Efforts to Enhance Questioning Engagement and Mathematics Learning Achievement in Data Organization Topic Through Project-Based Learning (PjBL) Model in Fourth Grade of Public Elementary School 2 Kober

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Abstract: This study aims to enhance students' questioning activity and learning achievement in mathematics, specifically in the topic of data organization, through the implementation of the PjBL (Project-based Learning) model for fourth-grade students at Public Elementary School 2 Kober in the second semester of the academic year 2022/2023. Classroom Action Research was employed as the research technique, conducted in two cycles with four sessions each, following the four research stages proposed by Kemmis and MC. Taggart, namely: planning, implementation, observation, and reflection. The participants of this study were fourth-grade students at Public Elementary School 2 Kober in the academic year 2022/2023, totaling 23 students. Various methods such as observation, interviews, tests, and documentation were used to collect information. Both qualitative and quantitative data analysis methods were employed in this study. The results of this research indicate an improvement in students' questioning activity and learning achievement in the topic of data organization in mathematics. This is evidenced by the increased level of student questioning activity in Cycle II, which achieved a good criteria, compared to Cycle I, which only reached a sufficient criteria. Furthermore, students' learning achievement can also be demonstrated by an improvement that has reached the Minimum Completeness Criteria (KKM) for the majority of students in the fourth grade. Based on the findings of this research, it can be concluded that the implementation of the PjBL approach can enhance students' questioning activity and learning achievement in the topic of data organization in mathematics for fourth-grade students at Public Elementary School 2 Kober in the academic year 2022/2023.

Keywords: questioning engagement, learning achievement, Project-Based Learning (PjBL) model.

Abstrak: Penelitian ini bertujuan untuk meningkatkan keaktifan bertanya dan prestasi belajar matematika materi panyusunan data melalui model pembelajaran PjBL pada siswa kelas IV SD Negeri 2 Kober Semester II Tahun Pelajaran 2022/2023. Metode penelitian menggunakan Penelitian Tindakan Kelas yang dilaksanakan dalam dua siklus setiap siklus

terdiri dua kali pertemuan, dengan empat tahap penelitian dari Kemmis dan MC. Taggart yang terdiri dari perencanaan, pelaksanaan, pengamatan dan refleksi. Subjek penelitian ini adalah siswa-siswi kelas IV SD Negeri 2 Kober tahun ajaran 2022/2023. Dengan jumlah 23 siswa. Teknik pengumpulan data yang digunakan adalah observasi, wawancara, tes, dan dokumentasi. Analisis data yang digunakan dalam penelitian ini adalah analisis kualitatif dan kuantitatif. Hasil penelitian ini adalah meningkatnya keaktifan bertanya dan prestasi belajar matematika materi panyusunan data. Hal ini dibuktikan dengan peningkatan keaktifan bertanya siswa pada siklus II yang berhasil mendapat kriteria baik, dari siklus I yang hanya mendapat kriteria cukup. Pada prestasi belajar siswa dapat dibuktikan pula dengan peningkatan yang telah mencapai KKM pada sebagian besar jumlah siswa di kelas IV. Berdasarkan hasil penelitian ini dapat disimpulkan bahwa dengan penerapan pembelajaran PjBL dapat meningkatkan keaktifan bertanya dan prestasi belajar matematika materi panyusunan data siswa kelas IV SD Negeri 2 Kober tahun ajaran 2022/2023.

Kata kunci: keaktifan bertanya, prestasi belajar, model pembelajaran Project Based Learning (PjBL)

INTRODUCTION

Education is crucial for individuals to improve their quality of life. Education begins from childhood and continues throughout adulthood. Education is not only about knowledge but also encompasses personality development, behavior, and more. In general, education is a process for individuals to develop their potential. The ultimate goal of education is to help students become responsible and productive members of society by teaching them the necessary content to succeed in the workforce and instilling values such as patriotism and strong self-esteem (Setiyono, Muslim, & Irianto, 2020, p. 25).

Students are an integral part of the teaching and learning process as they transition from a state of not knowing to knowing. Skinner (1960) defined learning as "a process of progressive behavior adaptation" (Andiani, Ibrahim, & Rusmono, 2023, p. 883). This definition states that learning is a gradual process of adaptation, leading to progressive behavior. Positive behavior adjustment tends to occur when the adaptation process aligns with forward-thinking action patterns. Improvement occurs through training. On the other hand, a lack of learning can result in decreased responsiveness.

The actions or behaviors of students are crucial in the educational process. One of the activities students engage in is asking questions. The questions posed by students can facilitate teachers in understanding the extent to which students comprehend the material being presented. When students ask questions, teachers can provide information that students can understand, thereby preventing misunderstandings.

Academic achievement can decline if students do not actively participate in asking questions (Coutinho & Almeida, 2014, p. 3781). In conclusion, students can enhance their understanding and acquire new mental abilities by actively engaging with the content through questioning. Both students and teachers can benefit from participating in question and answer sessions.

The ability to ask questions is a crucial scientific competency for students to possess. Generally, students in higher grades have the skills to ask questions during the learning process. Students in the age range of 6-12 years should have the ability or skill to ask questions about the material being taught. This allows students to acquire information they do not yet know using their own words (Sofwan, 2016, p.30). The implementation of the Merdeka Curriculum in primary schools does not seem to be fully effective. Various issues are still present in the learning process, such as instructional activities that rely on demonstrations and lectures, lack of active questioning by students, and limited student engagement.

By asking questions, both teachers and students can participate in a two-way exchange of information. This is achieved by seeking clarification on unknown or poorly understood material through verbal communication from both teachers and students (Astuti, 2015, p. 11). After receiving explanations, students should feel free to ask any clarifying questions they may have.

The success of students in learning occurs when they are able to successfully complete challenging tasks. Hornby states that achievement is something that an individual accomplishes, especially through their own effort and skills (Priadi & Nuha, 2019, p.91). Students' abilities to question, present, experiment, and so on will increase as their knowledge of the subject matter grows, as they are given more opportunities to direct and guide their own learning. According to the definition given by experts, learning achievement is an inherent personal trait. Individuals who are driven to develop themselves are motivated by the accomplishments of their acquired abilities or fields of expertise.

Mathematics learning is one of the essential subjects to be studied. Bruner's learning theory (1966) is particularly suitable for teaching mathematics. The theory encompasses three stages of learning for mathematics: enactive, iconic, and symbolic (Zuliana,

Retnowati, & Widjajanti, 2019, p. 3). The enactive stage involves learning while engaged in activities. In the iconic stage, students learn through visual representations. To produce meaningful information, individuals must first enter the symbolic stage, in which they systematically trace the steps taken to solve problems. This aligns with the research field of mathematics education.

Fourth-grade students at Public Elementary School 2 Kober were observed, and their lack of engagement in the classroom was confirmed by the teacher. Students were seen moving from desk to desk, playing games, and chatting with their peers. The teacher was still unable to stimulate student inquiry effectively. The teacher dominated the classroom, and students rarely collaborated on projects or research. It was also observed that the teacher only explained the material at the front of the class without moving from the front to the back, resulting in students in the back desks being distracted from the material. After the lecture concluded, the teacher invited questions from the class. However, no one in the class seemed curious enough to ask questions, and thus, questions went unanswered. When no one raised their hand, the teacher posed questions to the class; when no one answered, children would throw questions to their neighbors to get them to speak up. Only a few students were able to express their opinions and answer the questions given.

Based on the statements above, it is deemed necessary to conduct Classroom Action Research to investigate the questioning engagement and learning achievement of students through the PjBL model in Mathematics. The innovation in this study lies in the implementation of the PjBL model, where the teacher provides opportunities for students to experience meaningful learning by training them to actively ask questions through stimulus materials and assigning projects that ignite their curiosity, thus enabling students to confidently engage in questioning with the teacher and their peers.

The research problem of this study aims to determine whether the PjBL teaching model can enhance questioning engagement and learning achievement in fourth-grade students. Based on the established research problem, the objective of this study is to determine the improvement in questioning engagement and learning achievement of fourth-grade students through the implementation of the PjBL teaching model.

Although teachers may benefit from the use of PjBL models, it is rarely applied due to the time and effort required to initiate and complete projects. The PjBL model is a

holistic educational framework that promotes student collaboration and ongoing research. As students conduct their own research in small groups, they gain experience in teamwork and develop skills that may positively impact their academic development (Amin, 2022). Students can create something new through collaborative efforts in various areas, including design, problem-solving, decision-making, and research.

The focus of PjBL models is on individual learners. PjBL, or project-based learning, is a pedagogical framework that enables teachers to better manage student learning through the integration of meaningful projects (Made Wina in Al-Tabany, 2014). Working on a project requires students to develop, assess, conduct research, overcome challenges, and work independently, all based on challenging topics and tasks.

RESEARCH METHOD

The research method used is the Classroom Action Research method. Classroom Action Research is a research method that examines the cause and effect of treatment, while also documenting what happens when the treatment is given, and showcasing the entire process from the initial implementation of the treatment to the impact of that treatment. To enhance student learning, many educators engage in what is called "Classroom Action Research", also known as the "Process and Results of Classroom Action Research" (Arikunto, 2014). Classroom action research allows educators to assess their own performance and determine how well they address challenges in teaching and learning.

The Kemmis and MC Taggart cycle model is used for this research. Taggart's iterative process for problem-solving includes the following steps: formulation of a plan, implementation of that plan, evaluation of results, and revision of the plan (Kemmis and MC Taggart in Yulia, Yarmi, Yatimah, & Sumantri, 2018, p. 94). Both test and non-test data collection methods are utilized in this investigation. The testing method used is descriptive formative assessment. Non-test techniques are assessment tools used to gather information about students' conditions without using test instruments (Muryaningsih, 2020 & Ariyanti, 2020, p. 279). Non-test methods include observation through aids such as interviews and written records.

In this research, both quantitative and qualitative approaches are used to examine the data. The quantitative data analysis is utilized to process the data obtained from the observations of questioning engagement. The analysis of the observation sheets for students' questioning engagement employs a rating scale from 1 to 5 (Artanto & Widoyoko, 2022, p. 1). A score of 1 represents the worst possibility, while a score of 5 represents the best possibility. The following formula is used to determine the scale range:

Scale range $= \frac{max\ score-\ min\ score}{highest\ score}$

$$= \frac{5-1}{5} = \frac{4}{5} = 0,8$$

The range of 0.8 is calculated based on parameters. This leads to the following set of validation criteria:

**Table 1. Criteria for Assessing Students' Questioning Engagement**

Average	Criteria
> 4,2 s/d 5,0	Very good
> 3,4 s/d 4,2	Good
> 2,6 s/d 3,4	Adequate
> 1,8 s/d 2,6	Insufficient
1,0 s/d 1,8	Very Insufficient

To analyze students' learning achievement, it is done by administering a written test in the form of descriptive questions that align with the subject matter. At the end of each cycle, the average of all students' scores is calculated, and then the class average is determined.

RESULT AND DISCUSSION

In order to organize the data of fourth-grade students at Public Elementary School 2 Kober in the second semester of the academic year 2022/2023, the researcher conducted research action using the PjBL model and collected empirical data on the improved question and answer activities related to mathematics learning outcomes.

Figure 1. Graph of Increased Students' Questioning Engagement
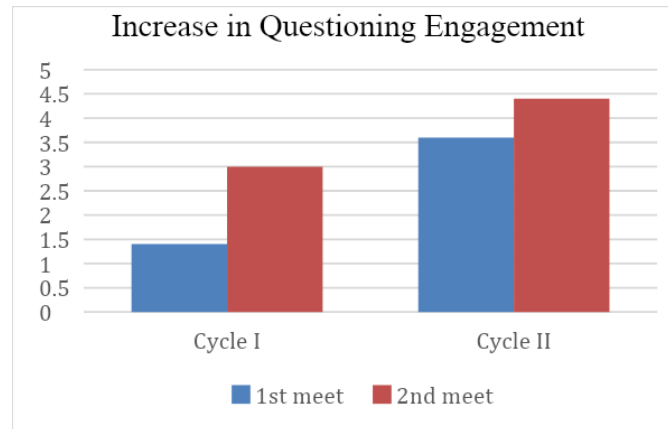
According to the data shown in Figure 1, students' engagement with inquiry increased from the first cycle to the second cycle. When fewer requirements were fulfilled in the first cycle, the average score was 2.2, whereas when more requirements were met, the score was 4. Between the first and second cycles, there was an average increase of 1.8 points. A significant improvement occurred in students who achieved scores above 3.4, reaching 4.2 with the criteria of "very good" in questioning engagement from Cycle I to Cycle I.

Students are expected to actively participate in the learning activities when using the PjBL instructional model, and the level of question-and-answer activity has increased in this research. Students who are able to understand the meaning of knowledge and utilize their mastered skills to generate solutions to overcome problems are the ones who benefit the most from PjBL learning. In line with this, Lestari states that questioning skills involve the ability to seek explanations on a certain matter (Lestari, as cited in Hajar, 2022). From this statement, it can be inferred that students' questioning engagement in learning activities is highly necessary, through which teachers can determine the level of students' understanding in the given subject. According to this perspective, students can enhance their learning abilities and obtain answers to important problems by practicing the habit of asking good questions.

The increased engagement of students in asking questions also influences the improvement of students' learning achievement. The learning achievement results of students in Cycle I and II can be observed from the evaluation outcomes that have been conducted. The learning achievement results of students in each cycle are measured

based on the student evaluation questions given at the end of each cycle. The learning achievement results of students can be seen in Table 2.

Table 2. Learning Achievement Improvement Results

Cycle	Lowest Score	Highest Score	Passing Grade	Relative Frequency
Pre-action	40	100	15	15/24 x 100% = 62%
I	50	100	16	16/23x 100% = 69%
II	60	100	20	20/23 x 100% = 86%

Table 2 shows the tendency of improvement in students' mathematics performance. From the relative frequency, it can be observed that there has been an increase of 17.4% from Cycle I to Cycle II. This indicates the attainment of the established success indicator, which is to achieve 80% of the total number of students. The improvement in achievement is not only a result of the contributions of the learning model, but also the efforts of the students themselves. The lessons have been implemented effectively, enabling students to fully comprehend all the information presented by the teacher. These findings are in line with Mulyasa's view that an individual's learning achievement is the result of their participation in learning activities (Mulyasa, 2014). In this view, students' ability to accurately complete assessment forms reflects how effectively they have internalized the course content during the learning process.

CONCLUSION

Students may have a stronger emotional connection to the information they learn when the PjBL model is used. This is supported by the opinion of Sunismi, Werdiningsih, and Wahyuni in their article titled "Project Based Learning". Students engaged in PjBL-based education not only understand the subject matter but also develop the skills they need to make a significant contribution to society (Sunismi, Werdiningsih, & Wahyuni, 2022). Skills such as listening, speaking, reading, writing, researching, questioning, evaluating, reflecting, leading, and critical thinking are all included.

There is evidence that the PjBL learning framework improves students' proficiency levels. This is supported by research by Lazić, Knežević, and Maričić in their study titled "The influence of PjBL on student achievement in elementary mathematics education." Students in the experimental group using the PjBL model for learning

outperformed their counterparts in the control group learning through conventional methods (Lazić, Knežević, & Maričić, 2021, p. 7). Therefore, it can be concluded that the use of the PjBL model can make students actively engaged and accompanied by improved learning achievement.

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REFERENCES

Al-Tabany, T. I. B. (2014). Mendesain Model Pembelajaran Inovatif, Progresif, dan Kontekstual (T. Trianto, Ed.). In *Jakarta: Prenada Media Group*.

Amin, L. Y. S. S. (2022). 164 Model Pembelajaran Kontemporer. In *Bekasi*. Pusat Penerbit LPPM.

Andiani, Ibrahim, N., & Rusmono. (2023). Improving Calculus Learning Outcomes Using Structured Assignment Methods–Based Modules. *International Journal of Information and Education Technology*, *13*(6), 882–889. https://doi.org/10.18178/ijiet.2023.13.6.1883

Arikunto, S. (2014). Prosedur Penelitian Suatu Pendidikan. In *Jakarta*. Rineka Cipta.

Artanto, T. T. R., Widoyoko, S. E. P., & Khaq, M. (2022). Pengembangan Media Pembelajaran Berbasis Padlet Terintegrasi Nilai Pendidikan Karakter pada Tema 7 Sub Tema 1 untuk Peserta Didik Kelas V SD. *JOTE: Journal on Teacher Education*, *4*(1), 432–441.

Astuti, M. S. (2015). Peningkatan Keterampilan Bertanya Dan Hasil Belajar Siswa Kelas 2 Sdn Slungkep 03 Menggunakan Model Discovery Learning. *Scholaria : Jurnal Pendidikan Dan Kebudayaan*, *5*(1), 10–23. https://doi.org/10.24246/j.scholaria.2015.v5.i1.p10-23

Coutinho, M. J., & Almeida, P. A. (2014). Promoting Student Questioning in the Learning of Natural Sciences. *Procedia - Social and Behavioral Sciences*, *116*, 3781–3785. https://doi.org/10.1016/j.sbspro.2014.01.841

Hajar, J. A. (2022). Keterampilan Mengajar. In *Banyumas* (p. 77). Pena Persada Kerta Utama.

Lazić, B. D., Knežević, J. B., & Maričić, S. M. (2021). The influence of project-based learning on student achievement in elementary mathematics education. *South African Journal of Education*, *41*(3), 1–10. https://doi.org/10.15700/saje.v41n3a1909

Mulyasa, H. E., & Anang Solihin Wardan. (2014). *Pengembangan dan implementasi kurikulum 2013 / H. E. Mulyasa*.

Muryaningsih, S & Ariyati, A. (2020, December). Penerapan Media Pop Up Book Pada Tema Alam Semesta Dengan Model Pembelajaran Contextual Teaching And Learning (CTL) Bagi Peserta didik Paud Aisyiyah Di Cabang Aisyiyah Rawalo. Seminar Nasional. LPPM. 2. Retieved December, 20, 2022. Dari: https://semnaslppm.ump.ac.id/index.php/semnaslppm/article/view/158/153

Priadi, A., & Nuha, R. A. (2019). The Influence of Family's Support for Students English Learning Achievement at Elementary School Age. *English Language Teaching Educational Journal*, *2*(2), 90–101.

Setiyono, S., Muslim, A., & Irianto, S. (2020). Peningkatan Hasil Belajar Matematika Materi Pengumpulan Data Melalui Model Pembelajaran Kooperatif Tipe Jigsaw Di Kelas V Sd Negeri 1 Sidareja. *Pendas : Jurnal Ilmiah Pendidikan Dasar*, *5*(Vol 5 No 1 June 2020), 25–37. https://doi.org/10.23969/jp.v5i1.2514

Sofwan, M. (2016). Meningkatkan Kemampuan Bertanya Dasar Siswa Dengan Menggunakan Model Discovery Learning Di Kelas Iii B Sdn 64/1 Muara Bulian. *Jurnal Pendidikan Tematik Dikdas Universitas Jambi*, *1*(1), 29–36.

Sunismi, Werdiningsih, D., & Wahyuni, S. (2022). PEMBELAJARAN BERBASIS PROYEK (Project Based Learning). In *CV. Literasi Nusantara Abad* (p. 156).

Yulia, L., Yarmi, G., Yatimah, D., & Syarif Sumantri, M. (2018). Improved Skill Speaks with a Scientific Approach in Students of Class Iv Sdn Jakasampurna 1V Kota Bekasi. *International Journal of Advances in Scientific Research and Engineering*, *4*(8), 92–96. https://doi.org/10.31695/ijasre.2018.32824

Zuliana, E., Retnowati, E., & Widjajanti, D. B. (2019). How should elementary school students construct their knowledge in mathematics based on Bruner's theory? *Journal of Physics: Conference Series*, *1318*(1), 6–10. https://doi.org/10.1088/1742-6596/1318/1/012019