn and inhibits the development of analytical thinking potential. This problem becomes even more crucial when the subject studied is Natural Sciences (IPA), which should prioritize the process of inquiry and discovery.

Material on the life cycle of animals in grade III elementary school is one of the crucial topics in the science curriculum because it involves an understanding of ecosystem sustainability and abstract biological concepts. The phenomenon of metamorphosis and the stages of development of living things are often difficult for students to understand if they are only conveyed through lectures or book texts. Without active involvement in observing and discussing the phenomenon, students struggle to distinguish the specific characteristics of each phase of an animal's life [3]. Therefore, a pedagogical approach is

[1] Faelani, 'Eksperimentasi Model Pembelajaran Inkuiri Terbimbing Dan Discovery Learning Pada Pembelajaran Fisika', *Seminar Nasional Pendidikan*, 2020; Diana Putri Larasati and Imam Sucahyo, 'Tren Penerapan Model Pembelajaran Guided Discovery Untuk Mengajarkan Materi Fisika Di SMA', *IPF: Inovasi Pendidikan Fisika*, 10.1 (2021), doi:10.26740/ipf.v10n1.p144-152; Muzaffer Toprak Keskin, Özlem Alagül, and Ferda Gürsel, 'Self-Discovery and Life Skill Building through Holistic Learning in High School Students', *Journal of Adventure Education and Outdoor Learning*, published online 2022, doi:10.1080/14729679.2022.2100798.

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[3] Sischa Fitria Apriani and others, 'Pengembangan Media Puzzle Pada Materi Metamorfosis Untuk Meningkatkan Hasil Belajar Siswa Kelas 3', *JIIP - Jurnal Ilmiah Ilmu Pendidikan*, 8.1 (2025), doi:10.54371/jiip.v8i1.6275; Annisa Fauziah, Din Azwar Uswatun, and Astri Sutisnawati, 'Penerapan Media Pembelajaran Pop Up Book Untuk Meningkatkan Pemahaman Konsep IPA Pada Materi Metamorfosis Di Sekolah Dasar', *Jurnal Basicedu*, 9.4 (2025), doi:10.31004/basicedu.v9i4.10281; Jihan Fairuz Qolbi and Syamsuyurnita, 'Pengaruh Penggunaan Media Booklet Metamorfosis Terhadap Hasil Belajar Pada Pembelajaran IPA Siswa SD Kelas 4 Di Sanggar Belajar Pandan Malaysia', *Pendas: Jurnal*

needed that is able to bridge these abstract concepts with empirical realities that can be experienced directly by students in their environment.

Discovery Learning emerged as an innovative learning model designed to overcome these barriers through a self-discovery approach[4]. This model encourages learners to organize their own learning, conduct investigations, and draw conclusions based on the data they find. By positioning teachers as facilitators, Discovery Learning gives students autonomy to explore the subject matter in more depth. Through the stages of stimulation, problem statement, and verification, this model inherently stimulates students' curiosity and trains their thinking acumen in dealing with new situations.

Optimization of critical thinking skills through Discovery Learning occurs when students are faced with the challenge of finding solutions to unsolved problems [5]. In the context of the life cycle of animals, students are not simply informed about the difference between perfect and imperfect metamorphosis, but are challenged to classify them based on self-observation. This mental process of comparing, categorizing and evaluating scientific evidence is what shapes students' cognitive acuity. Previous research has shown that discovery-based learning is able to significantly improve students' argumentation skills, as every conclusion they draw is based on an empirical proofing process. In addition to the cognitive aspect, the social dimension in the form of communication skills is also the main focus in the application of this model. Discovery Learning facilitates interaction between students through group discussions and presentation of findings. In those interactions, students are forced to formulate their thoughts into clear sentences, respond to peer questions, and defend their arguments with valid data. The ability to communicate scientific ideas orally and in writing is an important aspect of science literacy. Thus, this model not only hones individual intelligence, but also builds the collaborative intelligence necessary in community life.

Although the potential of the Discovery Learning model has been widely discussed in the educational literature, its implementation in elementary schools in rural areas often

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faces unique challenges. SD Negeri Kampung Besar is a relevant research locus because it reflects the characteristics of schools with the dynamics of student heterogeneity that require a fresher and more participatory teaching approach. There is still an assumption that students in low grades (such as grade III) are not mature enough to conduct discovery-based learning independently. This research aims to break the stigma by proving that with the right guidance, elementary school students are able to carry out a systematic discovery process.

The use of qualitative data analysis software such as NVivo in this study provides a new dimension in the evaluation of the success of the learning model. With the help of this technology, every phenomenon that arises during the learning process whether in the form of speech, behavior, or student work can be systematically encoded to attract key themes related to the development of critical thinking and communication skills. A descriptive qualitative approach supported by modern software analysis ensures that the conclusions drawn have strong credibility and interpretive depth. This provides methodological advantages in mapping the real impact of the pedagogical interventions carried out.

This research seeks to answer the challenge of how to effectively integrate active learning strategies into the science curriculum at the elementary level. The focus on animal life cycle material was chosen because it has high visual and observational potential, which aligns with the Discovery Learning syntax. The success of the implementation of this model is expected not only to have an impact on the achievement of momentary academic scores, but also on the formation of students' character as lifelong learners who have high curiosity and superior communication skills. This is in line with the vision of global education which emphasizes the mastery of soft skills competencies in addition to hard skills. This article aims to comprehensively describe the effectiveness of the application of the Discovery Learning model in improving students' critical thinking and communication skills at SD Negeri Kampung Besar. Through exposure to in-depth observation and interview data, it is hoped that this research can make a theoretical contribution to the development of active learning models in elementary schools. In addition, the results of this research are expected to be a practical reference for educators and policy makers in designing learning strategies that are more inclusive, innovative, and oriented towards the holistic development of students' potential in the future.

RESEARCH METHODS

This study uses a qualitative approach with a descriptive design to explore in depth how the implementation of the Discovery Learning model can optimize students' critical thinking and communication skills. The qualitative approach was chosen because the researcher wanted to capture complex phenomena in the classroom that cannot be measured just by numbers, but through the interpretation of students' behavior, speech, and interaction during the learning process. The case study strategy was applied at SD Negeri Kampung Besar, where the researcher acted as a key instrument that participatively observed every emerging dynamic. With this design, researchers can describe the field reality holistically and systematically regarding the effectiveness of learning models in the context of animal life cycle material.

The subjects of this study are grade III students of SD Negeri Kampung Besar which amount to one heterogeneous class. The selection of subjects is based on the consideration

that students in this phase are in a period of cognitive transition from concrete operations to more complex understanding, thus requiring measurable critical thinking stimulation. The research location was chosen deliberately (purposive) because of the characteristics of the school environment which allowed the application of the discovery model based on the surrounding environment. In addition to students, classroom teachers are also involved as key informants to provide perspectives on obstacles and supports in the application of the Discovery Learning model, so that comprehensive data is obtained from various stakeholder perspectives in the classroom.

The data collection technique was carried out through triangulation methods which included participatory observation, in-depth interviews, and documentation. Observations are carried out during the learning process to record student activities in each Discovery Learning syntax, from providing stimuli to drawing conclusions. Structured and unstructured interviews were conducted with students to explore the depths of their critical thinking as well as to teachers to validate findings in the field. Meanwhile, documentation in the form of learning implementation plans (RPP), student work results, and learning video recordings were collected as empirical evidence that supported the observation data. All of this data is then converged to ensure the validity and reliability of research findings through cross-checking between data sources.

The methodological uniqueness in this study lies in the use of qualitative data analysis software, namely NVivo, to process the data that has been collected. The use of NVivo aims to improve efficiency and transparency in the process of coding large amounts of data from interview transcripts and field notes. With this device, researchers can perform thematic mapping more accurately, build relationships between categories, and visualize data in the form of word trees or concept maps. This digitization of data analysis minimizes the subjectivity of researchers and allows the identification of hidden patterns of how students' communication skills develop gradually during group interactions in the Discovery Learning model.

The data analysis process follows an interactive model consisting of data collection, data reduction, data presentation, and conclusion drawn. In the reduction stage, data that are not relevant to the research focus on critical thinking and communication are separated, while crucial data are categorized into specific codes within NVivo. Once the data is organized, the researcher presents the findings in the form of a descriptive narrative supported by direct quotes from the research subjects as well as visualizations from the analysis software. The final stage is verification, where the researcher conducts critical reflection on the findings to ensure that the conclusions drawn truly represent the reality that occurred at SD Negeri Kampung Besar, as well as answer research questions thoroughly.

To ensure the reliability of the data, this study applies four main criteria: credibility, transferability, dependability, and confirmability. Credibility is achieved through extended observation and triangulation of techniques. Transferability is sought by providing a very in-depth description of the research context so that the results can be understood or adapted by other researchers in a similar environment. External audits are carried out on the research process to ensure dependability, while confirmability is maintained by ensuring that all findings are truly derived from field data and are not subjective biases of the researcher. All of these procedures are strictly carried out to produce scientific works that have high integrity and can be accounted for at the international level.

RESULT AND DISCUSSION

Research Results

The results of the observation show that the application of the Discovery Learning model at SD Negeri Kampung Besar on animal life cycle materials has been carried out in accordance with the planned syntax. At the stimulation stage, the teacher succeeded in triggering students' curiosity by presenting the media of real images and specimens around the school environment. This activity creates a high initial engagement, where students begin to show an exploratory interest in the different phases of life between the different types of animals they encounter on a daily basis.

In the problem statement stage, students demonstrate the ability to formulate fundamental questions about the difference between perfect and imperfect metamorphosis. During the data collection process, students work in groups to make direct observations of the objects provided. The use of structured worksheets helps students organize the information they find, so that the process of discovering concepts does not happen randomly but is systematic and oriented to learning goals.

The effectiveness of learning outcomes is strongly supported by the use of the surrounding environment as a natural laboratory. Students not only rely on the text of books, but also observe real phases in animals such as butterflies and frogs that exist around the school. Data obtained from NVivo show that the keywords "direct observation" and "environment" emerged as the dominant themes underlying students' understanding of the concept of dynamic animal life cycle material.

Analysis of student work results and interviews revealed a significant increase in critical thinking aspects. Students begin to be able to provide logical arguments when categorizing animals into specific types of metamorphosis. They no longer simply memorize phases, but can explain the reasons why certain phases are referred to as larvae or pupae. Through NVivo coding, there was an improvement in students' "analysis" and "evaluation" skills compared to the conditions before the Discovery Learning model intervention.

In the communication dimension, the results of the study showed positive changes in verbal behavior. During the group discussion, students who were previously passive began to dare to express their opinions. The frequency of interaction between students increases along with the freedom afforded in the discovery model. Students learn to use simple scientific terms appropriately when explaining their findings to peers, reflecting the growth of science communication literacy at the elementary level.

The verification stage is a crucial moment where students present the results of their discussions in front of the class. Documentation data show that most groups are able to present the sequence of animal life cycles correctly and provide clarification to questions from other groups. This process not only tests the correctness of the concepts they discover, but also trains confidence and dexterity in public speaking.

The results of the study also highlight the role of teachers who transform from primary sources of information to supportive guides. Teachers provide scaffolding or minimal assistance when students experience impasse in the discovery process. From the interview transcript analyzed with NVivo, the teacher stated that this model makes it

easier for them to assess students' affective and psychomotor abilities more objectively because students' activities look more real and measurable.

Based on the analysis of concept maps and word trees in NVivo, it was found that the mastery of the concept of animal life cycle was directly proportional to the intensity of group discussions. The themes of "collaboration" and "discussion" are closely related to the success rate of students in achieving the minimum completeness criteria. This data visualization emphasizes that the success of Discovery Learning in this school does not occur in isolation, but through strong social and cognitive interactions between students, teachers, and learning resources.

Discussion and Discussion

This discussion underlines that the implementation of Discovery Learning has succeeded in changing the learning landscape at SD Negeri Kampung Besar from a mechanistic model to a constructivistic model. By placing students as active subjects, the knowledge formed is more permanent because it is based on empirical experience. This is in line with cognitive theory which states that learning will be more meaningful if individuals are directly involved in the process of constructing their own understanding [6]. Findings on increased critical thinking suggest that early age is not a barrier to the development of high-level cognitive skills. Through challenges in the problem statement stage, grade III students were proven to be able to perform a simple logical analysis. This success proves that the right instructional strategies can stimulate students' metacognitive abilities, even on biological material that is considered as complex as the life cycle of animals.

The rapidly developing communication skills in this study show that language is a tool of thinking. As students discuss to solve invention problems, they simultaneously hone their linguistic and logical skills. Communication in the context of Discovery Learning is not just talking, but a process of negotiation of deep meaning. This reinforces the view that science literacy cannot be separated from students' communicative abilities in the classroom[7].

[6] Ahmad Arif Fadilah and others, 'Analisis Strategi Discovery Learning Untuk Meningkatkan Hasil Belajar Peserta Dididk', *Cendekia Pendidikan*, 11.2 (2025); Aleksandar Milenković, Jelena Stevanić, and Natali Zdravković, 'The Impact of Discovery-Based Learning with Physical Manipulatives in Teaching the Area of Triangles and Quadrilaterals on Students' Achievement', *Journal of Pedagogical Research*, 9.3 (2025), doi:10.33902/JPR.202533557; I Gede Anugrah Pinaruh and I Made Dharma Atmaja, 'Upaya Meningkatkan Kemampuan Self-Regulated Learning Melalui Penerapan Discovery Learning Berbantuan Google Sites', *Pendas : Jurnal Ilmiah Pendidikan Dasar*, 10.2 (2025); Made Purwa Dana Atmaja and others, 'Integrating Balinese Local Wisdom in Culinary Art Program: Enhancing Students' Food Literacy and Culinary Skills Through Discovery Learning', *New Educational Review*, 79.1 (2025), doi:10.15804/tner.2025.79.1.08.

[7] Mugi Arto, Nego Linuhung, and Rahmad Bustanul Anwar, 'Discovery Learning Model: A Solution to Improve Learners' Mathematical Generalization Ability', *International Journal of Multidisciplinary Reseacrh of Higher Education (IJMURHICA)*, 8.3 (2025); Khairunnisa Khairunnisa, 'A Meta-Analysis of the Effect of Discovery Learning Model on Students' Conceptual Understanding and Mathematical Reasoning Abilities', *International Journal of Education*, 18.1 (2025).

The use of real media in the school environment is a key factor in the success of this model. Piaget's theory of child development emphasizes that elementary school students are still at the concrete operational stage. By presenting real objects, the Discovery Learning model provides a cognitive bridge that makes it easier for students to understand abstract concepts of metamorphosis. The school environment acts as an unlimited and highly contextual learning resource for students' lives [8].

Group discussions in this model not only have an impact on cognitive learning outcomes but also on the development of social character. Students learn to respect the opinions of others, work together, and share roles in teams. This phenomenon shows that Discovery Learning has a holistic educational dimension that prepares students for 21st century skills, where collaboration is one of the most sought-after competencies in the world of tomorrow's work. Although successful, this discussion also noted challenges such as time constraints in the discovery process. Teachers must have excellent time management so that each syntax can be implemented without compromising students' right to explore. However, the efficiency achieved through the use of NVivo in analyzing student progress provides a solution for teachers to reflect more quickly and accurately on the learning process that has taken place.

The use of NVivo in this study makes a significant methodological contribution. Thematic analysis that is usually subjective has become more measurable and systematic. This allows researchers to see the relationship between communication variables and critical thinking more sharply through a coding matrix. The use of this technology at the elementary school level proves that educational research can be improved in quality through the adoption of modern data analysis software. One of the long-term impacts of this model is the growth of learning independence. Students begin to show initiative to look for additional information beyond what the teacher provides. The confidence that arises after successfully "discovering" something independently becomes a strong intrinsic motivation for them. This independence is the main capital for students to become lifelong learners in a very dynamic information era [9].

The results of this study have practical implications for educators not to hesitate to abandon the lecture method. Discovery Learning is proving relevant to be applied in elementary schools as long as teachers are able to design the right stimulus. The science curriculum should be encouraged to provide more space for simple field observations and experiments, because that is where the essence of science really is that is, the process of finding out about nature in a systematic way. As a closing part of the discussion, it can

[8] Ida Bayu Khori'ana, Iqnatia Alfiansyah, and Nataria Wahyuning Subayani, 'Pengaruh Model Pembelajaran Discovery Learning Terhadap Pemahaman Konsep Materi Wujud Zat Dan Perubahannya Kelas IV Sekolah Dasar', *GURUKU: Jurnal Pendidikan Dan Sosial Humaniora*, 3.3 (2025); Mutia Ardila and others, 'The Impact of Discovery Learning on Higher-Order Thinking Skills in Chemistry: A Meta-Analysis', *Lantanida Journal*, 13.1 (2025).

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be emphasized that the optimization of critical thinking and communication skills through Discovery Learning is a strategic step in improving the quality of basic education. This research provides strong evidence that the integration of innovative learning models, environmental utilization, and analytical technology support can create a superior learning ecosystem. Further research is suggested to explore the use of this model in other subjects to see the consistency of its effectiveness in different contexts.

CONCLUSION

Based on the results of the data analysis and discussion, it can be concluded that the application of the Discovery Learning model to animal life cycle materials is significantly able to optimize the critical thinking and communication skills of grade III students at SD Negeri Kampung Besar. Through a series of syntax that starts from the provision of stimuli to the verification stage, students transform from passive recipients of information to active discoverers of knowledge, where they are able to independently analyze biological phenomena and formulate logical arguments. The integration of environmental observation as a concrete learning resource has proven to be an effective cognitive bridge in strengthening concept understanding and honing students' linguistic skills when collaborating in groups. The use of NVivo software in this study confirms the finding that the intensive patterns of social interaction in the discovery process are directly proportional to the improvement of students' cognitive quality and verbal articulation skills, which overall proves that this innovative learning model is particularly relevant for developing 21st century competencies at the primary education level.

Based on the findings of the study, it is recommended that educators consistently adopt discovery-based learning models such as Discovery Learning and dare to explore the school environment as a natural laboratory to create a more contextual and meaningful learning experience. The school is expected to provide support in the form of teacher competency development training in designing innovative learning tools and providing adequate supporting facilities for students' exploratory activities. In addition, for future researchers, it is recommended to expand the scope of the research by applying this model to different subjects or using mixed research methods to measure the quantitative impact of the intervention more precisely. It is also important for education policymakers to continue to encourage the integration of qualitative data analysis technologies such as NVivo in learning evaluation, in order to gain deeper and more objective insights into students' character development and high-level thinking skills in the future.

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