



The Effectiveness of Nature Exploration Games in Sharpening Problem-Solving Skills



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Abstract

This study aims to examine the effectiveness of nature exploration games in enhancing problem-solving skills among primary school students aged 5–12 years at Al-Jazila Primary School, Padalarang, West Bandung Regency. The population consisted of all students at Al-Jazila Primary School. The sample included 20 students from grades 1–3 as the experimental group and 20 students from grade 4 as the control group, selected through purposive sampling. This research employed a quantitative approach with a quasi-experimental design using non-equivalent control groups. Data were processed using SPSS version 26, and non-parametric statistical analysis was performed using the median test. The findings indicate that although there was an increase in the average score of the experimental group, no statistically significant difference was found between the experimental and control groups. This suggests that nature exploration games did not have a significant impact on improving students' problem-solving skills in this study. Nevertheless, the research highlights the importance of developing more structured and sustainable learning designs to optimize students' cognitive skill development in primary education settings.

Keywords: Nature Exploration Games, Problem-Solving Skills, Early Childhood, Experimental Research, Non-Parametric Statistical Test

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Introduction

Primary education represents a crucial stage in children's development, where cognitive, social, and emotional abilities continue to grow and form the foundation for lifelong learning¹. One of the key cognitive skills that must be developed during this stage is problem-solving². These skills are essential for fostering critical thinking, decision-making, and adaptability in facing future challenges³. However, in practice, learning that is overly academic and focused mainly on content mastery often neglects the development of problem-solving skills particularly through learning approaches that are meaningful and connected to students' real-world experiences⁴. At the primary school level, students naturally exhibit

¹ Khairul F Ne'matullah, "Children Outdoor Play Towards Educational Sustainability: A Scoping Review," 2022, <https://doi.org/10.15405/epms.2022.10.54>; Hilary A T Caldwell et al., "Regional Differences in Movement Behaviours of Children and Youth During the Second Wave of the COVID-19 Pandemic in Canada: Follow-Up From a National Study," *Can J Public Health* 113, no. 4 (2022): 535–46, <https://doi.org/10.17269/s41997-022-00644-6>; V K Kurukulaarachchi, "Early Childhood Education Degree Programme for Non-State Higher Education Institutes in Sri Lanka – Need Survey," *Cinec Academic Journal* 6, no. 1 (2023): 9–14, <https://doi.org/10.4038/caj.v6i1.113>; Anita A H Udju, "Analysis of the Use of Super Book Media on the Development of Language and Fine Motor Skills in Early Childhood," *Edukatif Jurnal Ilmu Pendidikan* 6, no. 1 (2024): 770–80, <https://doi.org/10.31004/edukatif.v6i1.6383>; Rakimahwati Rakimahwati, "Inquiry Based Colage Activities Using Colored Shells on the Development of Creativity of Early Children," *Jurnal Obsesi Jurnal Pendidikan Anak Usia Dini* 7, no. 2 (2023): 2485–95, <https://doi.org/10.31004/obsesi.v7i2.3592>; M M Islam and Nuruzzaman Khan, "Early Childhood Development and Its Association With Maternal Parity," *Child Care Health and Development* 49, no. 1 (2022): 80–89, <https://doi.org/10.1111/cch.13011>; Eti Nurhayati et al., "Educational Computer Game and Their Implications on Early Children's Language Skill," *Jurnal Obsesi Jurnal Pendidikan Anak Usia Dini* 6, no. 6 (2022): 6766–76, <https://doi.org/10.31004/obsesi.v6i6.3488>; Anggarda P Muji et al., "Meta-Analysis of Early Childhood Learning During the Covid-19 Pandemic Using the Prism Method," *International Journal of Research in Counseling and Education* 6, no. 1 (2022): 27, <https://doi.org/10.24036/00480za0002>.

² Sainee Tamphu et al., "Building Bridges to the Future of Learning : Exploring Artificial Intelligence Research Using R- Studio Assisted Bibliometrics," *Cogent Education* 11, no. 1 (2024), <https://doi.org/10.1080/2331186X.2024.2417623>.

³ Eva Pölzl-Stefanec, Mailina Barta, and Catherine Walter-Laager, "Assurance and Development of Interaction Quality: The Impact of Blended-Learning Professional Development Training Programme," *Early Childhood Education Journal* 52, no. 6 (2023): 969–78, <https://doi.org/10.1007/s10643-023-01479-7>; Anke M Weber and Samuel Greiff, "ICT Skills in the Deployment of 21st Century Skills: A (Cognitive) Developmental Perspective Through Early Childhood," *Applied Sciences* 13, no. 7 (2023): 4615, <https://doi.org/10.3390/app13074615>; Siti Nurjanah et al., "The Effect of Social Skill Training of Early Childhood Education During COVID-19 Pandemic," *Open Access Macedonian Journal of Medical Sciences* 10, no. G (2022): 607–12, <https://doi.org/10.3889/oamjms.2022.9677>; Nur Aliyah, "Development of Traffic Maze Media to Stimulate Problem of 4-5 Years Old Children," *J. Computer Science Advancements* 1, no. 2 (2023): 92–102, <https://doi.org/10.55849/jsc.v1i2.455>; Jiabin Lyu, "The Effective of Block Play and Pretend Play in Early Childhood Development," *Lecture Notes in Education Psychology and Public Media* 16, no. 1 (2023): 155–60, <https://doi.org/10.54254/2753-7048/16/20231138>; Dale Walker et al., "Advances in the Technical Adequacy of the Early Problem-Solving Indicator Progress Monitoring Measure for Infants and Toddlers," *Topics in Early Childhood Special Education* 42, no. 4 (2022): 289–301, <https://doi.org/10.1177/02711214221129237>.

⁴ Rahayu Prasetyo, Novita Nur Synthiawati, and Nugroho Susanto, "Pengembangan Model Pembelajaran Outdoor Games Activities Untuk Meningkatkan Problem Solving Skills Siswa," *Jurnal Obsesi: Jurnal Pendidikan Anak Usia Dini* 7, no. 6 (2023): 7362–70, <https://doi.org/10.31004/obsesi.v7i6.5545>.

strong curiosity and a desire to explore and solve simple problems in their surroundings⁵. One effective approach to sharpen this ability is through nature exploration games, which allow students to interact directly with their environment, stimulate curiosity, and encourage them to find creative solutions to various challenges. Moreover, nature exploration also contributes positively to students' physical, social, and emotional development. Unfortunately, with the growing influence of digital technology, many students now spend more time with gadgets than engaging in outdoor learning, resulting in limited opportunities to learn from nature. Therefore, nature exploration games are essential as a means to support students' holistic development both in skills and learning experiences⁶.

Nature exploration games not only help primary school students develop problem-solving skills but also provide enjoyable and meaningful learning experiences⁷. Activities such as observing animals, identifying natural patterns, or creating simple constructions from natural materials train students to think critically, collaborate with peers, and apply their knowledge in real contexts⁸. In primary education, this approach aligns with the principles of experiential learning, which emphasize hands-on practice and direct engagement with the environment. However, not all schools systematically integrate nature exploration into their

⁵ Farida Kumalasari, Yulia Hamdani Putri, and Hera Febria Mavilinda, "Studi Netnografi: Manfaat Sekolah Berbasis Alam Terhadap Kesehatan Anak," *Jurnal Ilmu Kesehatan Masyarakat* 13, no. 02 (2024): 131–41, <https://doi.org/https://doi.org/10.33221/jikm.v13i02.2619>; An Nisa Zulfah, Nikmatur Rohmah, and Mufaroah Mufaroah, "Peran Senam Dalam Meningkatkan Kemampuan Motorik Kasar Anak Usia Dini Di KB Nurul Islam," *Sindoro: Cendikia Pendidikan* 7, no. 4 (2024): 11–20, <https://doi.org/https://doi.org/10.33221/jikm.v13i02.2619>.

⁶ Nicole Miller et al., "Primary School Educators' Perspectives and Experiences of Nature-Based Play and Learning and Its Benefits, Barriers, and Enablers: A Qualitative Descriptive Study," *International Journal of Environmental Research and Public Health* 19, no. 6 (2022): 3179, <https://doi.org/10.3390/ijerph19063179>; Brooke E Watson et al., "Parent Perceived Barriers and Facilitators of Children's Adventurous Play in Britain: A Framework Analysis," *BMC Public Health* 22, no. 1 (2022), <https://doi.org/10.1186/s12889-022-13019-w>; Jian-Bo Wu, "Association Between Early Childhood Outdoor Activity and Anxiety Symptoms in Preschoolers," 2024, <https://doi.org/10.21203/rs.3.rs-4137839/v1>; Caldwell et al., "Regional Differences in Movement Behaviours of Children and Youth During the Second Wave of the COVID-19 Pandemic in Canada: Follow-Up From a National Study."

⁷ Jiaqi Yu et al., "Developing a Stealth Assessment System Using a Continuous Conjunctive Model," *Journal of Learning Analytics* 9, no. 3 (2022): 11–31, <https://doi.org/10.18608/jla.2022.7639>; Siti K Anis et al., "Nominal Group Technique Application Towards Design of Components and Elements of Non-Digital Game Framework," *International Journal of Evaluation and Research in Education (Ijere)* 11, no. 1 (2022): 213, <https://doi.org/10.11591/ijere.v11i1.22164>; Carla Sousa, "Playing at the School Table: Systematic Literature Review of Board, Tabletop, and Other Analog Game-Based Learning Approaches," *Frontiers in Psychology* 14 (2023), <https://doi.org/10.3389/fpsyg.2023.1160591>; Weilun Chen, "Resto Quest – A Serious Game On the Restorative Effects Of Immersive Virtual Environments," 2023, 199–213, https://doi.org/10.1007/978-3-031-37171-4_14.

⁸ Sholikhul Hadi and Firman Priyo Suhasto, *Tumbuh Kembang Optimal: Panduan Pola Asuh Orang Tua Bijak Untuk Memahami Dan Merangsang Perkembangan* (PT Human Persona Indonesia, 2024).

learning processes⁹. Challenges such as limited facilities, restricted time allocation, and a lack of understanding among educators regarding the benefits of this method remain significant barriers. Therefore, further research is necessary to explore the potential of nature exploration games in enhancing primary students' problem-solving skills more comprehensively.

Several previous studies have demonstrated that nature exploration provides significant benefits for students' development¹⁰. Nature-based learning activities have been shown to enhance critical thinking and collaboration skills among primary school students, as well as help them recognize patterns and understand cause-and-effect relationships key components of problem-solving abilities¹¹. Other studies also reveal that nature exploration contributes positively to students' social and emotional growth, supporting their overall learning engagement¹². However, most of these studies focus on the general impact of nature exploration and do not specifically examine how nature-based games can improve problem-solving skills within the context of primary education. In addition, many of these studies were conducted in limited geographic areas with relatively small sample sizes, making their findings less generalizable. These gaps highlight the need for more in-depth research that

⁹ Steve Scott et al., "The Impact of Time Spent in Natural Outdoor Spaces on Children's Language, Communication and Social Skills: A Systematic Review Protocol," *International Journal of Environmental Research and Public Health* 19, no. 19 (2022): 12038, <https://doi.org/10.3390/ijerph191912038>; Muhammad Thohri, "Development of Arabic Language Curriculum Focused on Diversity and Inclusion," *An-Nabighoh Jurnal Pendidikan Dan Pembelajaran Bahasa Arab* 26, no. 1 (2024): 31–50, <https://doi.org/10.32332/annabighoh.v26i1.31-50>; George Koutsouris, "Do We Have to Rethink Inclusive Pedagogies for Secondary Schools? A Critical Systematic Review of the International Literature," *British Educational Research Journal* 50, no. 1 (2023): 260–86, <https://doi.org/10.1002/berj.3926>; Christopher Mihajlovic and Stefan Meier, "Including Students With Special Educational Needs in Physical Education: An Analysis of the Current Finnish National Core Curriculum," *The Curriculum Journal* 33, no. 2 (2022): 279–96, <https://doi.org/10.1002/curj.156>.

¹⁰ Zheng Jiang, "The Effectiveness of Nature-Based Learning in Promoting Physical, Cognitive, and Emotional Development in Young Children: A Case Study in China," *International Journal of Education & Technology* 1, no. 3 (2023), <https://doi.org/10.59021/ijetech.v1i3.24>; Man Wang, "The Impact of Parent-Child Reading on Children's Language Development," *Frontiers in Humanities and Social Sciences* 3, no. 10 (2023): 81–87, <https://doi.org/10.54691/fhss.v3i10.5687>; Sze L Yoong et al., "A Randomised Controlled Trial of an Implementation Strategy Delivered at Scale to Increase Outdoor Free Play Opportunities in Early Childhood Education and Care (ECEC) Services: A Study Protocol for the Get Outside Get Active (GOGA) Trial," *BMC Public Health* 22, no. 1 (2022), <https://doi.org/10.1186/s12889-022-12883-w>; Wantini Wantini et al., "Learning Model During Post Covid-19 Pandemic to Improve Early Childhood Language Development," *Jurnal Obsesi Jurnal Pendidikan Anak Usia Dini* 6, no. 6 (2022): 6187–97, <https://doi.org/10.31004/obsesi.v6i6.3115>; Tobroni Tobroni et al., "Nature-Based Learning Management in Improving Children's Natural Intelligence," *Al-Tanzim Jurnal Manajemen Pendidikan Islam* 6, no. 4 (2022): 1010–20, <https://doi.org/10.33650/al-tanzim.v6i4.3899>.

¹¹ Ahmad Mufid Hisyam Ali, Puji Yanti Fauziah, and M Ali Latif, "Eksplorasi Lingkungan Dalam Pembelajaran Anak Di Lembaga PAUD," *Jurnal Obsesi: Jurnal Pendidikan Anak Usia Dini* 7, no. 5 (2023): 5575–84, <https://doi.org/10.31004/obsesi.v7i5.5181>.

¹² Amiliya (2020)

adopts a more targeted approach to explore the effectiveness of nature exploration games in developing problem-solving skills among primary school students.

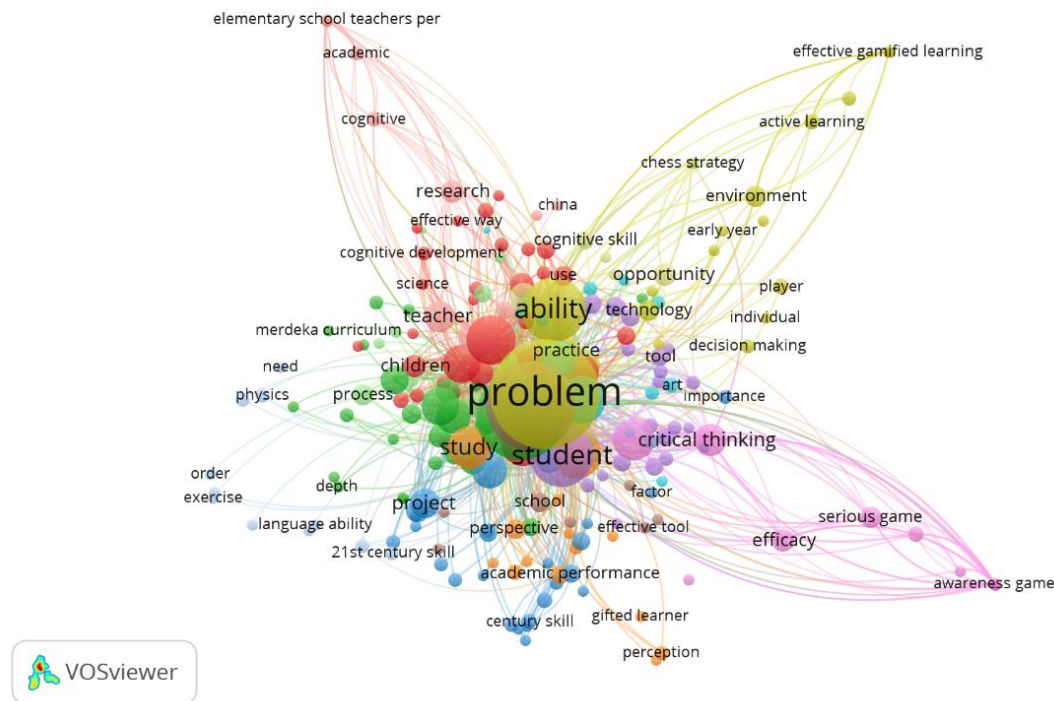


Figure 1. VOSviewer

Based on the bibliometric analysis using VOSviewer, research related to problem-solving skills is still largely dominated by academic and technology-based approaches, while nature exploration has not yet become a primary focus in enhancing these skills. The identified gap lies in the limited number of studies that explicitly link nature exploration games with the development of problem-solving abilities among primary school students¹³. Furthermore, existing concepts such as *serious games* and *awareness games* are more commonly associated with technology-based learning rather than nature-based approaches. The lack of

¹³ Romita Trehan, "The Role of Gaming for Information, Education and Communication of AMR: Full Review of Online Education Resources," *Jac-Antimicrobial Resistance* 6, no. 3 (2024), <https://doi.org/10.1093/jacamr/dlae080>; Owen Lockwood and Mei Si, "A Review of Uncertainty for Deep Reinforcement Learning," *Proceedings of the Aaai Conference on Artificial Intelligence and Interactive Digital Entertainment* 18, no. 1 (2022): 155–62, <https://doi.org/10.1609/aiide.v18i1.21959>; Azlina U Widiarti, "The Role of Traditional Games on Children's Ground Motor and Emotional Ability," *Apes Journal of Physical Education Sport and Health (Ajpes)* 2, no. 2 (2022): 1149–1433, <https://doi.org/10.15294/ajpes.v2i2.60887>; Mehmet Mart, "Children's Experiences Outdoors: Education and Community Contexts," *Journal of Childhood Education & Society* 4, no. 3 (2023): 230–33, <https://doi.org/10.37291/2717638x.202343339>; Georgia Mavroudaki, "Escaping the Bondage of Bullying: A Game-Based Learning Approach," *European Conference on Games Based Learning* 18, no. 1 (2024): 723–33, <https://doi.org/10.34190/ecgbl.18.1.2751>.

explicit connections between nature exploration and problem-solving in primary education indicates that this study has the potential to fill an important gap in the existing body of literature.

The novelty of this research lies in its innovative integration of nature exploration games with problem-based learning within the context of primary education. Unlike previous studies that primarily focus on the general influence of nature exploration on children's development, this study specifically investigates the effectiveness of nature exploration games in improving problem-solving skills among primary school students. Moreover, this approach introduces a new pedagogical perspective in Indonesian primary education, where nature exploration has traditionally been viewed as a recreational activity rather than a structured learning strategy. Therefore, this study not only contributes theoretically to the field of primary education but also provides a foundation for developing more innovative and environmentally oriented learning curricula.

This study aims to examine the effectiveness of nature exploration games as a strategy to enhance problem-solving skills among primary school students. By implementing nature-based games, this research seeks to provide new insights into how such activities can stimulate creativity, critical thinking, and students' ability to face various challenges. In addition, this study explores the factors that support or hinder the implementation of nature exploration games in primary education, offering practical recommendations for teachers and education practitioners. The findings of this research are expected to contribute meaningfully to the development of innovative learning methods that support the holistic growth of primary school students while strengthening their connection with the natural environment.

Research Methods

This study employed a quantitative approach with an experimental method using a quasi-experimental design, specifically the non-equivalent control group design. The design involved two groups: an experimental group that received the treatment in the form of Nature Exploration Games to Enhance Problem-Solving Skills among Primary School Students, and a control group that did not receive the treatment and served as a comparison. Unlike true experimental designs, this quasi-experimental design did not involve full randomization, making it suitable for educational settings where random assignment is often not possible.

The design characteristics included the use of experimental and control groups, the implementation of pretest and posttest measures, and partial control over external variables.

The study was conducted at Al-Jazila Primary School, Padalarang, West Bandung Regency. The population consisted of all students in grades one to four, and a total of forty students were selected as participants using purposive sampling. The experimental group comprised twenty students from grades one to three, while the control group consisted of twenty students from grade four. The inclusion criteria for participants were regular school attendance, the ability to participate in outdoor activities, and parental consent to take part in the research. The selection of twenty students per group was based on class size and the need to ensure optimal observation and supervision during nature-based learning sessions. Although purposive sampling has potential bias due to the non-random nature of selection, this was minimized by ensuring both groups were comparable in age, gender balance, and academic background.

Ethical considerations were carefully maintained throughout the research process. Approval was obtained from the school principal and the institutional ethics committee before data collection began. In addition, written parental consent was secured to ensure that all participants joined voluntarily and with full understanding of the study's objectives and procedures. Parents were informed about the types of activities involved, especially outdoor exploration sessions, as well as the safety measures implemented during these sessions. All personal data and assessment results were treated as confidential, and participation had no impact on students' academic grading or evaluation. The experimental procedure consisted of three main stages carried out over four weeks. During the first week, both the experimental and control groups completed a pretest on problem-solving skills to establish baseline data. The second and third weeks were devoted to the treatment phase, in which the experimental group participated in nature exploration game activities three times per week, each lasting approximately sixty minutes. These activities included observing natural objects, identifying environmental patterns, solving outdoor puzzles, and constructing simple structures using natural materials. The control group, on the other hand, continued their regular classroom activities without any nature-based intervention. In the fourth week, both groups undertook the posttest, using the same instrument as in the pretest, to measure any improvement in problem-solving skills following the intervention.

The instrument used to assess problem-solving skills was a teacher observation rubric developed specifically for primary school contexts. The rubric consisted of ten indicators assessing creativity, logical reasoning, and critical thinking, each rated on a four-point Likert scale ranging from 1 (very low) to 4 (very high). The instrument underwent expert validation by three specialists in early education and experiential learning, resulting in a Content Validity Index (CVI) of 0.87, which indicates strong validity. Reliability testing using Cronbach's Alpha yielded a coefficient of 0.82, demonstrating high internal consistency.

Data analysis was conducted using SPSS version 26, combining both descriptive and inferential statistical analyses. Descriptive statistics were used to present data on the mean, standard deviation, and frequency distribution to describe overall patterns in the students' performance. Inferential statistics were applied using Two-Way ANOVA to test differences in meanscores between groups and gender categories before and after treatment. The assumptions of normality and homogeneity of variance were tested using the Kolmogorov–Smirnov, Shapiro–Wilk, and Levene's tests, respectively. When significant differences were detected, a post-hoc Tukey HSD test was conducted to determine which specific groups differed significantly. The effect size (η^2) was also calculated to determine the magnitude of the treatment's impact. If the normality assumption was not met, the Median Test was applied as a non-parametric alternative. Through this comprehensive design and analysis, the study sought to determine not only the statistical significance of nature exploration games in improving students' problem-solving abilities but also the practical significance of implementing such activities in primary school learning environments.

Results and Discussion

This section presents the research results from all the activities carried out. The results consist of quantitative data from pretest and posttest results in the experimental and control classes. The data processing was performed using SPSS version 26. Based on the data processing of the pretest, descriptive statistical analysis of the "Enhancing Problem-Solving Skills in Early Childhood" is presented in the table below.

Table 1. Descriptive Statistics

School	Gender	Mean	Std. Deviasi
B1	Male	51.87	3.720
	Female	51.83	2.406

	Total	51.85	2.907
	Male	49.55	2.697
B2	Female	54.44	4.640
	Total	51.75	4.375
	Male	52.78	3.632
	Female	53.18	3.371
B3	Total	53.00	3.403
	Male	52.73	3.438
B4	Female	52.22	2.635
	Total	52.50	3.035
	Male	51.67	3.504
	Female	52.85	3.336
Total	Total	52.28	3.449

The data shows that the average scores for male and female students in class B1 are 51.87 and 51.83, respectively, with standard deviations of 3.720 and 2.406, resulting in an overall mean of 51.85 and a standard deviation of 2.907. In class B2, the average scores for male and female students are 49.55 and 54.44, respectively, with standard deviations of 2.697 and 4.640, leading to an overall mean of 51.75 and a standard deviation of 4.375. In class B3, the average scores for male and female students are 52.78 and 53.18, respectively, with standard deviations of 3.632 and 3.371, resulting in an overall mean of 53.00 and a standard deviation of 3.403. In class B4, the average scores for male and female students are 52.73 and 52.22, respectively, with standard deviations of 3.438 and 2.635, leading to an overall mean of 52.50 and a standard deviation of 3.035. Therefore, the overall average score for male and female students is 51.67 and 52.85, respectively, with standard deviations of 3.504 and 3.336, resulting in an overall mean of 52.28 and a standard deviation of 3.449.

Table 2. Between Subjects Factors

Class	Gender		N
	Male	Female	
B1	8	12	20
B2	11	9	20
B3	9	11	20
B4	11	9	20
Total	39	41	80

The number of male and female students in each class is as follows: Class B1, 8 male and 12 female (total: 20 students). Class B2, 11 male and 9 female (total: 20 students). Class B3, 9 male and 11 female (total: 20 students). Class B4, 11 male and 9 female (total: 20

students). Overall, the total number of male and female students is 39 and 41, respectively, with a total of 80 students. To make more specific generalizations based on the data obtained from various samples, inferential statistical tests were performed, starting with normality tests, as shown below.

Table 3. Tests of Normality

	Kolmogorov-Smirnov ^a		Shapiro-Wilk	
	Statistic	Sig.	Statistic	Sig.
Standardized Residual	.218	.000	.923	.000

The significance values for the standardized residuals in the Kolmogorov-Smirnov and Shapiro-Wilk tests are 0.000. Based on the decision criteria, H_0 is rejected, meaning that the residual standard values do not follow a normal distribution (Sig. < 0.05).

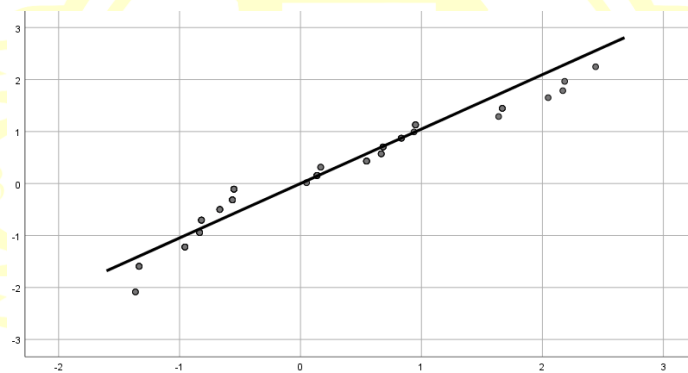


Figure 2. Normal Q-Q Plot of Standardized Residual

The points on the diagram do not scatter around the diagonal line and are significantly far apart, indicating that the standardized residuals do not follow a normal distribution.

Table 4. Levene's Test of Equality of Error Variances^{a,b}

	Levene Statistic	Sig.
Based on Mean	1.893	.083
Based on Trimmed Mean	1.743	.113

The significance value for the mean is 0.083. Based on the decision criteria, H_0 is accepted (Sig. > 0.05), indicating that the data has homogeneous variances across the three experimental classes and one control class. Therefore, the next step is to continue with a non-parametric statistical test using the Median Test.

Table 5. Median Test of Class

	Nilai
Median	80.00
Chi-Square	2.083 ^b
Asymp. Sig.	.555

The significance value is 0.555 (greater than 0.05). This means that the initial problem-solving skills of early childhood students in the experimental classes (B1, B2, and B3) do not differ significantly from the control class (B4).

Table 6. Median Test of Gender

	Nilai
Median	80.00
Chi-Square	2.702
Asymp. Sig.	.100

The significance value is 0.100 (greater than 0.05). Therefore, it can be concluded that there is no significant difference in the initial problem-solving skills of male and female students across each class. Subsequently, data processing for the posttest was conducted, focusing on descriptive statistical analysis of the problem-solving skills enhancement in early childhood, presented in the following table.

Table 7. Descriptive Statistics

School	Gender	Mean	Std. Deviasi
B1	Male	78.75	4.432
	Female	78.17	4.764
	Total	78.40	4.524
B2	Male	77.73	3.438
	Female	81.11	4.167
	Total	79.25	4.064
B3	Male	78.33	3.536
	Female	78.64	3.233
	Total	78.50	3.285
B4	Male	78.18	3.371
	Female	78.89	3.333
	Total	78.50	3.285
Total	Mal	78.21	3.533
	Female	79.10	3.974
	Total	78.66	3.768

The average scores for male and female students in class B1 are 78.75 and 78.17, respectively, with standard deviations of 4.432 and 4.764, resulting in an overall mean of 78.40 and a standard deviation of 4.524. In class B2, the average scores for male and female students are 77.73 and 81.11, respectively, with standard deviations of 3.438 and 4.167, leading to an overall mean of 79.25 and a standard deviation of 4.064. In class B3, the average scores for male and female students are 78.33 and 78.64, respectively, with standard deviations of 3.536 and 3.233, resulting in an overall mean of 78.50 and a standard deviation of 3.285. In class B4, the average scores for male and female students are 78.18 and 78.89, respectively, with standard deviations of 3.371 and 3.333, leading to an overall mean of 78.50 and a standard deviation of 3.285. Therefore, the overall average scores for male and female students are 78.21 and 79.10, respectively, with standard deviations of 3.533 and 3.974, resulting in an overall mean of 78.66 and a standard deviation of 3.768.

Table 8. Tests of Normality

	Kolmogorov-Smirnov ^a		Shapiro-Wilk	
	Statistic	Sig.	Statistic	Sig.
Standardized Residual	.195	.000	.938	.001

The significance values for the standardized residuals in the Kolmogorov-Smirnov and Shapiro-Wilk tests are 0.000 and 0.001. Based on the decision criteria, H_0 is rejected (Sig. < 0.05), indicating that the residual standard values do not follow a normal distribution.

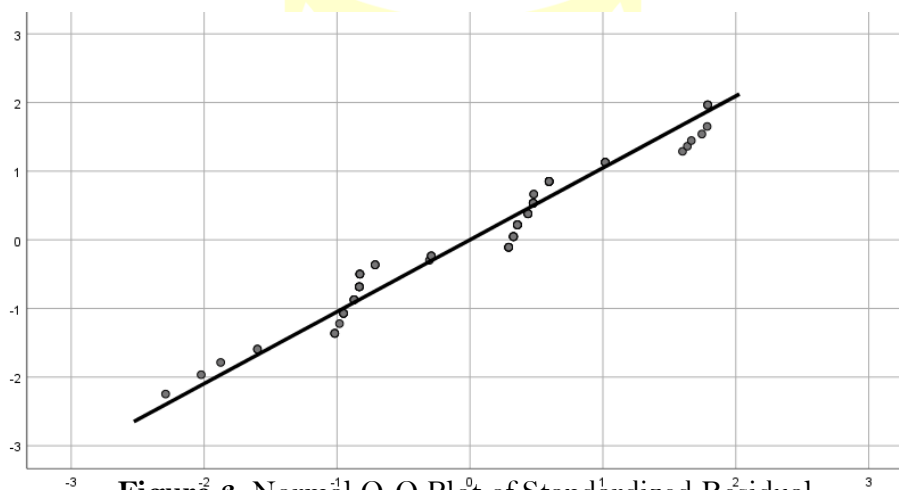


Figure 3. Normal Q-Q Plot of Standardized Residual

Based on Figure 3 above, it can be seen that the data points on the diagram do not spread around the diagonal line and are significantly distant from the line, indicating that the standardized residuals do not follow a normal distribution.

Table 9. Levene's Test of Equality of Error Variances^{a,b}

	Levene Statistic	Sig.
Based on Mean	.654	.710
Based on Trimmed Mean	.636	.725

Based on Table 9 above, the significance value based on the mean is 0.710. According to the decision criteria, H_0 is rejected, meaning that $\text{Sig.} > 0.05$, which indicates that the data is homogeneous or has the same variance between the three experimental classes and the control class. Therefore, the next step is to proceed with a non-parametric statistical test using the Median Test.

Table 10. Median Test of Class

	Value
Median	80.00
Chi-Square	1.569 ^b
Asymp. Sig.	.667

Based on Table 10 above, the significance value is 0.667 (greater than 0.05). This leads to the conclusion that there is no significant difference in the problem-solving skills of early childhood students in the experimental classes (B1, B2, and B3), which received treatment with nature exploration games, compared to the control class (B4). Therefore, the effectiveness between the experimental and control classes does not need to be further assessed, as no significant differences were found.

Table 11. Median Test of Gender

	Nilai
Median	80.00
Chi-Square	3.187
Asymp. Sig.	.074

Based on Table 11 above, the significance value is 0.074 (greater than 0.05). It can be concluded that there is no significant difference in problem-solving skills in early childhood between male and female students in the experimental classes (B1, B2, and B3) that received treatment with nature exploration games and the control class (B4).

Based on the analysis of the pretest and posttest data in the experimental class, which received treatment through nature exploration games, and the control class, which did not receive the treatment, it was found that there was an increase in the average scores in both groups. However, the results of the normality test indicated that the data were not normally distributed, thus a non-parametric statistical test was used. The Median Test on the pretest data showed no significant difference in the initial problem-solving skills between the experimental and control groups. This indicates that both groups had relatively comparable initial conditions.

Furthermore, the Median Test on the posttest data also showed a significance value greater than 0.05, meaning that there was no significant difference in problem-solving skills between the experimental and control groups after the treatment was given. Therefore, the nature exploration games implemented in this study did not show a statistically significant effect on improving problem-solving skills in early childhood compared to the control class that did not receive the treatment.

Nevertheless, the increase in the average scores in the experimental class indicates a developmental improvement, although the difference was not strong enough to be detected as statistically significant. Therefore, a more structured learning design, a longer intervention duration, and strengthened assessment instruments are needed in future studies so that the impact of nature exploration games can be observed more optimally.

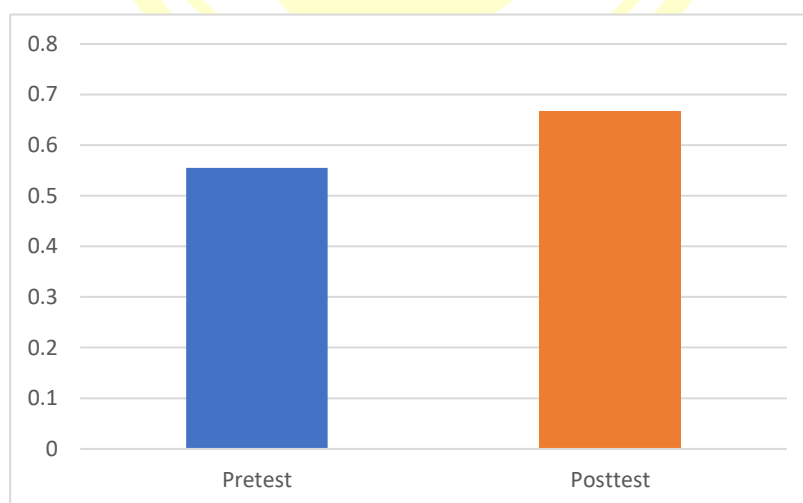


Figure 4. Comparison of Pretest and Posttest Values in the Experimental Class

The findings of this study indicate that the application of nature exploration games to enhance early childhood problem-solving skills in the experimental classes (B1, B2, B3) and the control class (B4) did not show significant differences based on statistical tests. While the data revealed an increase in the average scores of the experimental group compared to the control group, the statistical tests demonstrated that this difference was not significant. Based on non-parametric statistical tests conducted using the Median Test, the obtained significance values were $0.555 > 0.05$ for the pretest and $0.667 > 0.05$ for the posttest, indicating no significant difference in problem-solving skills between the experimental and control groups.

This phenomenon could be related to several factors that need to be considered. According to ¹⁴, the effectiveness of a learning method heavily depends on consistent implementation and how the approach aligns with the students' characteristics. In this study, while nature exploration games were expected to stimulate children's problem-solving skills, suboptimal or less structured implementation may have influenced the results achieved. This aligns with ¹⁵ who stated that problem-solving skills require a well-organized approach where children are not only given tasks but also provided opportunities for reflection and constructive feedback.

Additionally, another factor to consider is the homogeneity of the data between the experimental and control classes. The significance values greater than 0.05 indicate no variance differences between the two groups. This shows that the characteristics of the students in both groups were relatively similar, which may have contributed to the insignificant results. According to ¹⁶, insignificant differences between experimental and control groups can occur due to internal factors, such as students' readiness to learn or differences in how they understand and apply nature exploration games.

Although no significant differences were found between the experimental and control classes, these results provide insights into the importance of a more structured approach and focused teaching to develop early childhood problem-solving skills. Future research should

¹⁴ Ernawulan Syaodih, "Desain Pembelajaran Project Insektarium Mengembangkan Literasi Anak Usia Dini Dalam," *Jurnal Pendidikan Anak* 10, no. 2 (2024): 167–77.

¹⁵ Oktani Haloho, "Strategi Guru Dalam Pengembangan Logika Anak Usia Dini," *Ideas: Jurnal Pendidikan, Sosial, Dan Budaya* 8, no. 4 (2022): 1429, <https://doi.org/10.32884/ideas.v8i4.1063>.

¹⁶ Tatang Aulia Rahman, Nur Lailatul Fitri, and Ana Aulia, "Implementasi Model Pembelajaran Sentra Untuk Mengoptimalkan Kecerdasan Majemuk," *Al-Hikmah: Indonesian Journal of Early Childhood Islamic Education* 6, no. 02 (2022): 145–57, <https://doi.org/10.35896/ijecie.v6i02.411>.

consider more detailed study designs, such as longer durations, reinforced instructions from educators, and other variables that may influence the results, such as students' interest and motivation to learn ¹⁷. Additionally, although the nature exploration games in this study did not show significant differences. However, more intensive and continuous implementation is required to achieve more optimal outcomes. Thus, this study illustrates that while nature exploration games have the potential to enhance early childhood problem-solving skills, deeper implementation and more structured approaches are still necessary to achieve better results.

Conclusion

This study aimed to examine the effectiveness of nature exploration games in enhancing problem-solving skills among early childhood learners. Based on descriptive and inferential statistical tests, it can be concluded that while there was an increase in the average scores of the experimental groups that received the nature exploration game intervention, the difference between the experimental groups (B1, B2, B3) and the control group (B4) was not significant. This is evidenced by the results of non-parametric statistical tests using the Median Test, where the significance values for both the pretest and posttest were greater than 0.05, indicating no significant differences in problem-solving skills between the two groups. Furthermore, the study found that the normality test for the standardized residuals indicated that the data were not normally distributed, which affected further analysis. However, the homogeneity test showed that the data between the experimental and control groups were homogeneous, meaning that the variance across groups was relatively uniform. Therefore, despite the lack of significant differences, these results highlight that other factors beyond the nature exploration game approach, such as students' readiness and motivation to learn, may influence the outcomes.

Although this study did not find significant differences, it still provides important contributions to the development of instructional methodologies in early childhood education. The findings underscore the importance of a more structured approach in implementing nature exploration games to achieve optimal learning outcomes. This aligns

¹⁷ Sholeh Hasan and Lilik Hidayati, "Nilai Pendidikan Akhlak Dalam Film Animasi Nussa Dan Rara Sebagai Media Pembelajaran Materi Akidah Akhlak Di MI Nurul Huda Srimulyo," *JUPIN (Jurnal Pendidikan Islam Nusantara)* 2, no. 1 (2023): 74–93, <https://doi.org/https://doi.org/10.30599/jupin.v2i1.493>.

with the views of several experts who argue that problem-solving skills in early childhood require a more targeted and sustained approach. Overall, this study suggests that further research should consider additional factors that may affect problem-solving skills in early childhood, such as the role of teachers, the duration of the intervention, as well as the reinforcement of instructions and feedback. Moreover, more in-depth studies with comprehensive designs could help identify more effective ways to develop these skills through game-based approaches

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