Indonesian Journal of Early Childhood Educational Research, 4(2)-December 2025 269-283

Indonesian Journal of Early Childhood Educational Research

ISSN : 2963-6760 (Online)
ISSN : 2962-1364 (Print)

Project-Based Learning with Recycled Bottle Planting: Effects on Young Children's Cognitive and Gross Motor Skills

Lailil Murro[1*], Rachma Hasibuan[2], Sri Setyowati[3]
[1,2,3]Universitas Negeri Surabaya, Indonesia

***Corresponding Author**: Lailil Murro, **E-mail**: lailil.23003@mhs.unesa.ac.id

Received: June 06, 2025	Revised: June 18, 2025	Accepted: June 24, 2025	Online: Juli 15, 2025

ABSTRACT
Early childhood is a critical phase for developing both cognitive and gross motor abilities. However, many early education practices remain cognitively centered, providing limited structured motor stimulation. This study investigates the effect of Project-Based Learning (PjBL) through a recycled bottle planting project on the cognitive and gross motor development of children aged 5–6 years at RA Rachmat Bangil. Employing a quantitative approach with a quasi-experimental design, the study involved an experimental group participating in a series of hands-on activities designing, cutting, decorating bottles, planting seeds, and plant care while a control group received conventional instruction. Results showed that children in the PjBL group achieved significantly higher cognitive gain scores compared to the control group. Although improvements in gross motor skills were also observed, they were less substantial. The project's physical nature fostered coordination, balance, and movement in a meaningful and enjoyable context. These findings confirm that PjBL, even with simple materials, effectively supports holistic child development. The study suggests that early childhood educators integrate physical engagement within cognitive learning through contextual, environmentally conscious projects.

Keywords: *Project-Based Learning, Recycled Materials, Seed Planting, Cognitive Development, Gross Motor Skills.*

Journal Homepage https://ejournaluinmybsk.ecampus.id/index.php/ijecer/index

How to cite: Murro, L., Hasibuan, R., & Setyowati, S. (2025). Project-Based Learning With Recycled Bottle Planting: Effects on Young Children's Cognitive and Gross Motor Skills. *Indonesian Journal of Early Childhood Educational Research (IJECER),* 4(2), 269–283. https://doi.org/10.31958/ijecer.v4i2.15463
Published by: Universitas Islam Negeri Mahmud Yunus Batusangkar, Indonesia

INTRODUCTION

Early childhood education is the primary foundation for shaping children's character, intelligence, and skills for the future (Desmita et al., 2023; Idris et al., 2022; Setiowati & Warmansyah, 2023). At this stage, children are highly sensitive to environmental stimuli and therefore require appropriate stimulation to optimize all aspects of their development cognitive, motor, socio-emotional, and language (H. Kurniawati & Husnayain Madani, 2024; Maromi & Pamuji, 2024; Mustakim et al., 2020). In the learning process, young children are recognized as excellent imitators who learn through sensory experiences and direct interactions with their environment. Therefore, learning activities must encourage children to be active, explore, and construct knowledge through real interactions with objects around them (Khodarasih et al., 2025; Roussou, 2004; Syaharra et al., 2025).

Cognitive and gross motor aspects are two essential dimensions of development that must be given serious attention in children aged 5–6 years (Sukarti et al., 2023; Yulia et al.,

2025). Cognitive development includes the ability to think, remember, observe, classify, and solve problems (Istiqomah & Maemonah, 2021). At this age, children begin to make simple decisions, understand cause-and-effect relationships, and plan actions (Rusady et al., 2025). Optimal cognitive development greatly influences children's readiness to enter primary education (Dhiaulhaq et al., 2024; Yulia et al., 2025). On the other hand, gross motor development relates to the ability to control body movements involving large muscles, such as walking, running, jumping, and throwing a ball (Triyono et al., 2022). Good gross motor skills enable children to interact actively with their environment and enhance coordination, balance, and self-confidence.

These two aspects are interconnected and can reinforce each other. Physical activities that challenge gross motor skills can also stimulate children's thinking and problem-solving abilities. Therefore, a deep understanding of cognitive and gross motor development in early childhood is crucial so that parents, teachers, and education practitioners can provide appropriate and effective stimulation (Triyono et al., 2022). Recent educational neuroscience findings also suggest that motor activity is closely linked to cognitive processing in the brain, particularly in areas related to executive function and spatial reasoning. Engaging children in purposeful movement during learning not only supports physical growth but enhances attention, memory retention, and the ability to make logical connections (Roussou, 2004).

However, preliminary observations at RA Rachmat Bangil indicate that children's gross motor development has not yet reached its optimal potential. Some children still struggle with balance movements such as walking on a straight line, hopping on one foot, or throwing a ball with proper coordination. Furthermore, learning activities tend to focus more on cognitive aspects while providing limited opportunities for physical exploration. This condition indicates the need for learning strategies that can support the maximum development of gross motor skills (Mustakim et al., 2020).

As an early childhood education institution, RA Rachmat Bangil plays an important role in stimulating and developing all aspects of child development through structured and enjoyable play-based activities. However, in practice, not all early childhood institutions, including RA Rachmat Bangil, optimally design learning activities that support gross motor development. This may be due to limitations in facilities, lack of variation in teaching methods, or insufficient understanding among teachers regarding the importance of gross motor stimulation (Mustakim et al., 2020). Gross motor development is not only related to physical aspects but also closely connected to cognitive development. Physically active children tend to think more logically and solve simple problems more easily. However, in the implementation of learning at RA Rachmat Bangil, activities that support gross motor development are not yet structured or integrated into real-life contexts of the children. In fact, meaningful and contextual learning can be the key to naturally and enjoyably stimulating children's motor abilities (Roussou, 2004).

One potential approach to address this issue is Project Based Learning (PjBL), a project-based learning model that involves children in the process of exploration, planning, execution, and reflection on real-life activities (Dywan & Airlanda, 2020). The activity of creating recycled bottle planters is a simple yet meaningful project for young children. In the process, children are directly involved in activities such as carrying and cutting used bottles,

filling them with soil, watering, and planting seeds—all of which involve gross motor movements. At the same time, this activity sharpens logical thinking skills, instills environmental awareness, and introduces basic scientific concepts such as plant growth and recycling (Dywan & Airlanda, 2020; Ruhiyat, S., Andika W.D., Lia, D., & Pagarwati, 2024)

Based on preliminary observations at RA Rachmat Bangil, it was found that not all children aged 5–6 years show cognitive development appropriate to their age stage. Some children experience difficulties in recognizing patterns, classifying objects by shape or color, and understanding multi-step instructions. In addition, logical thinking and problem-solving skills have not developed optimally. This issue may be influenced by the lack of appropriate stimulation, both at school and at home. The predominance of one-way teaching, minimal exploratory activities, and limited engaging learning media are suspected to be the causes of the slow cognitive development (Istiqomah & Maemonah, 2021). This situation has become a significant concern for teachers and educators at RA Rachmat Bangil, as delays in cognitive development at an early age may affect children's readiness to enter primary education. Therefore, a learning approach is needed that can optimally stimulate both developmental aspects (Mustakim et al., 2020; Priyanti & Warmansyah, 2021).

Project Based Learning (PjBL) is one such approach that is increasingly used in early childhood education. This method emphasizes learning through children's active involvement in projects relevant to their daily lives. PjBL not only encourages children to think critically, differentiate shapes and colors, and solve problems (cognitive abilities), but also requires physical engagement such as running, lifting, or arranging objects that directly involve gross motor skills (Dywan & Airlanda, 2020). However, the implementation of PjBL in early childhood settings still requires further study, particularly regarding its effectiveness in enhancing cognitive and gross motor development simultaneously. This study aims to fill that gap by examining the extent to which PjBL affects both developmental aspects in children aged 5–6 years. By understanding the impact of PjBL on cognitive and gross motor development, it is expected that teachers and early childhood practitioners can adopt more effective, enjoyable, and developmentally appropriate teaching strategies (Dywan & Airlanda, 2020; Ruhiyat, S., Andika W.D., Lia, D., & Pagarwati, 2024).

Previous studies have shown that PjBL is effective in improving various aspects of early childhood development. Priantika et al., (2024) found that nature-based PjBL significantly affects children's creative thinking abilities. Hasni & Amanda, (2022) confirmed the effectiveness of PjBL in improving geometry skills among 5–6-year-old children. Kurniawati et al., (2024) also concluded that the implementation of PjBL can enhance creativity in early childhood in alignment with the Merdeka Curriculum. Meanwhile, emphasized that PjBL supports children's motor and communication development through the physical activities it involves.

Additionally, the study by Tabun et al. (2024) showed that the PjBL method combined with playdough media significantly improves children's fine motor skills, while found that integrating PjBL with Direct Instructions effectively enhances fine motor control in children's hand movements (Ariana & Novitawati, 2023). Supporting these findings, (Anggraeni et al., 2023). confirmed the positive impact of PjBL on fostering creativity and cognitive development in early childhood; moreover, PjBL activities not only engage children

in hands-on, meaningful learning but also foster environmental awareness and problem-solving through real-life applications (Nurhayanti et al., 2021). In line with these perspectives, Ruhiyat, S., Andika W.D., Lia, D., & Pagarwati, (2024) emphasizes that recycled-material-based PjBL projects also contribute to children's ecological sensitivity while simultaneously developing their cognitive and gross motor competencies through purposeful, integrated tasks.

Although Project-Based Learning (PjBL) has been widely recognized as an effective approach in fostering children's creativity, critical thinking, and cognitive abilities, existing studies tend to examine these outcomes in isolation, often overlooking the equally important domain of physical development—particularly gross motor skills. Research focusing on the simultaneous impact of PjBL on both cognitive and gross motor domains remains scarce, especially when applied through simple, real-world activities that align with children's daily experiences (Rosiana et al., 2024; Sakila et al., 2023; Setyowati et al., 2023; Turiyah, 2023). This study introduces the use of recycled bottle planting as a novel project-based learning activity that not only supports children's cognitive growth but also promotes physical engagement through purposeful motor tasks. The integration of environmental values, scientific exploration, and motor coordination into a single learning experience marks the unique contribution of this research to the field of early childhood education.

This study aims to examine the effects of Project-Based Learning through recycled bottle planting on the cognitive and gross motor development of children aged 5–6 years (Sufa & Widyahening, 2023; Sugihartini & Yudiana, 2018; Zainiya Anisa, 2022). It specifically seeks to determine how active participation in designing, decorating, and utilizing recycled bottles for seed planting enhances children's abilities in observation, classification, problem-solving, and following instructions, while simultaneously improving coordination, balance, and other large muscle movements. The goal is to provide evidence-based insight into how PjBL can be strategically implemented to foster holistic child development in early childhood educational settings.

RESEARCH METHODOLOGY

Research Approach and Design

This study employed a quantitative approach with a quasi-experimental design to examine the effect of implementing Project-Based Learning (PjBL) through recycled bottle planting activities on the cognitive and gross motor development of early childhood learners at RA Rachmat Bangil. The study involved two groups: an experimental group receiving PjBL-based instruction and a control group receiving conventional instruction. All participants were children aged 5–6 years at RA Rachmat Bangil, totaling 30 children, with 15 in each group (Sakila et al., 2023). No sampling technique was used, as the entire population served as the research subjects. The study adopted a non-equivalent control group design, in which both groups were administered a pretest to measure their initial cognitive and gross motor abilities, followed by a posttest after the intervention to identify developmental changes. The experimental group underwent a PjBL intervention, focusing on a hands-on project involving recycled bottle planters. Rehny & Sari, (2023)Children actively participated in planning, collecting materials, cutting and decorating bottles, preparing planting media,

sowing seeds, and caring for the plants throughout the research period. In contrast, the control group received traditional, instructional learning without project-based elements.

Participants and Research Setting

The study was conducted at RA Rachmat Bangil, targeting children aged 5–6 years during the even semester of the 2024–2025 academic year. A total of 30 children participated, representing the full population in the specified age group at the institution. The duration of the study was four weeks, with two weeks allocated for intervention.

Instruments and Data Collection

Data collection was conducted using multiple instruments, including observation sheets, tests (pretest and posttest), documentation, and field notes. Observations recorded student behavior and activity throughout the learning process in both groups. Pretest and posttest were designed to assess cognitive and gross motor skills before and after the intervention. The test instruments were constructed based on developmental indicators outlined in Decree of the Head of BSKAP No. 032/H/KR/2024 on Learning Outcomes for Basic and Secondary Education in the Merdeka Curriculum (Candra Susanto et al., 2024). Documentation (photos and videos) was used to visually capture the PjBL implementation and student engagement.

Field notes provided qualitative insight into responses, participation, and dynamics during the project.

The cognitive development instrument assessed children's abilities to classify objects by color and shape and to understand and solve simple problems, such as selecting appropriate planting locations and identifying solutions to plant growth challenges. The gross motor assessment focused on the ability to follow basic physical exercises, bend and stand, balance on one foot, and perform coordinated upper-body movements (Pratiwi et al., 2023). All instruments underwent validity and reliability testing, yielding acceptable Cronbach's Alpha values of 0.886 for the cognitive scale and 0.651 for the gross motor scale, indicating strong reliability.

Data Analysis Technique

Quantitative data were analyzed using the Mann–Whitney U test, as assumption testing showed non-normal and non-homogeneous data distribution. The test was used to determine significant differences in gain scores between the experimental and control groups across both cognitive and gross motor variables. Gain scores were calculated by subtracting pretest scores from posttest scores for each participant. The analysis aimed to test the hypothesis regarding the effectiveness of PjBL on early childhood development.

Control of External Variables and Research Ethics

To ensure data validity and control extraneous variables, the study maintained consistent subject characteristics, uniform implementation of PjBL, and objective assessment procedures. Two external observers—a homeroom teacher and the school principal—were involved in the assessment to enhance objectivity (Muhibbin & Harjanty, 2024). Instrument

content validity was confirmed through expert judgment by early childhood education lecturers. The research was conducted in accordance with ethical standards, with approval and informed consent obtained from both the institution and parents/guardians.

Expected Contribution

With its rigorous design and comprehensive procedures, this research is expected to provide meaningful insight into the impact of Project-Based Learning using recycled bottle planting on the cognitive and gross motor development of early childhood learners. Moreover, the study may serve as a valuable reference for the development of innovative, contextual learning models in early childhood education settings.

RESULTS AND DISCUSSION

Overview of Research Location and Subjects

This study was conducted at RA Rachmat Bangil, Pasuruan, involving 30 children aged 5–6 years who were divided into two groups: an experimental group (15 children) receiving Project-Based Learning (PjBL) instruction through recycled bottle planting activities, and a control group (15 children) receiving conventional learning. All subjects were identified by initials and grouped accordingly, as presented in Table 1 below:

Table 1. Research Subject Overview

No	Initial	Group	No	Initial	Group
1	Aln	Control	1	Kin	Experiment
2	Sfq	Control	2	Knz	Experiment
3	Hsb	Control	3	Nsv	Experiment
4	Br	Control	4	Ark	Experiment
5	Sls	Control	5	Nra	Experiment
6	Fz	Control	6	Zyn	Experiment
7	Snm	Control	7	Arn	Experiment
8	Jj	Control	8	Dha	Experiment
9	Alv	Control	9	Rzk	Experiment
10	Rhn	Control	10	Arf	Experiment
11	Cc	Control	11	Afn	Experiment
12	Bma	Control	12	Abm	Experiment
13	Hrl	Control	13	Aql	Experiment
14	Jzi	Control	14	Dms	Experiment
15	Amd	Control	15	Ihm	Experiment

Instrument Validity and Reliability Testing

All research instruments underwent validity and reliability testing. All items under the cognitive and gross motor skill variables were declared valid with p-values < 0.001. The Cronbach's Alpha for cognitive skills was 0.886, and for gross motor skills was 0.651, indicating that the instruments were reliable.

Table 2. Validity Test for Cognitive Skills

No	Item	p-value	Conclusion
1	Classifying seeds based on shape	<0.001	Valid
2	Classifying gardening tools based on function	<0.001	Valid
3	Classifying pots based on color	<0.001	Valid
4	Choosing the correct place to plant	<0.001	Valid
5	Identifying the causes of plant growth problems	<0.001	Valid

Table 3. Validity Test for Gross Motor Skills

No	Item	p-value	Conclusion
1	Standing on one foot	<0.001	Valid
2	Coordinated hand lifting and lowering	<0.001	Valid
3	Bending and returning to standing position	<0.001	Valid

Table 4. Reliability Test Results

Variable	Cronbach Alpha	Conclusion
Cognitive Skills	0.886	Reliable
Gross Motor Skills	0.651	Reliable

Descriptive Analysis Results

Cognitive Skills

Pretest and posttest data for cognitive skills in both groups show a significant improvement, particularly in the experimental group.

Table 5. Descriptive Data on Cognitive Skills

No	Subject	Control (Pre)	Control (Post)	Gain	Subject	Experiment (Pre)	Experiment (Post)	Gain
1	Aln	8	13	5	Kin	10	18	8
2	Sfq	8	13	5	Knz	8	17	9
…	…	…	…	…	…	…	…	…
	Average	9.87	14.27	4.4		9.53	16.67	7.13

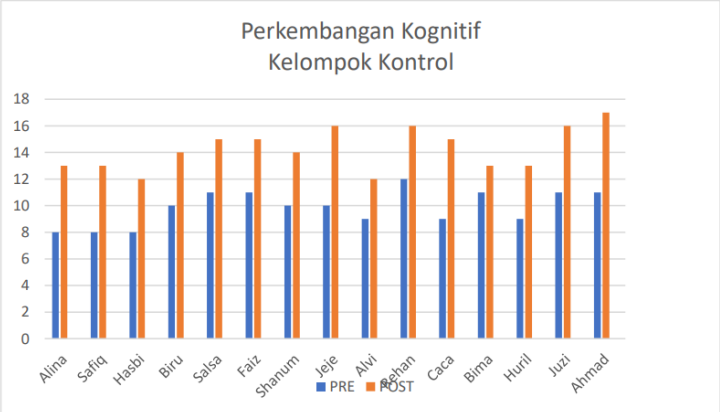

Figure 1. Cognitive Development of the Control Group

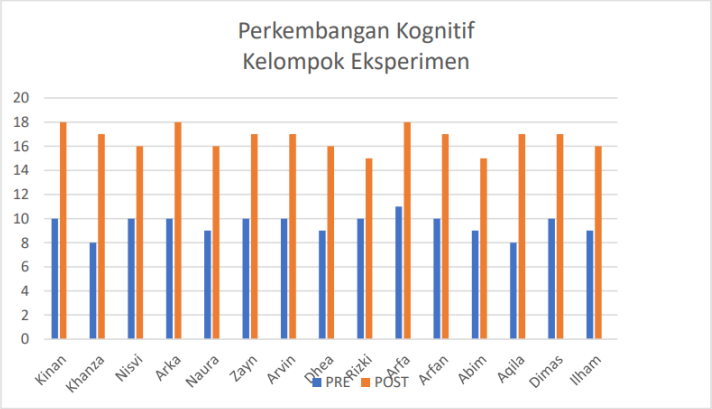

Figure 2. Cognitive Development of the Experimental Group

Gross Motor Skills

An improvement in gross motor skills was also observed in both groups, although the difference was not as substantial as in the cognitive domain.

Table 6. Descriptive Data on Gross Motor Skills

No	Subject	Control Group			No	Subject	Experimental Group		
		Pre	Post	Gain			Pre	Post	Gain
1	Aln	8	11	3	1	Kin	7	11	3
2	Sfq	7	10	3	2	Knz	8	11	3
3	Hsb	7	9	2	3	Nsv	7	11	4
4	Br	9	10	1	4	Ark	8	9	0
5	Sls	8	9	1	5	Nra	7	9	1
6	Fz	8	9	1	6	Zyn	9	10	1
7	Snm	6	10	4	7	Arn	7	10	3
8	Jj	7	9	2	8	Dha	8	10	2
9	Alv	7	10	3	9	Rzk	8	10	1
10	Rhn	9	8	1	10	Arf	7	10	3
11	Cc	5	9	4	11	Afn	7	10	3
12	Bma	7	9	2	12	Abm	7	10	1
13	Aln	6	10	4	13	Aql	8	10	2
14	Sfq	8	10	2	14	Dms	8	11	1
15	Hsb	7	9	2	15	Ihm	8	10	1
	Mean	7.27	9.47	2.20			7.60	10.	

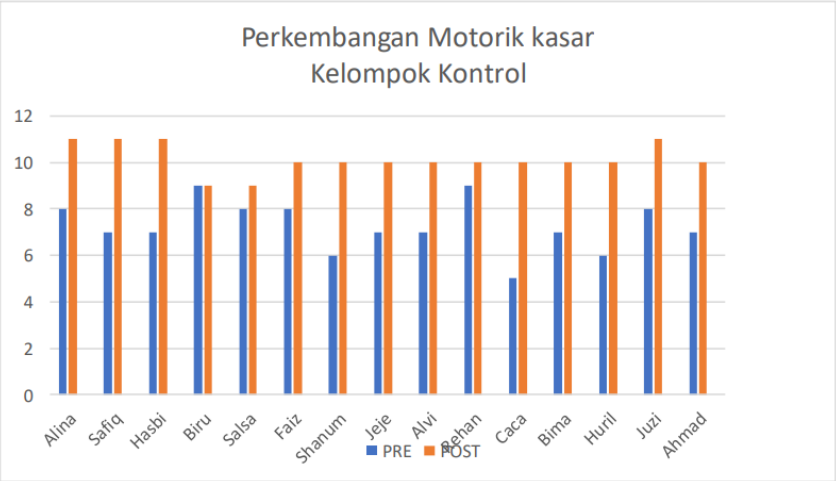

Figure 3. Gross Motor Development of the Control Group

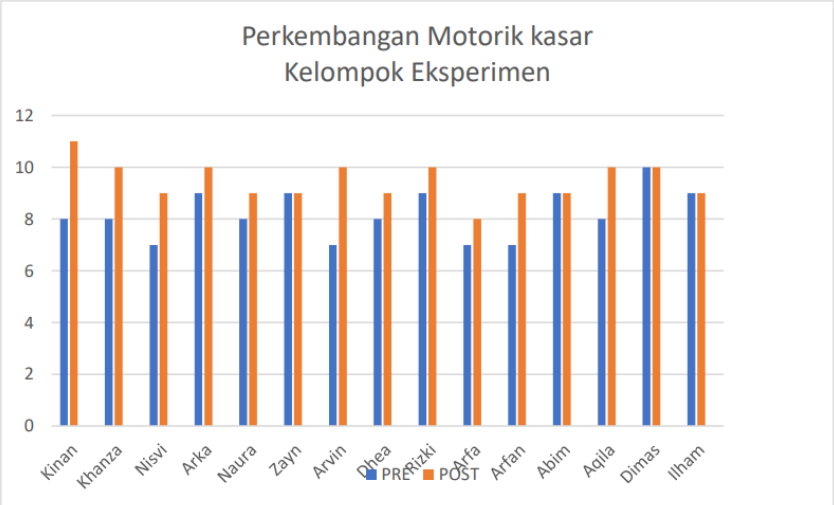

Figure 4. Gross Motor Development of the Experimental Group

Descriptive Statistics

Table 7. Overall Descriptive Statistics

Statistic	Pre Cog	Post Cog	Gain Cog	Pre Gross	Post Gross	Gain Gross
Mean	9.700	15.467	5.767	7.733	9.800	2.067
Std. Deviation	1.088	1.776	1.755	1.112	0.761	1.437
Minimum	8.000	12.000	2.000	5.000	8.000	0.000
Maximum	12.000	18.000	9.000	10.000	11.000	5.000

Skill Categorization

Table 8. Cognitive Ability Categorization

Score Range	Category	Control Pre	Control Post	Experimental Pre	Experimental Post
16–20	High	0	13	0	13
11–15	Medium	6	2	1	2
5–10	Low	9	0	14	0

Table 9. Gross Motor Skill Categorization

Score Range	Category	Control Pre	Control Post	Experimental Pre	Experimental Post
10–12	High	0	13	1	7
7–9	Medium	13	2	14	8
3–6	Low	2	0	0	0

Assumption Testing

The results of the normality and homogeneity tests indicated that some of the data were not normally distributed and not homogeneous**,** therefore the analysis was conducted using non-parametric statistics (Mann–Whitney U test).

Hypothesis Testing

Table 10. Hypothesis Test Results for Cognitive Gain

t	df	p
-6.861	28	<.001

Table 11. Hypothesis Test Results for Gross Motor Gain

t	df	p
3.636	28	0.001

The results indicate that there are significant differences between the experimental and control groups in both aspects cognitive and gross motor skills**.** The p-values less than 0.05 in both hypothesis tests confirm that Project-Based Learning through recycled bottle planting has a statistically significant effect on the cognitive and gross motor development of early childhood learners at RA Rachmat Bangil**.**

Discussion

Improvement in Cognitive Skills

The experimental group that received Project-Based Learning (PjBL) instruction demonstrated a significantly greater improvement in cognitive abilities compared to the control group. The average gain score for the experimental group was 7.13, while the control group recorded only 4.4. This finding aligns with Piaget's theory of cognitive development and is supported by previous studies (Turiyah, 2023), which assert that project-based learning effectively fosters early childhood thinking skills, including classification, reasoning, and problem-solving. PjBL creates opportunities for children to construct knowledge through direct experience, observation, and active manipulation of their environment, which are essential for cognitive growth at the preoperational stage (Rosiana et al., 2024; Sulistyowati et al., 2020). The hands-on nature of recycled bottle planting projects requiring planning, sorting, decision-making, and sequencing stimulates higher-order thinking processes in a meaningful and developmentally appropriate context.

Improvement in Gross Motor Skills

Enhancement in gross motor skills was also observed in both groups, with the experimental group achieving a gain score of 2.53, compared to 2.20 in the control group. Although the difference is not as substantial as that observed in cognitive gains, it nonetheless indicates that PjBL contributes positively to the stimulation of gross motor coordination and movement control in early learners. This outcome is supported , who found that physical engagement embedded in project-based tasks can enhance gross motor skills, particularly when the project includes moderately intense physical activities. Activities such as lifting bottles, pouring water, and transporting planting materials provided natural opportunities for children to develop balance, coordination, and body awareness. Unlike traditional classroom settings, PjBL ensures that physical activity is not isolated but meaningfully integrated into learning goals, thereby promoting motor development without compromising instructional content.

Overall Effectiveness of PjBL

In summary, the implementation of Project-Based Learning through recycled bottle planting projects has proven effective in advancing both cognitive and gross motor development among early childhood learners. One of the key strengths of PjBL lies in its ability to actively engage children in real-life, hands-on experiences that simultaneously stimulate mental and physical domains. The contextual and enjoyable nature of these projects supports holistic development by merging cognitive exploration with purposeful movement. These findings reinforce the call for early childhood educators to adopt PjBL approaches in daily instruction, not only to enhance academic readiness but also to support the physical competencies essential for school success. Moreover, it is recommended that future PjBL projects be designed with a balance between cognitive challenges and gross motor activities to ensure that all developmental areas are addressed in an integrated and meaningful way.

CONCLUSION

Based on the findings of this study at RA Rachmat Bangil, it can be concluded that the implementation of Project-Based Learning (PjBL) through recycled bottle planting projects has a positive and significant impact on the cognitive and gross motor development of early childhood learners. This model effectively enhances children's thinking abilities such as observation, classification, and problem-solving—while also stimulating physical coordination, balance, and large muscle skills through active involvement in meaningful tasks. The statistical analysis confirmed a significant difference between the experimental and control groups in both developmental domains, demonstrating the holistic effectiveness of PjBL. Furthermore, this study highlights the importance of integrating active, contextual, and environmentally friendly learning experiences into early childhood education, and encourages teachers, institutions, and parents to support children's growth through creative, hands-on projects using simple materials.

REFERENCES

Anggraeni, A. R., Anugrahana, A., & Yan Ariyanti, P. B. (2023). Penerapan Model Pembelajaran Project Based Learning terhadap Kreativitas Siswa dengan Menggunakan Bahan Alam pada Kelas 1 SD Negeri Plaosan 1. *Jurnal Pendidikan Tambusai*, *7*(1), 3683–3690. https://doi.org/10.31004/jptam.v7i1.5790

Ariana, L., & Novitawati, N. (2023). Mengembangkan Kemampuan Anak Dalam Mengontrol Gerakan Tangan Menggunakan Otot Halus Melalui Kombinasi Model Project Based Learning Dan Model Direct Instructions Pada Kegiatan Mozaik. *Jurnal Inovasi, Kreatifitas Anak Usia Dini (JIKAD)*, *3*(3), 32. https://doi.org/10.20527/jikad.v3i3.10065

Candra Susanto, P., Ulfah Arini, D., Yuntina, L., Panatap Soehaditama, J., & Nuraeni, N. (2024). Konsep Penelitian Kuantitatif: Populasi, Sampel, dan Analisis Data (Sebuah Tinjauan Pustaka). *Jurnal Ilmu Multidisplin*, *3*(1), 1–12. https://doi.org/10.38035/jim.v3i1.504

Desmita, D., Rahmadani, S., Kharisma Diyenti, A., Warmansyah, J., Silvianetri, S., & Binti Fakaruddin, N. A. A. (2023). The Relationship of Parent-Child Interaction in Developing Effective Communication in Early Childhood. *Indonesian Journal of Early Childhood Educational Research (IJECER)*, *2*(2), 47. https://doi.org/10.31958/ijecer.v2i2.11524

Dhiaulhaq, M., Utami, T., & Nabila Akifah Noor, A. (2024). Enhancing Early Childhood Cognitive Skills Through Patterned Meronce Activities with Loose Parts. *Indonesian Journal of Early Childhood Educational Research (IJECER)*, *3*(1), 69. https://doi.org/10.31958/ijecer.v3i1.12513

Dywan, A. A., & Airlanda, G. S. (2020). Efektivitas Model Pembelajaran Project Based Learning Berbasis STEM dan Tidak Berbasis STEM terhadap Kemampuan Berpikir Kritis Siswa. *Jurnal Basicedu*, *4*(2), 344–354. https://doi.org/10.31004/basicedu.v4i2.353

Hasni, U., & Amanda, R. S. (2022). Pengembangan Model Pembelajaran Project Based Learning Untuk Meningkatkan Kemampuan Geometri Anak Usia 5-6 Tahun. *Jurnal PG-PAUD Trunojoyo : Jurnal Pendidikan Dan Pembelajaran Anak Usia Dini*, *9*(1), 1–11. https://doi.org/10.21107/pgpaudtrunojoyo.v9i1.13537

Idris, T., Wita, A., Rahmi, E., & Warmansyah, J. (2022). Ablution Skills in Early Childhood : The Effect of Big Book Media. *Jurnal Obsesi: Jurnal Pendidikan Anak Usia Dini*, *6*(6), 5549–5557. https://doi.org/10.31004/obsesi.v6i6.3185

Istiqomah, N., & Maemonah, M. (2021). Konsep Dasar Teori Perkembangan Kognitif Pada Anak Usia Dini Menurut Jean Piaget. *Khazanah Pendidikan*, *Vol 15*(2), 151. https://doi.org/10.30595/jkp.v15i2.10974

Khodarasih, D., Sari, M., & Pérez, C. (2025). Development of the Magic Cube Numbers Educational Tool to Enhance Symbolic Thinking Skills in Children Aged 4 - 5 Years. *Journal of Early Childhood Education and Teaching (JECET)*, *1*(1), 1–10. https://doi.org/00.00000/jecet.0000.000-00

Kurniawati, H., & Husnayain Madani, I. (2024). Implementation of Learning Methods Based on Natural Materials and Science for Group B Kindergarten. *Journal of Islamic Education Students (JIES)*, *4*(1), 130. https://doi.org/10.31958/jies.v4i1.12310

Kurniawati, R., Kurniawati, R., & Muttaqin, M. 'Azam. (2024). Implementasi Metode Project Based Learning Terhadap Kreativitas Anak Usia 5-6 Tahun Pada Terapan Kurikulum Merdeka. *Journal Of Early Childhood Education Studies*, *4*(1), 105–131. https://doi.org/10.54180/joeces.2024.4.1.136-163

Maromi, C., & Pamuji, P. (2024). When a Child is Speech Delay: Causes, Diagnosis, and Intervention. *Indonesian Journal of Early Childhood Educational Research (IJECER)*, *3*(1), 61. https://doi.org/10.31958/ijecer.v3i1.12476

Muhibbin, M., & Harjanty, R. (2024). Impelemetasi Metode Montsessori dalam Menanamkan Nilai-Nilai Pendidikan Agama Islam Anak di RA Marzukiyah Praya, Lombok Tengah. *NUSRA : Jurnal Penelitian Dan Ilmu Pendidikan*, *5*(2), 875–880. https://doi.org/10.55681/nusra.v5i2.2803

Mustakim, M., Fauziyah, N., Rahim, A. R., & Sukaris, S. (2020). Seminar Mengoptimalkan Golden Age Anak. *DedikasiMU(Journal of Community Service)*, *2*(4), 607. https://doi.org/10.30587/dedikasimu.v2i4.2059

Nurhayanti, D., Hajerah, H., & Zainuddin, I. (2021). Penerapan Model Project Based Learning dalam Meningkatkan Kemampuan Membilang Anak 1- 10 dengan Media Kongkrit Pohon Angka pada Kelompok A di TK Tunas Bangsa Indramayu Jawa Barat. *Jurnal Pemikiran Dan Pengembangan Pembelajaran*, *3*(4), 18–24.

Pratiwi, D., Wiranti, D. A., & Nila Ariani, N. A. (2023). Art Project Practice Learning:Early Childhood Education in Children's Fine Motor Development. *Indonesian Journal of Early Childhood Education Studies (IJECES)*, *12*(1), 19–28. https://doi.org/10.15294/ijeces.v12i1.67670

Priantika, D., Hasanah, H., & Hadi Pradana, P. (2024). Pengaruh Model Pembelajaran Project Based Learning Berbasis Alam terhadap Creative Thinking Anak Usia Dini. *Murhum:Jurnal Pendidikan Anak Usia Dini*, *5*(1), 558–571. https://doi.org/10.37985/murhum.v5i1.605

Priyanti, N., & Warmansyah, J. (2021). The Effect of Loose Parts Media on Early Childhood Naturalist Intelligence. *JPUD - Jurnal Pendidikan Usia Dini*, *15*(2), 239–257. https://doi.org/10.21009/jpud.152.03

Rehny, Z., & Sari, N. P. (2023). Upaya Mengembangkan Kemampuan Kognitif Pada Proses Sains Menggunakan Model Project Based Learning Kelompok A Tk. *Jurnal Inovasi, Kreatifitas Anak Usia Dini (JIKAD)*, *3*(2). https://doi.org/10.20527/jikad.v3i2.9132

Rosiana, R., Miyono, N., & Hanum, A. (2024). Penerapan model pembelajaran project based learning untuk meningkatkan hasil belajar peserta didik pada materi struktur lapisan bumi kelas V SDN Peterongan. *COLLASE (Creative of Learning Students Elementary Education)*, *7*(2), 223–229. https://doi.org/10.22460/collase.v7i2.22418

Roussou, M. (2004). Learning by doing and learning through play. *Computers in Entertainment*, *2*(1), 10–10. https://doi.org/10.1145/973801.973818

Ruhiyat, S., Andika W.D., Lia, D., & Pagarwati, A. (2024). Studi Literatur : Problem Solving pada Perkembangan Kognitif Anak Usia Dini melalui Bermain Literature Study : Problem Solving in Early Childhood Cognitive Development Through Play. *Jurnal Ilmiah*

Pesona Paud, *11*(1), 71–85.

Rusady, P., Fitriani, W., & Raza, A. (2025). Development of Pop - Up Book Media for Introducing Sexual Education to Children Aged 5 – 6 Years. *Journal of Early Childhood Education and Teaching*, *1*(1), 37–48.

Sakila, S. R., Hibana, H., & Tumbularani, T. (2023). Penerapan Model Pembelajaran Project Based Learning (Pjbl) dalam Implementasi Kurikulum Merdeka di Pendidikan Islam Anak Usia Dini. *EDUKASIA: Jurnal Pendidikan Dan Pembelajaran*, *4*(2), 2383–2392. https://doi.org/10.62775/edukasia.v4i2.599

Setiowati, E. A., & Warmansyah, J. (2023). *Parents' Beliefs, Attitudes toward School, and School Readiness of Preschoolers after Social Restrictions during the COVID-19 Pandemic* (Issue ICoeSSE). Atlantis Press SARL. https://doi.org/10.2991/978-2-38476-142-5_14

Setyowati, S., Rakhmawati, N. I. S., Fitri, R., Saroinsong, W. P., & Simatupang, N. D. (2023). Project-Based Learning in Improving Early Childhood Children's Ability to Know Social and Geographical Environments. *Jurnal Obsesi:Jurnal Pendidikan Anak Usia Dini*, *7*(3), 3461–3467. https://doi.org/10.31004/obsesi.v7i3.4653

Sufa, F. F., & Widyahening, C. E. T. (2023). Pengembangan Instrumen Kemampuan Berpikir Matematika dalam Perkembangan Kognitif anak usia dini. *Jurnal Obsesi:Jurnal Pendidikan Anak Usia Dini*, *7*(3), 3819–3830. https://doi.org/10.31004/obsesi.v7i3.3646

Sugihartini, N., & Yudiana, K. (2018). Addie Sebagai Model Pengembangan Media Instruksional Edukatif (Mie) Mata Kuliah Kurikulum Dan Pengajaran. *Jurnal Pendidikan Teknologi Dan Kejuruan*, *15*(2), 277–286. https://doi.org/10.23887/jptk-undiksha.v15i2.14892

Sukarti, S., Hidayati, S., Aghnaita, A., Muzakki, M., & Karim, A. (2023). Cognitive Development of Children through Illustrated Letter Card Media in Kindergarten. *Indonesian Journal of Early Childhood Educational Research (IJECER)*, *2*(1), 10. https://doi.org/10.31958/ijecer.v2i1.8796

Sulistyowati, S., Reffiane, F., & Handayani, D. E. (2020). Pengaruh model pembelajaran project based learning berbasis etnosains tema ekosistem terhadap aktivitas belajar siswa. *Jurnal Pendidikan Surya Edukasi (JPSE)*, *6*(2), 120–132. https://doi.org/10.37729/jpse.v6i2.6802

Syaharra, S. I., Sari, M., & Ahmed, S. (2025). Development of Interactive Smart Poster Media for Sexual Education Introduction to Children Aged 5 – 6 Years. *Journal of Early Childhood Education and Teaching*, *1*(1), 11–18.

Triyono, T., Yanuardi, Y., Hartaya, K., & Hartono, R. (2022). Efforts for the Role of Mothers as Informal Educators in Stimulating Motoric Development in Early Childhood in Kedung Jaya Bogor. *International Journal on Engineering, Science and Technology*, *1*(2), 70–85. https://doi.org/10.46328/ijonest.113

Turiyah, T. (2023). Analisis Implementasi Model Project Based Learning (PjBL) dalam Mengembangkan Kemampuan Kognitif Anak Sekolah Dasar. *Social, Humanities, and Educational Studies (SHES): Conference Series*, *6*(1), 106. https://doi.org/10.20961/shes.v6i1.71063

Yulia, N., Warmansyah, J., & Jiwon, L. (2025). The Impact of Google Sites – Based Interactive Media Integrating Sumbang Duo Baleh on the Development of Politeness in Early Childhood. *Journal of Early Childhood Education and Teaching*, *1*(1), 26–36.

Zainiya Anisa. (2022). Branding Sekolah Islam Modern: Sekolah Islam Terpadu, Madrasah/Sekolah Alam, dan Tahfiz Al-Qur'an. *EL-HIKMAH: Jurnal Kajian Dan Penelitian Pendidikan Islam*, *16*(1), 49–64. https://doi.org/10.20414/elhikmah.v16i1.6191