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The Effects of the Project-Based Learning Model and Loose Parts Media on IPAS Learning Outcomes in a Fifth-Grade Elementary Student Who Is a Slow Learner

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ABSTRACT

This study examined changes in the Natural and Social Sciences (IPAS) learning outcomes of a fifth-grade student with slow learning difficulties following an intervention combining Project-Based Learning (PjBL) and loose parts media. The study employed a quantitative experimental approach using an A-B-A Single-Subject Research design. The participant was one 10-year-old student at SD Islam Tirtayasa, Serang, Indonesia. Data were collected through repeated learning outcome tests, classroom observations, and documentation across three phases: baseline-1 (A1), intervention (B), and baseline-2 (A2). The test scores were 53, 33, and 67 during A1; 80, 86, 80, 80, and 100 during B; and 100 in all three A2 sessions. Visual analysis indicated higher scores during the intervention phase than during baseline-1, followed by consistently high scores during baseline-2. These descriptive patterns suggest that the combined intervention was associated with improved IPAS learning outcomes for the participant. However, the short and variable baseline, repeated testing, and single-participant design limit causal interpretation and generalizability. Further research involving additional participants and stronger experimental controls is needed to examine the robustness of these findings.

Article Information

Keywords:
Pembelajaran Berbasis Proyek, *Loose Parts*, Hasil Belajar IPAS, Lamban Belajar, Penelitian Subjek Tunggal

ABSTRACT

Penelitian ini dilatarbelakangi oleh rendahnya hasil belajar Ilmu Pengetahuan Alam dan Sosial (IPAS) pada seorang siswa lamban belajar (*slow learner*) kelas V di SD Islam Tirtayasa, yang berkaitan dengan kesulitan dalam memahami materi serta pembelajaran yang masih berpusat pada guru. Penelitian ini bertujuan untuk mengkaji pengaruh penerapan model *Project-Based Learning* (PjBL) yang dipadukan dengan media *loose parts* dalam meningkatkan hasil belajar IPAS. Penelitian ini menggunakan pendekatan eksperimen dengan desain *Single-Subject Research* (SSR) pola A-B-A. Subjek penelitian adalah satu orang siswa kelas V yang tergolong lamban belajar. Data dikumpulkan melalui tes hasil belajar, observasi, dan dokumentasi, kemudian dianalisis menggunakan analisis visual dalam kondisi dan antarkondisi. Skor yang diperoleh subjek adalah 53, 33, dan 67 pada fase *baseline-1* (A1); 80, 86, 80, 80, dan 100 pada fase intervensi (B); serta 100, 100, dan 100 pada fase *baseline-2* (A2). Hasil analisis visual menunjukkan adanya peningkatan level, arah kecenderungan data yang membaik, serta dipertahankannya hasil belajar yang tinggi setelah intervensi dihentikan. Temuan ini menunjukkan adanya hubungan positif antara intervensi gabungan PjBL dan media *loose parts* dengan peningkatan hasil belajar IPAS pada siswa sekolah dasar kelas V yang mengalami lamban belajar.

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1. 1. INTRODUCTION

Elementary education plays a pivotal role in developing students' academic, social, emotional, and character competencies. Every child, including those with special educational needs, is entitled to appropriate educational services tailored to their distinct learning characteristics and requirements (Depdiknas, 2003). Among students with special needs in inclusive elementary classrooms, slow learners represent a significant group. Slow learners are generally defined as children possessing borderline intellectual functioning (IQ scores ranging between 70 and 90) who encounter persistent difficulties in grasping abstract concepts, maintaining attention, processing information, and completing academic tasks independently (Hallahan & Kauffman, 2014). Consequently, slow learners require instructional approaches that are concrete, structured, step-by-step, and augmented with engaging learning media (Marlina, 2019).

One of the subject areas posing notable cognitive challenges for slow learners is Natural and Social Sciences (IPAS), which demands observational skills, problem-solving, and critical thinking. In conventional elementary classroom settings, IPAS instruction predominantly relies on teacher-centered expository lecturing, rendering students passive observers. This traditional paradigm often leads to sub-optimal learning outcomes, particularly among slow learners (Eranda et al., 2024). Initial observations of a fifth-grade slow learner at SD Islam Tirtayasa revealed that the student required extended processing time to comprehend instructions, struggled with written tasks, made frequent spelling omissions, and repeatedly left test items unanswered.

To address these learning barriers, Project-Based Learning (PjBL) offers a highly promising pedagogical framework. PjBL is a student-centered instructional model that engages learners in real-world problem solving through hands-on project creation (Thomas, 2000). Previous empirical work by Humairoh et al. (2025) demonstrated that PjBL significantly improves science learning outcomes in elementary students by fostering active participation and conceptual comprehension. Alongside structured instructional models, concrete learning media are essential for bridge-building abstract science concepts. Loose parts media—comprising open-ended natural materials such as leaves, stems, stones, and seeds that can be manipulated, rearranged, and transformed—provide rich multisensory experiences that stimulate exploration, spatial reasoning, and creative expression (Nicholson, 1971; Flannigan & Dietze, 2017).

From the perspective of revised Bloom's taxonomy, cognitive learning outcomes span six hierarchical levels: remembering, understanding, applying, analyzing, evaluating, and creating (Anderson & Krathwohl, 2001). Slow learners typically experience cognitive bottlenecks at the understanding and applying levels due to limited abstract reasoning capacity. Recent empirical studies support pedagogical adaptation for slow learners: Nasaruddin & Mumpuniarti (2025) found PjBL effective in enhancing science conceptual understanding among slow learners, while Herlina et al. (2025) reported that integrating PjBL with loose parts media substantially boosted cognitive skills in early and primary childhood education.

Accordingly, this study aimed to: (1) evaluate the baseline IPAS learning outcomes of a fifth-grade slow learner prior to intervention; (2) analyze changes in IPAS learning outcomes during the application of a combined PjBL and loose parts media intervention; and (3) assess the maintenance and overall effect of the intervention using an A-B-A Single-Subject Research (SSR) design.

2. RESEARCH METHODS

This study adopted a quantitative experimental approach utilizing an A-B-A Single-Subject Research (SSR) design. SSR is specifically engineered to evaluate the efficacy of instructional interventions on individual subjects through continuous, repeated measurements across distinct experimental conditions (Sunanto et al., 2005). The A-B-A design comprised three sequential phases: baseline-1 (A1), representing pre-intervention baseline performance; intervention (B), representing the implementation of the PjBL model integrated with loose parts media; and baseline-2 (A2), representing the post-intervention maintenance phase after withdrawal of the active treatment.

This study involved one 10-year-old student; therefore, special attention was paid to the participant's rights, privacy, and well-being throughout the research process. Permission to conduct the study at the school was obtained from the authorized school officials. [Explain whether the study received approval from a research ethics committee or was exempt from formal ethical review under the applicable institutional policy.] Consent was obtained from the parent or legal guardian before the study began, and the child's willingness to participate was sought by explaining the study's aims and procedures in age-appropriate language. Participation was voluntary, and the participant was informed that they could withdraw without penalty. To protect the participant's identity, the initials SWT were used in reporting the findings, and identifying information was omitted. Photographs of activities and other documentation were handled carefully to prevent unauthorized disclosure of identity. To minimize the burden of repeated measurements, test sessions took the participant's learning pace into account and included clear instructions, breaks when needed, and support to reduce fatigue or discomfort. Intervention and assessment procedures were adapted to the participant's learning needs while maintaining consistency across research phases.

The instrument used to measure IPAS learning outcomes was a written test consisting of 15 multiple-choice questions about plant parts. The instrument was developed based on the learning objectives and competency achievement indicators relevant to the material taught. The test blueprint considered the scope of the material and cognitive process levels in the revised Bloom's Taxonomy, particularly remembering (C1), understanding (C2), and applying (C3), adapted to the participant's learning characteristics and needs. Each item was designed to assess the student's understanding of plant parts and their characteristics, including the ability to identify and distinguish different leaf venation patterns.

Each correct answer was assigned 1 point, while each incorrect answer was assigned 0 points. The final score was calculated by dividing the number of correct answers by the total number of questions and multiplying the result by 100. Thus, the maximum possible score was 100. The test was administered in every research session to monitor changes in the participant's learning outcomes during baseline-1 (A1), intervention (B), and baseline-2 (A2).

During baseline-1 (A1), learning outcomes were measured in three sessions before the intervention was introduced. The participant's scores were 53, 33, and 67, indicating variation in learning outcomes and the absence of a stable data pattern. The

baseline phase consisted of three sessions, reflecting how the study was conducted. However, because the baseline data remained variable, ending measurement after the third session cannot be interpreted as evidence that stability had been achieved. This is a methodological limitation because a short and unstable baseline makes it difficult to determine whether score changes during the intervention phase were associated with the treatment or influenced by natural fluctuations in the participant's learning outcomes. The findings are therefore interpreted in light of this limitation.

To support instrument validity, the process of having the questions reviewed by experts or teachers competent in IPAS instruction should be described based on the procedures actually undertaken. If the instrument underwent expert validation, describe the aspects reviewed, such as alignment between the questions and learning objectives, content accuracy, language clarity, and the suitability of the difficulty level for the participant's characteristics. If the instrument was piloted, the results may be used to assess item difficulty, discrimination, and test reliability. However, if expert validation, piloting, or psychometric testing was not conducted, this limitation should be stated transparently and considered when interpreting the findings. The intervention was implemented over five learning sessions by combining the Project-Based Learning (PjBL) model, loose parts media, and intensive support tailored to the participant's learning needs. The PjBL stages included formulating a driving question, planning the project, developing a schedule, implementing and monitoring the project, presenting the project results in the form of a mind map, and evaluation and reflection. The loose parts media consisted of leaves with pinnate, palmate, curved, and parallel venation patterns, as well as plant stems collected from the area around the school.

All IPAS learning-outcome tests in every session were administered directly by the principal researcher (Uswatun Hasanah), assisted by the fifth-grade teacher at SD Islam Tirtayasa as an independent observer. The test was administered individually at the end of each session to ensure that the participant understood the instructions without receiving help with the answers. To ensure that the treatment was delivered in accordance with the planned lesson implementation plan (RPP), an intervention-fidelity check was conducted. The teacher completed a treatment-fidelity checklist during every intervention session (B). The checklist covered the PjBL stages (formulating a driving question, project planning, scheduling, project monitoring, presenting the mind map, and evaluation), as well as the use of loose parts media. The fidelity assessment indicated an implementation adherence rate of 93.3%, suggesting that the intervention was delivered consistently and in accordance with the planned procedures.

3. RESULTS AND DISCUSSION

3.1 Research Results

3.1.1 Learning Outcomes during Baseline-1 (A1)

During baseline-1 (A1), the participant completed 15 multiple-choice questions in three sessions without receiving the intervention. The test scores were 53 in the first session, 33 in the second session, and 67 in the third session. The 34-point range indicates variation in learning outcomes during the baseline phase. Based on these three measurements, the baseline data cannot be considered stable. Therefore, the scores in this phase serve as an initial description of the participant's learning outcomes, taking into account the limited number of measurements before the intervention.

Table 1. Test Results during Baseline-1 (A1)

Session	Correct Answers	Incorrect Answers	Score
Session 1	8	7	53
Session 2	5	10	33
Session 3	10	5	67

3.1.2 Learning Outcomes during the Intervention Phase (B)

During the intervention phase, the participant received five learning sessions using the PjBL model combined with loose parts media. Learning-outcome scores were 80, 86, 80, 80, and 100 in Sessions 1–5 (Table 2), while the number of incorrect answers decreased from three in the initial sessions to zero in the fifth session. Observations showed that learning-activity implementation ranged from 90% to 92.5% in each session, indicating the participant's active involvement during project-based learning.

Table 2. Test Results during the Intervention Phase (B)

Session	Correct Answers	Incorrect Answers	Score
Session 1	12	3	80
Session 2	13	2	86
Session 3	12	3	80
Session 4	12	3	80
Session 5	15	0	100

3.1.3 Learning Outcomes during Baseline-2 (A2)

During the intervention phase, instruction combined the Project-Based Learning (PjBL) model, loose parts media, and intensive support tailored to the participant's characteristics and learning needs. The intervention was delivered over five learning sessions. The PjBL model involved formulating a driving question, planning the project, preparing an activity schedule, implementing and monitoring the project, presenting the project results as a mind map of plant parts, and conducting evaluation and reflection. The loose parts media consisted of leaves with pinnate, palmate, curved, and parallel venation patterns, as well as plant stems collected from the area around the school.

Intensive support was provided throughout the project activities to help the participant understand instructions, recognize plant parts, observe and compare leaf characteristics, and complete the project step by step. Support was adapted to the participant's needs at each stage, especially when the participant had difficulty understanding instructions or performing tasks. Learning outcomes were measured through tests administered in every research session, while observations documented the participant's engagement during learning. Thus, the intervention was treated as an integrated package comprising PjBL, loose parts media, and intensive support, rather than as three separately tested components.

Table 3. Test Results during Baseline-2 (A2)

Session	Correct Answers	Incorrect Answers	Score
Session 1	15	0	100

Session 2	15	0	100
Session 3	15	0	100

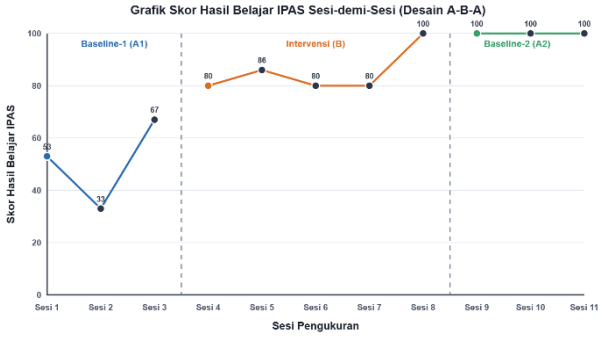


Figure 1. Session-by-Session Changes in IPAS Learning-Outcome Scores during Baseline-1 (A1), Intervention (B), and Baseline-2 (A2)

3.1.4 Within-Phase Visual Analysis

The within-phase analysis showed that baseline-1, intervention, and baseline-2 consisted of 3, 5, and 3 sessions, respectively. The trend during baseline-1 was upward (+), the intervention phase showed a generally level trend with high scores (=), and baseline-2 remained level at the maximum score (=). Data stability was variable during baseline-1 and stable during the intervention and baseline-2 phases. The level change was +14 during baseline-1 (from 53 to 67), +20 during intervention (from 80 to 100), and 0 during baseline-2 because scores remained constant at 100 (Table 4).

Table 4. Summary of Within-Phase Visual Analysis

Component	Baseline-1 (A1)	Intervention (B)	Baseline-2 (A2)
Phase length	3	5	3
Trend direction	(+)	(=)	(=)
Stability level	Variable	Stable	Stable
Level change	53→67 (+14)	80→100 (+20)	100→100 (0)
Data range	53–67	80–100	100–100

3.1.5 Between-Phase Visual Analysis

Data were analyzed using visual analysis within an A-B-A Single-Subject Research (SSR) design. Analyses were conducted within each phase and between phases. Within-phase analysis covered level, trend, variability, and data stability. Between-phase analysis covered level change and the percentage of overlap between baseline-1 (A1) and the intervention phase (B).

Data stability can be calculated by determining the percentage of data points that fall within a predefined stability range around the phase median. When an interval of ±15% of the median is used, the stability range is calculated as the median ±15% of the median. The stability percentage is calculated by dividing the number of data points within this range by the total number of data points and multiplying by 100%.

Table 5. Summary of Between-Phase Visual Analysis

Component	B / A1	A2 / B
Change in data trend	(+) Increasing	(=) Stable
Level change	+13	0
Percentage of data overlap	0%	100%
Learning-outcome trend	Increasing	Stable / maintained

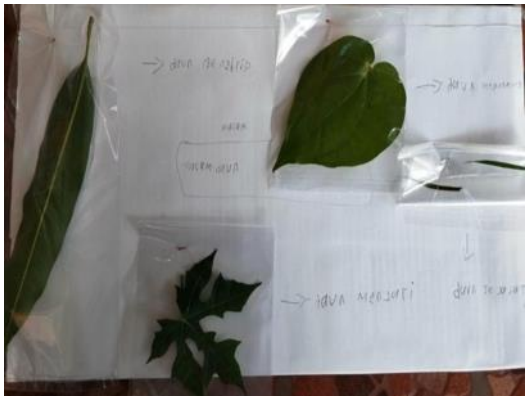


Figure 2. Loose Parts Media (Variations in Leaves and Stems) Used in the Study

3.2 Discussion

The baseline-1 results indicate that the participant's initial understanding of plant parts was relatively low and unstable, as reflected by the high frequency of errors in each session. This finding is consistent with Hallahan and Kauffman (2014), who state that slow learners have intellectual functioning slightly below average, require more time to process information, and may experience difficulty with abstract thinking. This also supports Marlina's (2019) view that slow learners need simple, concrete instructional strategies adapted to their learning characteristics. Instruction relying solely on lectures may leave students less active and result in limited understanding of the material.

One factor to consider when interpreting these findings is that baseline-1 consisted of only three sessions, with scores of 53, 33, and 67. This variation indicates that the participant's learning outcomes were not stable before the intervention. A short and variable baseline limits the study's ability to distinguish intervention-related changes from natural fluctuations in learning outcomes. Regression to the mean is also possible, whereby an unusually low or high score on one measurement tends to move closer to the average in a subsequent measurement. Therefore, the score increase after the intervention cannot be interpreted entirely as a direct effect of the treatment. Although scores increased during intervention and remained at 100 throughout baseline-2, the findings should be understood as a descriptive pattern of change in one participant, rather than definitive causal evidence. Future studies should use a longer baseline and establish data-stability criteria before introducing the intervention to strengthen the validity of their conclusions.

Following the intervention combining the PjBL model and loose parts media, the participant's learning outcomes increased

and remained high during baseline-2. PjBL may have supported this improvement by giving the student opportunities to learn through direct experience: rather than only listening to the teacher, the student observed plants, collected plant parts, and organized them into a mind-map project. These activities helped make previously abstract concepts more concrete, consistent with Thomas's (2000) view that PjBL promotes conceptual understanding through authentic project activities.

Nevertheless, the improvement cannot be attributed separately to the PjBL model, loose parts media, or intensive support. The A-B-A Single-Subject Research (SSR) design evaluated the intervention package as a whole without isolating the contribution of each component. The findings therefore indicate an association between implementing the intervention package and increased learning-outcome scores, but they do not establish which component contributed most. The short and variable initial baseline and the possible effects of repeated testing should also be considered when interpreting the score changes.

children's exploration, creativity, and thinking skills (Flannigan & Dietze, 2017; Nicholson, 1971). This finding is consistent with Rahmawati (2022), who reported that loose parts media improved elementary science learning through exploration of concrete objects, and with Sumilat et al. (2023) and Syarifudin et al. (2024), who found that PjBL increased elementary students' engagement and learning outcomes.

4. CONCLUSION

Based on the findings, the following conclusions can be drawn: (1) before the intervention, the slow learner's IPAS learning outcomes were relatively low and unstable, as shown by baseline-1 scores of 53, 33, and 67; (2) after the intervention combining Project-Based Learning (PjBL) and loose parts media, scores were 80, 86, 80, 80, and 100 during the intervention phase and remained at 100 throughout baseline-2; and (3) the combined PjBL and loose parts approach was positively associated with improved IPAS learning outcomes for the fifth-grade slow learner, as indicated by visual analysis in the Single-Subject Research (SSR) design, which showed increased data levels, a more favorable trend, stable data during intervention and baseline-2, and 0% overlap in the B/A1 comparison, suggesting a strong intervention-associated pattern. The findings show an increase in the participant's IPAS learning outcomes during implementation of an intervention package integrating the Project-Based Learning (PjBL) model, loose parts media, and intensive support. Scores increased from 53, 33, and 67 during baseline-1 to 80, 86, 80, 80, and 100 during intervention, and remained at 100 throughout the three baseline-2 sessions. This indicates a positive pattern of change associated with the intervention package. However, because all components were delivered simultaneously to one participant, the study cannot determine the separate contribution of each component. Future research should use component-analytic designs and include more participants to obtain stronger evidence.

These findings suggest that teachers may consider combining Project-Based Learning with loose parts media as an alternative approach to IPAS instruction for slow learners, using step-by-step activities and concrete materials from the surrounding environment. Future research should include more participants within a class and examine the effects of this approach on other outcomes, such as learning motivation, creativity, and social skills.

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