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Developing a collaborative BCCT nature-based approach to foster logical thinking and cooperation in early childhood education through local wisdom value

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Abstract This study developed a nature-based Beyond Centers and Circle Time (BCCT) approach integrated with local wisdom values to improve logical thinking and cooperation skills in early childhood. The research method used the ADDIE development model with a control group pretest-posttest experimental design. The results revealed a significant increase in the experimental group compared with the control group. Children's logical thinking skills in the experimental group increased by 28.6 points, whereas those in the control group increased by only 22.0 points. This shows the effectiveness of the nature-based BCCT approach in stimulating logical thinking skills through environmental exploration, real problem solving, and the integration of local wisdom values. In terms of cooperation skills, the experimental group experienced an average increase of 23.35 points, which was greater than that of the control group, which only increased by 18.3 points. These findings confirm that the nature-based BCCT approach can encourage more intensive social interactions through collaborative activities. Thus, the nature-based BCCT approach is effective in improving early childhood logical thinking and cooperation skills. The implication is that this approach can be an effective learning model in early childhood education by integrating cognitive and social aspects in a more natural and interesting learning atmosphere.

Keywords: BCCT, nature-based approach, logical thinking, cooperation skills, local wisdom

1. Introduction

Logical thinking and cooperation skills are two important aspects of early childhood education (ECE) that contribute significantly to a child's holistic development. Education at this stage focuses not only on cognitive aspects but also on fostering the social, emotional, and interpersonal development of children. In this context, logical thinking can help children solve problems and make the right decisions, whereas cooperation teaches children to interact with others and work in teams (Uge et al., 2019). The ability to think logically in early childhood is very important for building a strong cognitive foundation. Logical thinking allows children to understand cause–and–effect relationships, organize information, and make inferences. Hsu & Wang (2018) reported that educational games involving problem solving can improve children's logical thinking skills. In addition, proper training in physical literacy and physical activity also contributes to the growth of children' capacity for logical thought, as these activities often involve planning and execution that require critical thinking (Barratt et al., 2024).

The importance of cooperation is mirrored in the character development of young children in early childhood education. Through cooperation, children learn values such as responsibility, mutual respect, and empathy. Research Kochenderfer et al. (2022) shows that children who engage in group activities tend to be more adept at adjusting to a variety of social situations and possess superior social skills. Therefore, education that emphasizes cooperation can help children build positive relationships with peers and adults around them. The development of logical thinking and cooperation skills are mutually supportive. When children learn to think logically, they can be more effective in collaborating with their peers. In situations where children have to solve problems together, their logical thinking skills help them identify the most effective solutions and work together to achieve the desired results (Bronkhorst et al., 2020). Thus, education that integrates these two aspects will provide long-term benefits to children's development.

Globally, there are concerns about the lack of logical thinking and cooperation skills in children due to a lack of interaction with the natural environment and limited access to collaborative learning approaches. Data from UNESCO (2021) show that approximately 40% of young children worldwide do not have access to quality education that promotes social skills and critical thinking (Chapman & O'Gorman, 2022). A study by Thomas et al. (2019) also showed that countries with more

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cognitively focused education systems tend to have difficulties developing children's cooperation skills. This problem requires attention through innovative and locally based educational approaches.

In Indonesia, especially in coastal areas, there are serious challenges related to the incorporation of learning in an environment and local wisdom values. Data from Direktorat Statistik Kesejahteraan Rakyat (2023), reveal that only 25% of early childhood development (ECD) programs adopt this approach. This condition is more difficult in coastal areas because of the lack of adequate educational infrastructure. Many coastal kindergartens lack adequate learning facilities, including safe play areas and nature exploration tools. Local surveys have shown that 40% of kindergartens in these areas lack appropriate facilities, which reduces children's opportunities to learn through direct interaction with the environment (Alme & Reime, 2021). In addition to infrastructure limitations, a lack of teacher understanding and training in integrating local cultural values into the curriculum prevents children from fully connecting with their coastal culture. Approximately 60% of teachers in coastal areas felt that they were not trained in locally based approaches, even though coastal local wisdom can enrich children's learning. Coupled with only 20% of teachers being trained in nature-based learning methods, the difficulty of developing collaboration and logical thinking abilities in early childhood in this region is even greater. If these issues are not addressed, the cognitive and social development of children in coastal areas could be stunted.

If problems in early childhood education in coastal areas are not addressed, various negative impacts may arise, especially on children's cognitive and social development (Dzakadzie & Agbayisah, 2022). Without environment-based learning facilities and the integration of local wisdom values, children in coastal areas lose the opportunity to interact directly with nature and their culture, which should be an important source of learning in the early stages of development. As a result, their logical thinking skills are not well honed due to the lack of exploratory activities that trigger curiosity and problem-solving skills (Wyver, 2022). This will also limit the development of their cooperation skills due to a lack of experience in collaborative activities in relevant environments.

Furthermore, the absence of contextualized and culturally appropriate learning can make it difficult for coastal children to understand and appreciate their own cultural identity. This has the potential to undercut a feeling of cultural and communal affiliation, which is fundamental to the formation of social character (Allen et al., 2021). The lack of education that supports early cognitive and social skills can also have a long-term impact on children's readiness for the next level of education, as well as on their ability to adapt to the wider social environment (Kulic et al., 2019). Thus, if this problem is not addressed immediately, there is a risk of losing the potential of the young generation in coastal areas to develop optimally, in terms of academic, social and emotional aspects.

The issue of early childhood education in coastal areas is interesting to study because it combines educational challenges with the great potential of local wisdom and the unique natural environment (Jeti & Manan, 2022). On the one hand, exploration of this topic could lead to solutions that enhance children's logical thinking and cooperation skills with culturally and environmentally appropriate approaches. In addition, this problem has the opportunity to strengthen local cultural identity, which is important for the development of children's social character (Ruiz-Garzón, 2021). Solving this problem not only supports the right of children in coastal areas to relevant education, but also helps create a solid foundation for their future cognitive and social development.

Nature-based collaboration has long been recognized as an effective pedagogical method to enhance cognitive and social development in early childhood, particularly in improving children's logical thinking and cooperation skills. Among the various approaches, the Beyond Center and Circle Time (BCCT) model, developed by Pamela Phelps, offers a structured learning framework that integrates play and learning through centers and circle time to support multiple dimensions of early childhood development. By applying a nature-based BCCT approach, children engage directly with their environment and local wisdom, enabling them not only to understand theoretical concepts but also to apply them in real-life contexts. This experiential learning process encourages logical reasoning, communication, collaboration, and collective problem-solving, which are essential foundations for higher-order thinking and social competence. Moreover, integrating local cultural values into this learning model enriches children's experiences, making them more meaningful, contextual, and relevant to their daily lives (Page & Eadie, 2019). Learning through real interactions with the natural environment also helps children grasp abstract concepts more concretely by linking theory to practice (Jiang & Hussain, 2023). Furthermore, incorporating local wisdom values into education fosters essential social virtues such as empathy, teamwork, and mutual respect while cultivating a strong sense of cultural identity and belonging among young learners (Lyesmaya et al. 2020).

1.1. Previous Research

The development of a nature-based BCCT collaborative approach to improve logical thinking and cooperation skills in early childhood education can be supported by several previous studies. Research by Ningsih shows the efficiency of kid-friendly school initiatives in enhancing kids' morals, which is relevant to the development of local wisdom values in early childhood education (Ningsih, 2020). In addition, research by Erdogan revealed that collaborative learning can improve critical thinking skills, which are also important in the context of logical thinking (Erdogan, 2019). Furthermore, (Buzzelli, 2015) the incorporation of local wisdom values into the curriculum can enrich the educational experience, fostering a sense of community and cultural identity. Research shows that effective learning strategies, including interactive and collaborative methods, can

improve social-emotional skills, which are critical for logical thinking and cooperation (Bagea et al., 2023). Thus, a nature-based BCCT approach that incorporates these elements can provide a strong foundation for early childhood education, aligned with contemporary pedagogical practices and community values.

1.2. Research Novelty

This research presents a significant novelty in the approach to early childhood education through creation of nature-based BCCT with an emphasis on local wisdom values. One of the main novelties is the integration of local wisdom as an important component in learning, which has not been widely explored in previous research. Previous research, like the one carried out by Mustajab et al. showed that the BCCT approach can improve children's multiple intelligences, but has not linked it to the context of local wisdom and the environment (Mustajab et al., 2020). Research by Erdogan emphasized the importance of collaborative learning in improving critical thinking skills, but did not specifically apply a nature-based approach (Erdogan, 2019). (Faisal et al., 2024) examined the application of cooperative education to raise environmental awareness in PAUD, but did not link it to local values. This research will fill the gap by combining the BCCT approach, collaborative learning, and local wisdom, and focusing on developing children's logical thinking and cooperation skills. Research by (Mustajab et al., 2020) using a case study-style qualitative methodology. The Research & Development (R&D) technique will be developed in this study, which will be conducted in coastal kindergartens where the natural environment and local knowledge values may be best used in the teaching and learning process.

1.3. Research urgency

Research on logical thinking and cooperation skills in early childhood, with a nature-based BCCT approach, is urgent to be carried out. This is due to the relevance and significant impact that logical thinking and cooperation skills have in overcoming current educational problems. With the increasing challenges in developing children's social and cognitive skills in the modern era, innovative and environment-based approaches are becoming increasingly important to implement in the educational context. This research is expected to provide concrete and applicable solutions to support children's development and reduce gaps in learning that occur in various regions, especially in coastal areas. In addition, this research also provides meaningful understanding and benefits, both in the form of sharpening theory and as a foundation for judgments or policies pertaining to education. By incorporating local knowledge values that can boost children's engagement in the learning process, educators and policymakers can use the research's findings as a basis to create more relevant and successful curricula and learning programs. In order to produce a generation that is more critical, cooperative, and aware of their surroundings, this research attempts to both improve the academic literature and really impact educational practice. Therefore, this research aims to develop and evaluate the effectiveness of the nature-based Beyond Center and Circle Time (BCCT) approach in improving early childhood logical thinking and cooperation skills through local wisdom values.

2. Materials and Methods

2.1. Research design

This study employed a Research and Development (R&D) approach using the *Analysis, Design, Development, Implementation, and Evaluation* (ADDIE) model integrated with an experimental pretest–posttest control group design. The R&D framework was applied to develop and validate a *collaborative BCCT (nature-based learning approach grounded in local wisdom values*, aimed at fostering logical thinking and cooperation skills among early childhood learners.The study's research methodology is depicted in Figure 1 below.

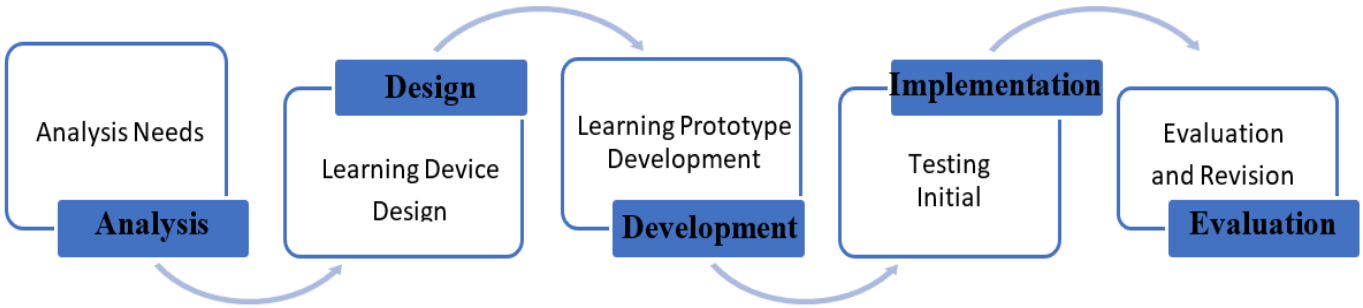

Figure 1 Research procedure.

Analyze, this stage aims to understand the needs, problems, and potential related to the ability to think logically and cooperate in early childhood. A needs analysis is conducted to identify relevant local wisdom values and the potential of a nature-based collaborative approach in improving these abilities.

Design, according to the findings of the field's needs analysis, this stage includes designing a nature-based BCCT collaborative approach. This design includes teaching materials, media, and activities that involve nature and collaborative aspects to develop children's logical thinking and cooperation. This learning design considers elements of local wisdom to strengthen children's understanding and interest.

Development, at the development stage, the prototype or initial design of the designed learning approach is developed. The results of this development will be tested on a limited basis to determine its usefulness. Validation will also be conducted by early childhood education experts and local wisdom experts.

Implementation, this stage involves applying the developed approach to a wider test group in early childhood education institutions. This implementation is performed to assess how the nature-based BCCT collaborative approach can be accepted by children and teachers in daily activities.

Evaluation, this evaluation is carried out thoroughly on the approach that has been implemented, both in terms of effectiveness and acceptance by learners. The evaluation is performed through questionnaires on the growth of children' capacity for collaboration and rational thought.

The experimental design used is summarized in Table 1.

Table 1 Research design control group pretest posttest design.

Group	Pretest	Treatment	Posttest
Control	O_1	X	O_2
Exsperiment	O_3	Xc	O_4

The experimental group received the nature-based BCCT approach integrated with local wisdom values, while the control group engaged in conventional teacher-centered learning. Both groups completed pretests and posttests to measure gains in logical thinking and cooperation.

2.2. Population, sample, and sampling technique

The population consisted of Kindergarten B students aged 5–6 years from two nature-based early childhood institutions in Sidoarjo Regency: DWP Segorotambak Kindergarten and Aisyiyah Bustanul Athfal 1 Candi Kindergarten. These schools were purposively selected because their curricula emphasize environmental exploration and local wisdom integration, which align with the study's focus. A total of 60 children participated in the study. Sampling was conducted using purposive sampling, with inclusion criteria based on school characteristics and parental consent to participate. To ensure group comparability, participants were randomly assigned to two equal groups (n = 30 each) using a simple randomization (lottery) method after stratification by age and gender.

2.3. Data collection process and data analysis technique

A questionnaire with two different types of instruments—logical thinking ability, which has 15 items divided into five dimensions—and cooperation ability, which has 24 items divided into six dimensions—is used to collect data for this study. Table 2 below presents the instruments used to measure logical thinking and cooperation abilities in early childhood.

This study's data analysis method, which employs SPSS 23 to analyze data via validity, reliability, normality, homogeneity, and independent sample t tests, aims to create a nature-based BCCT collaborative approach that promotes cooperation and logical thinking skills in early childhood education by valuing local wisdom.

3. Results

3.1. Validity and reliability of research instruments validity and reliability results of the logical thinking and cooperation skills instruments

The validity coefficients (r = 0.45–0.82) and high Cronbach's alpha values (α = 0.88 for logical thinking; α = 0.91 for cooperation) indicate that all items are valid and reliable, demonstrating strong internal consistency and suitability for measuring children's Table 3 presents the validity and reliability results of the logical thinking and cooperation skills instruments.

3.2. Normality test

Determining whether the distributions of the independent and dependent variables are normal or aberrant is the goal of the normality test. The data are considered regularly distributed if the significance level is greater than 5% (or 0.05), which is determined via the Kolmogorov–Smirnov test. A significance level below 5%, or 0.05, indicates that the data are not regularly distributed.

All of the cooperation skills dimensions' normality test findings had a significance value greater than 0.05, according to Table 5 above. This demonstrates that every variable pertaining to logical reasoning ability is normally distributed.

All of the cooperation skills dimensions' normality test findings had a significance value greater than 0.05, according to Table 4 above. This demonstrates that every cooperation skill variable can be considered to be regularly distributed.

Table 2 Instruments for measuring logical thinking and cooperation skills.

Variable	Dimension	Indicator	Source
Logical thinking skills	Sorting Objects	Arrange objects from smallest to largest or vice versa	Micklo (1995)
		Sort objects by color, size, or shape	
		Recognize order in daily activities	
	Classifying objects	Classify objects based on color, size, shape, or function	
		Sort objects into similar groups	
		Distinguishes similar and different objects within a group	
	Pattern Recognition	Recognize and continue simple patterns	
		Create own patterns with objects around	
		Understand patterns in stories	
	Recognizing Size Differences	Differentiate objects based on size (big-small, long-short)	
		Choosing objects that are bigger or smaller	
		Classifying objects from smallest to largest	
	Demonstrates Constructive Thinking	Solves simple problems by trying different ways	
		Experimenting with objects	
		Developing new ways to complete tasks or games	
Cooperation Skills	Communication and Social Interaction	Able to communicate with peers	Brownell etr al. (2006)
		Listens when friends speak	
		Using polite words in interaction	
		Conveying ideas or opinions clearly and simply	
	Sharing and Helping Each Other	Able to lend toys or tools to friends	
		Willing to help friends in need.	
		Does not mind when having to take turns using tools or facilities.	
		Has a caring attitude towards the needs of his/her friends.	
	Respect the Opinions and Rights of Others	Listens to a friend's opinion or idea without interrupting.	
		Appreciate differences of opinion and accept that everyone has different views.	
		Does not dominate games or group activities	
		Shows patience when having to wait for their turn.	
	Cooperation in Group	Willing to cooperate in group activities or games.	
		Takes a role in the group according to the agreement.	
		Completing group tasks together with full responsibility.	
		Avoiding conflict or resolving minor conflicts independently.	
	Self-Control and Emotions	Does not get angry or cry easily when there is a problem in the group.	
		Able to control the desire to always be prioritized.	
		Shows a calm attitude in the face of conflict.	
		Willing to reconcile or apologize after a conflict.	
	Collaborative Problem Solving	Willing to find solutions together when there is a problem.	
		Willing to accept help or input from friends.	
		Contributing ideas to solve problems faced by the group.	
		Does not impose his/her own opinion	

3.3. Homogeneity Test

The purpose of the homogeneity test is to determine whether the population variance meets the test criteria. If the p value is greater than 0.05, the group's variance is homogenous or constant. The Logical Thinking Skills and Cooperation Skills variables were compared via Levene's statistical test to determine their similarity.

There is no variance difference between samples in the group, according to the Levene test results on the logical thinking skills variable in Table 6, where the significance value is greater than 0.05. This suggests that the group's sample variation is uniform (homogeneous).

There is no variance difference across samples in the group, according to the Levene test results on the cooperation skills variable in Table 7, which show a significance value > 0.05. This suggests that the group's sample variation is uniform (homogeneous).

3.4. Effect of BCCT Nature-Based through Local Wisdom Value on Logical Thinking Skills Before and After Intervention

Table 8 displays the results of the Logical Thinking Skills exam, which was administered to the research participants following a lesson in which they received an intervention in the form of a nature-based BCCT.

Table 3 Validity and reliability results of the logical thinking and cooperation skills instruments.

Variable	Dimension	No. of Items	Range of Validity Coefficient (r)	Validity Category	Cronbach's Alpha (α)	Reliability Category
Logical Thinking Skills	Sorting Objects	3	0.58 – 0.81	High	0.86	High
	Classifying Objects	3	0.52 – 0.77	Moderate–High	0.84	High
	Pattern Recognition	3	0.61 – 0.82	High	0.87	High
	Recognizing Size Differences	3	0.49 – 0.73	Moderate	0.83	High
	Demonstrates Constructive Thinking	3	0.57 – 0.79	High	0.88	High
	Overall	15	0.45 – 0.82	Moderate–High	0.88	High
Cooperation Skills	Communication and Social Interaction	4	0.59 – 0.80	High	0.89	High
	Sharing and Helping Each Other	4	0.54 – 0.76	Moderate–High	0.87	High
	Respect the Opinions and Rights of Others	4	0.56 – 0.81	High	0.90	High
	Cooperation in Group	4	0.53 – 0.78	Moderate–High	0.88	High
	Self-Control and Emotions	4	0.60 – 0.79	High	0.91	Very High
	Collaborative Problem Solving	4	0.57 – 0.80	High	0.90	High
	Overall	24	0.45 – 0.82	Moderate–High	0.91	High

Table 4 Results of the logical thinking skills normality test.

No	Logical Thinking Skills	Control			Experiment		
		Kolmogorov Smirnov	Asymp. Sig	Explanation	Kolmogorov Smirnov	Asymp. Sig	Explanation
1	Sorting Objects	0.345	0.18	Normal	0.410	0.220	Normal
2	Classifying Objects	0.218	0.19	Normal	0.305	0.230	Normal
3	Recognizing Patterns	0.398	0.185	Normal	0.385	0.240	Normal
4	Recognizing Size Differences	0.345	0.175	Normal	0.400	0.225	Normal
5	Demonstrating Constructive Thinking	0.371	0.182	Normal	0.417	0.235	Normal

Table 5 Results of the cooperation skills normality test.

No	Cooperation Skills	Control			Experiment		
		Kolmogorov Smirnov	Asymp. Sig	Explanation	Kolmogorov Smirnov	Asymp. Sig	Explanation
1	Communication and Social Interaction	0.284	0.108	Normal	0.319	0.154	Normal
2	Sharing and Helping Each Other	0.321	0.125	Normal	0.298	0.167	Normal
3	Respecting the Opinions and Rights of Others	0.309	0.119	Normal	0.345	0.141	Normal
4	Group Cooperation	0.295	0.113	Normal	0.332	0.152	Normal
5	Self-Control and Emotions	0.310	0.122	Normal	0.341	0.160	Normal
6	Collaborative Problem Solving	0.287	0.118	Normal	0.325	0.148	Normal

Table 6 Logical thinking skills homogeneity test results.

No	Logical Thinking Skills	Levene Statistic	Asymp. Sig	Explanation
1	Sorting Objects	0.352	0.642	Homogenous
2	Classifying Objects	0.489	0.711	Homogenous
3	Recognizing Patterns	0.401	0.587	Homogenous
4	Recognizing Size Differences	0.467	0.623	Homogenous
5	Demonstrating Constructive Thinking	0.438	0.653	Homogenous

The Logical Thinking variable's value has increased, according to Table 8's data presentation results. The average pretest score of the control group was 62.8, which rose to 84.8. Following traditional instruction, pupils' logical thinking scores rose by 22.0 points. Furthermore, the experimental group's average pretest score rose from 61.5 to 90.5. Using the local wisdom value, the pupils who used the nature-based BCCT method experienced a 29.0-point gain in logical thinking. This research shows that

when students use a nature-based BCCT collaborative strategy to learn through local wisdom values, their logical thinking skills significantly improve.

Table 7 Results of the logical cooperation skills homogeneity test.

No	Cooperation Skills	Levene Statistic	Asymp. Sig	Explanation
1	Communication and Social Interaction	0.372	0.802	Homogenous
2	Sharing and Helping Each Other	0.453	0.745	Homogenous
3	Respecting the Opinions and Rights of Others	0.415	0.659	Homogenous
4	Group Cooperation	0.392	0.783	Homogenous
5	Self-Control and Emotions	0.427	0.748	Homogenous
6	Collaborative Problem Solving	0.461	0.712	Homogenous

Table 8 Results of the logical thinking skills pretest and posttest.

Class	Logical Thinking Skills	n	Pretest		Posttest		Gain
			Mean	Stdec	Mean	Stdev	
Control (Conventional)	Sorting Objects	30	62.0	9.5	84.0	10.8	22.0
	Classifying Objects		67.5	10.1	88.5	11	21.0
	Recognizing Patterns		65.0	12.0	83.5	10.2	18.5
	Recognizing Size Differences		60.5	11.8	86.0	9.9	25.5
	Demonstrating Constructive Thinking		59.0	9.7	82.0	10.5	23.0
	Overall		62.8	10.6	84.8	10.5	22.0
Experiment (BCCT + Local Wisdom Value)	Conceptual Understanding	30	64.0	8.9	89.0	9.2	25.0
	Problem-Solving		63.5	9.5	94.5	10.0	31.0
	Logical Thinking		62.0	12	92.0	9.5	30.0
	Data Structure Understanding		65.0	10.5	93.0	9.3	28.0
	Overall		61.5	9.2	90.5	9.8	29.0

The logical thinking variable increases, as shown in Figure 2. This occurred because, in comparison with the control group, the experimental group's ability to sort objects, classify objects, recognize patterns, recognize size differences, and demonstrate constructive thinking increased significantly after receiving a learning intervention utilizing the nature-based BCCT method through local wisdom.

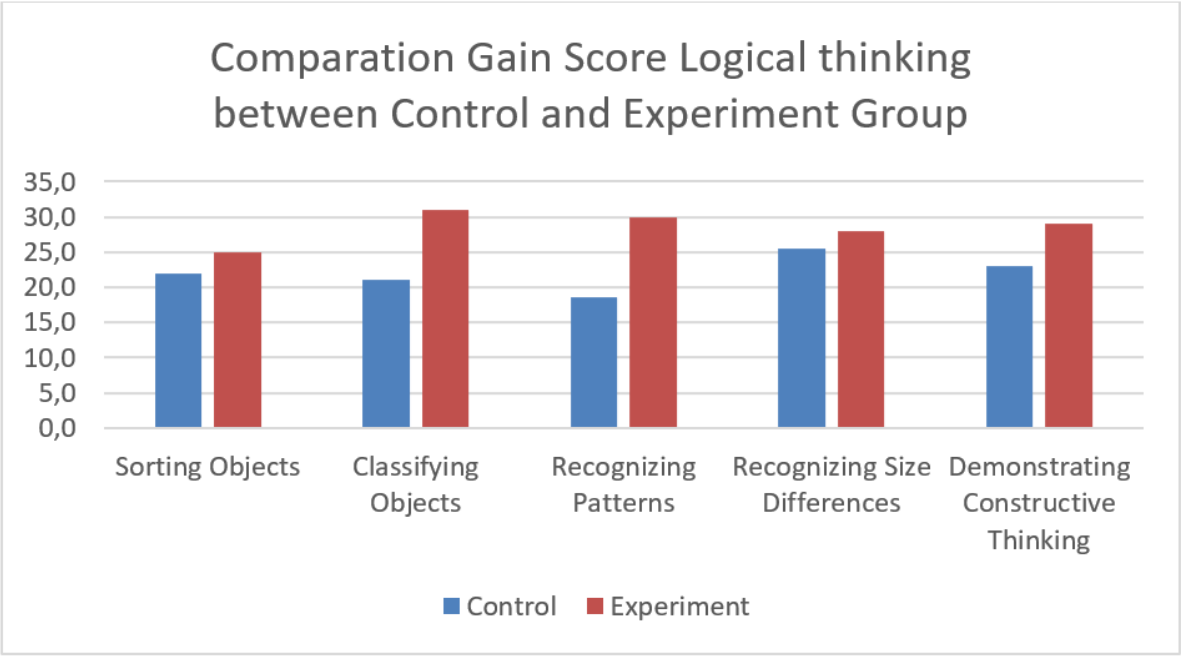

Figure 2 Comparative results of logical thinking improvement.

3.5. The Effectiveness of BCCT Nature-Based through Local Wisdom Value on Cooperation Skills Before and After Intervention

The value of the cooperation skills variable has increased, according to the data presented in Table 9. As demonstrated by the control group, whose average pretest score rose from 63.4 to 81.8. Following traditional instruction, students' cooperation skills improved by 18.3 points. Furthermore, the experimental group's average pretest score increased from 61.0 to 84.3. Following the nature-based BCCT method using local wisdom, the pupils' cooperation skills improved by 23.35 points.

Following instruction via a nature-based BCCT collaborative approach through local wisdom, pupils' cooperation skills significantly improve, according to this result.

Table 9 Results of the cooperation skills pretest and posttest.

Class	Cooperation Skills	n	Pretest		Posttest		Gain
			Mean	Stdec	Mean	Stdev	
Control (Conventional)	Communication and Social Interaction	30	60.0	8.5	80.0	9	20
	Sharing and Helping Each Other		68.5	9.0	84.5	10.5	16
	Respecting the Opinions and Rights of Others		66.0	12.0	83.0	11	17
	Group Cooperation		63.0	9.8	82.0	10.2	19
	Self-Control and Emotions		61.0	10.0	81.0	9.5	20
	Collaborative Problem Solving		62.0	9.2	80.0	10	18
	Overall		63.4	9.8	81.8	10.0	18.3
Experiment (BCCT + Local Wisdom Value)	Communication and Social Interaction	30	58.5	9	80.2	10.1	21.7
	Sharing and Helping Each Other		66.2	8.8	87.5	9.7	21.3
	Respecting the Opinions and Rights of Others		61.8	9.5	83.7	8.9	21.9
	Group Cooperation		60.0	10.5	85	9.8	25.0
	Self-Control and Emotions		57.0	8.7	81	9.6	24.0
	Collaborative Problem Solving		62.3	9.4	88.5	8.5	26.2
	Overall		61.0	9.3	84.3	9.4	23.35

The cooperation skills variable increases, as shown in Figure 3. This is because the nature-based BCCT approach was used to provide a learning intervention to the experimental group so that communication and social interaction, sharing and helping each other, respecting the opinions and rights of others, group cooperation, self-control and emotions and collaborative problem solving increased significantly compared with those of the control group.

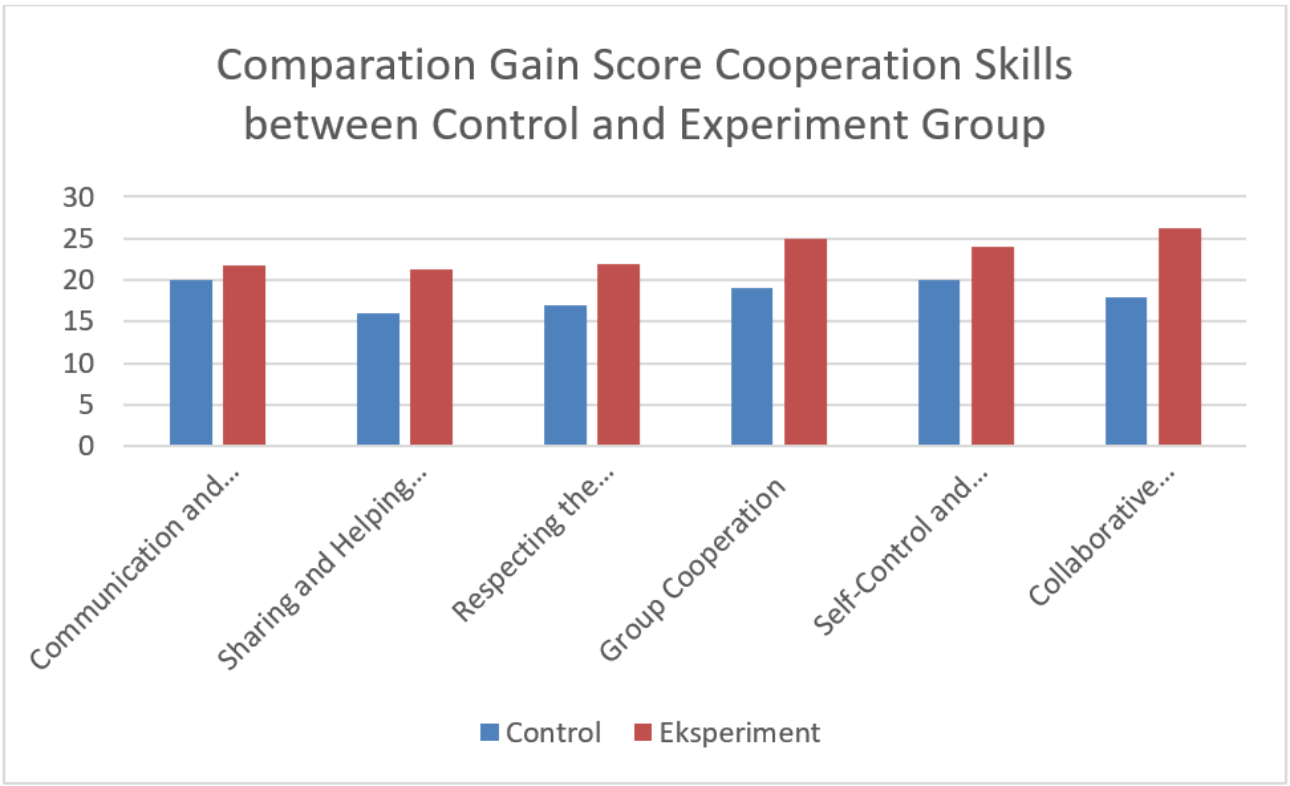

Figure 3 Comparative results of cooperation skill improvement.

3.6. The Effectiveness of BCCT Nature-Based through Local Wisdom Value into Learning on Logical Thinking Skills

Through local wisdom, this study evaluated the efficacy of nature-based BCCT in both the experimental and control groups. The purpose of this exam is to determine whether learning via the nature-based BCCT approach through local wisdom value has an impact on logical thinking.

Table 10 Results of the logical thinking skills hypothesis test.

No	Logical Thinking Skills	t-statistic	t-table	Sig	Explanation
1	Sorting Objects	3.102	2.000	0.00	Significant
2	Classifying Objects	3.245	2.000	0.00	Significant
3	Recognizing Patterns	3.327	2.000	0.00	Significant
4	Recognizing Size Differences	3.158	2.000	0.00	Significant
5	Demonstrating Constructive Thinking	3.058	2.000	0.00	Significant
	Overall	3.178	2.000	0.00	Significant

The overall dimension of the Logical Thinking variable in the sample t test has a t-count value of 3.178> 2.000 and a significance value of 0.000 < 0.05, according to the data presented in Table 10 above. This research shows that when students use the nature-based BCCT approach to learn through the value of local wisdom, their logical thinking significantly improves.

3.7. The Effectiveness of BCCT Nature-Based through Local Wisdom Value into Learning on Cooperation Skills

The purpose of this test is to determine whether to receive an intervention in the form of instruction with the nature-based BCCT method through local wisdom value.

The overall dimension of the cooperation skills variable in the sample t test has a t-count value of 3.295> 2.000 and a significance value of 0.000 < 0.05, according to the data presented in Table 11 above. This research shows that when students use the nature-based BCCT approach through local wisdom, their cooperation skills significantly improve.

Table 11 Results of the cooperation skills hypothesis test.

No	Cooperation Skills	t-statistic	t-table	Sig	Explanation
1	Communication and Social Interaction	3.250	2.000	0.00	Significant
2	Sharing and Helping Each Other	3.367	2.000	0.00	Significant
3	Respecting the Opinions and Rights of Others	3.470	2.000	0.00	Significant
4	Group Cooperation	3.652	2.000	0.00	Significant
5	Self-Control and Emotions	3.120	2.000	0.00	Significant
6	Collaborative Problem Solving	2.895	2.000	0.00	Significant
Overall		3.292	2.000	0.00	Significant

4. Discussion

4.1. The Effect of Nature-Based BCCT through Local Wisdom Value on Logical Thinking Before and After Intervention

According to the findings of the nature-based BCCT through the local wisdom value intervention, the experimental group's logical thinking score increased by 28.6 points, whereas the control group's score increased by only 22.0 points. This increase shows that the nature-based BCCT approach, through local wisdom, makes a greater contribution to developing logical thinking in children than does conventional learning.

Nature-based BCCT offers an approach that integrates local wisdom values in the context of outdoor learning. In this case, children are invited to interact directly with nature, using real experiences as a basis for building their critical and logical thinking skills (Wojciehowski & Ernst, 2018). This process also involves exploring the surrounding environment, which is rich in learning potential, such as the use of plants, animals or other natural phenomena that can stimulate children's questioning and logical reasoning (Johnstone et al., 2022). The local knowledge incorporated into this method presents ideas that are pertinent to regional customs and cultures, which enhances children's educational experiences and broadens their comprehension of the interrelationships among people, the natural world, and their social surroundings. For example, in a nature-based learning activity, children might learn about traditional ways of farming or protecting the environment, which then involves observation, comparison and analysis, thus enhancing their logical thinking skills.

Unlike conventional approaches, which tend to focus on the memorization and repetition of material, nature-based BCCT emphasizes active and collaborative learning. Children are encouraged to ask questions, discuss and find solutions together, which can hone their critical and logical thinking skills (Inoue et al., 2019). This makes the learning environment more lively and pleasurable, which helps children' cognitive skills grow more successfully. These findings unequivocally demonstrate that a method that integrates elements of nature and indigenous knowledge not only enhances children's comprehension of the environment but also significantly advances their capacity for logical thought (Prins et al., 2022).Therefore, in regard to enhancing logical thinking abilities in young children, nature-based BCCT based on local knowledge might be regarded as a more effective substitute for traditional teaching approaches.

4.2. The Effectiveness of Nature-Based BCCT through Local Wisdom Value on Cooperation Skills Before and After Intervention

The results of the intervention using nature-based BCCT through local wisdom values on students' cooperation skills clearly revealed an increase in the experimental group of 23.35 points, as opposed to just 18.3 points in the control group. This

proves that there is an undeniable increase in cooperation skills in students who use only conventional learning. This improvement shows that the nature-based BCCT approach, through local wisdom value, makes a greater contribution to developing cooperation skills in children than does conventional learning.

Nature-based BCCT facilitates a more collaborative and participatory learning experience, where students are invited to work together in groups by utilizing the natural resources around them. For example, in outdoor activities that involve nature exploration, children must interact, communicate and share responsibility in completing tasks or challenges. This approach emphasizes the importance of cooperation in solving problems together, which is an important aspect in developing children's social and cooperation skills (Uge et al., 2019). Local wisdom integrated in learning also enriches students' experiences, as it teaches cultural values and traditions related to cooperation in their social context (Rasidi et al., 2025). For example, in some local cultures, cooperation in activities such as royong or teamwork in the community is often an important part of daily life. By integrating these values in learning activities, students not only learn to work together in groups but also understand the meaning and importance of cooperation in their social lives.

Compared with conventional learning methods, which focus more on individualized learning and competition, nature-based BCCT through local wisdom encourages students to collaborate more, communicate and respect different opinions in teams. This contributes to better cooperation skills, as children learn to solve problems collectively, overcome differences, and support each other to achieve common goals (brown, guided, cooperative learning and individual knowledge acquisition). Thus, the findings of this study show that nature-based BCCT using local knowledge not only helps students develop their collaboration abilities but also provides them with a deeper, more meaningful experience. This method assists students in comprehending and putting the principles of collaboration into practice in their daily lives, which will certainly be beneficial in their future social and emotional development.

4.3. Effectiveness of the nature-based BCCT collaborative approach in improving logical thinking skills

The significance value of 0.000 < 0.05 and the t-count value of 3.178 > 2.000 support this. This research shows that students' logical reasoning abilities significantly improve after engaging in instruction via nature-based BCCT methods through local wisdom. The BCCT collaborative approach is an innovation in early childhood education that is effective for improving logical reasoning skills. This method combines center-based active learning principles with exploration in the natural environment. This approach provides concrete, relevant and engaging children's educational experiences (Aiym et al., 2022; Lee et al., 2022). By engaging in nature as a learning medium, children can understand cause–and–effect relationships, recognize patterns and build problem–solving skills that support basic logic development (Peer et al., 2019). For example, activities such as observing the life cycle of a plant, counting the number of stones, or categorizing leaves by size give children the opportunity to practice their analytical skills first-hand (Iñiguez & Pacheco, 2022).

The natural environment provides rich and dynamic learning resources, which cannot be fully replaced by classroom learning media (Lee et al., 2022). Children can experience a variety of sensory stimuli, such as touching the surface texture of natural objects, hearing animal sounds, or smelling flowers. This stimulation stimulates the child's brain to process information, connect abstract concepts with real experiences, and develop a deeper logical understanding. Research by (Speldewinde & Campbell, 2024) supports this finding by showing that children who engage in nature-based learning have better logic and analysis skills than do children who only learn in a traditional classroom. The infinite natural environment also allows children to explore freely and find creative solutions to the various problems they face (Bao et al., 2020).

One of the main strengths of this approach is its collaborative nature, where children are encouraged to learn together through social interaction. In nature-based activities, children are often asked to work together, share ideas and complete group tasks. These interactions not only strengthen logical thinking but also hone communication and collaboration skills (Horanska et al., 2022). Vygotsky's (1978) theory explains that cognitive development, including logical thinking, is strongly influenced by social interaction (Alharbi, 2023). In a nature-based BCCT approach, for example, children can jointly observe patterns on butterfly wings or arrange natural objects in a certain order. The process of sharing ideas and discussing with peers helps children develop systematic and logical ways of thinking (Speldewinde & Campbell, 2024).

Children's drive to learn is positively impacted by this nature-based method in addition to its cognitive benefits. Children are naturally drawn to colorful, open, and varied natural settings, which inspires them to participate in educational activities (Khoroshukha et al., 2021). According to research by Lanza et al. (2023) education increases children's emotional engagement, which contributes to the effectiveness of the learning process. When children feel happy and interested, they tend to be more active in exploring, asking questions and solving problems. This indirectly accelerates the improvement of their capacity for logical thought. The natural environment also provides realistic challenges for children to solve problems in creative ways, for example, when trying to build a small bridge from twigs or when determining a safe path when playing in a rocky area area (Grecu, 2023).

However, to ensure the effectiveness of this approach, several factors need to be considered. First, teachers must have adequate competencies to facilitate nature-based learning, including the ability to design relevant and engaging activities. Second, the support of a flexible curriculum that accommodates nature-based exploration is essential for optimal learning activities. Third, the availability of resources and access to the natural environment are also important factors. Overall, the

nature-based BCCT collaborative approach is a highly effective method for improving logical thinking skills in early childhood. Through concrete experiences, social interaction and high motivation, children can develop their cognitive abilities in a holistic and fun way (Falzon & Conrad, 2023). Previous research findings provide strong evidence that nature-based learning supports the development of logic and analysis in children. However, successful implementation requires support from all parties, including teachers, parents and policy makers, to create a supportive learning environment. Thus, this approach not only improves children's logic but also has a positive effect on their social, emotional and cultural development.

4.4. Effectiveness of the nature-based BCCT collaborative approach in strengthening cooperation skills

The significance value of 0.000 < 0.05 and the t-count value of 3.292 > 2.000 support this. This result shows that students' cooperation skills significantly improve after they participate in instruction via nature-based BCCT methods through local wisdom. The nature-based BCCT collaborative approach is proven effective in strengthening cooperation skills in early childhood. This approach prioritizes active learning principles that combine nature exploration with social interaction between children in a group (Johnstone et al., 2022). Outdoor activities give kids the chance to work together to complete tasks or achieve a common goal. For example, in activities such as searching for natural objects, building structures with natural materials, or planning outdoor games, children must communicate with each other, share ideas, and listen to their friends' opinions. This process indirectly trains them to understand the importance of each other's roles in the team as well as ways to collaborate effectively (Jiang & Hussain, 2023).

One reason why this approach is effective is that it provides an environment that encourages more active and natural social interactions. When children engage in activities in nature, they often feel freer and more open to working together because of the nonrigid and challenging atmosphere. For example, in nature-based activities such as building a shelter from twigs or finding a way to cross a small stream, children are required to communicate and share ideas with their peers. Research by Vygotsky (1978) emphasized that social interaction is an important aspect of child development, including social skills such as cooperation (Jordan & Chawla, 2019). In the context of nature-based BCCT, children learn to adapt to different opinions, contribute to discussions, and negotiate to reach better solutions (Yousef & Mahameed, 2022).

In addition, the collaborative approach of nature-based BCCT provides opportunities for children to learn about roles and responsibilities in groups. In nature activities, such as finding materials for nature projects or solving complex nature problems, children must learn to share roles according to their abilities and interests (Beer et al., 2018). This gives them the opportunity to understand the importance of valuing and respecting the contributions of others in achieving a common goal. Research by (Cecchini et al., 2021) claims that cooperative learning involving role sharing can increase the sense of responsibility and strengthen cooperation skills. When children feel that they have a meaningful contribution, they tend to be more motivated to cooperate and support each other (Kuo et al., 2019).

Nature-based activities can also help children develop social and emotional skills essential for cooperation (Yafie et al., 2020). Through hands-on experiences in nature, children learn to manage their emotions, work in teams and overcome challenges together. For example, when they face difficulties in completing group tasks, such as building a structure or finding solutions to natural problems encountered, children learn to support, motivate and resolve differences in a constructive way. (Koroll, 2022) reported that collaborative outdoor activities provide an ideal context for children to learn to manage conflict and strengthen their interpersonal relationships. This type of experiential learning creates deep emotional bonds between children, which can increase closeness and trust in cooperation (Antón-Solanas et al., 2021).

Participating in outdoor activities also enhances children' understanding of the importance of cooperation in the context of everyday life. For example, they may learn how to work together to maintain a communal garden, collect natural materials for an art project, or keep the neighborhood clean (Mann et al., 2022). These activities teach children not only about the importance of cooperation in the context of academics or classwork but also about taking care of their environment and social life. Johnstone et al. (2022) stated that nature-based learning strengthens children's empathy and social engagement, which has a direct effect on their ability to work in groups. Through such activities, children gain an understanding that cooperation involves not only sharing tasks but also supporting each other and contributing to a greater common goal (Yafie et al., 2023)

Overall, the nature-based BCCT collaborative approach provides a strong foundation for strengthening early childhood cooperation skills. Through hands-on experiences in nature, children learn about the natural world in addition to building social skills that are indispensable in their lives, such as sharing, communicating and respecting others. Engaging in nature activities that demand interaction, sharing roles and solving challenges together creates a deep and effective learning experience. Previous research has shown that cooperative skills, which are essential to children's social and emotional development, are strongly supported by nature-based learning. Thus, the collaborative nature-based BCCT approach can provide children with the social skills they need to engage in constructive interactions in a variety of social settings.

4.5. Limitations of the Study

Despite the promising findings, this study has certain limitations that should be acknowledged. The research was conducted only in two nature-based kindergartens located in coastal areas of Sidoarjo, Indonesia, which may limit the

generalizability of the results to other regions with different cultural, environmental, or socioeconomic contexts. The characteristics of local wisdom and environmental resources in these settings might not fully represent those in inland, urban, or rural schools. Future research is therefore recommended to involve a more diverse sample across various geographical and cultural contexts to better validate and extend the applicability of the nature-based BCCT collaborative approach. Additionally, longitudinal studies would help to examine the long-term effects of this intervention on children's cognitive and social development.

5. Conclusions

The study revealed that the nature-based BCCT collaborative approach through local wisdom significantly enhances young children's logical thinking and cooperation skills compared to conventional methods. Integrating natural exploration and local cultural values provides authentic and meaningful learning experiences that support both cognitive and social development. For educators, these findings highlight the importance of designing learning environments that integrate nature, play, and collaboration to help children connect theory with real-life experiences. For policymakers, the results emphasize the need to support early childhood programs that adopt nature-based and culturally responsive learning models through curriculum development and teacher training. Future research is recommended to examine the long-term effects of this approach and explore its applicability in diverse cultural and geographical contexts to strengthen its relevance for early childhood education policy and practice.

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6. Declarations

6.1. Ethical considerations

This study follows ethical standards in quantitative research with voluntary participation, informed consent, maintained anonymity and confidentiality, data securely stored for academic purposes, and the research protocol approved by the relevant institutional ethics committee.

6.2. Use of artificial intelligence (AI)

We would like to confirm that the following AI tools were used during the preparation of our manuscript, there are QuillBot and DeepL. These tools were used exclusively for language editing and/or grammatical improvement. The use of AI did not influence the scientific content, study design, data analysis, data interpretation, results, or conclusions of the manuscript. Full responsibility for the content remains with the authors.

6.3. Conflict of Interest

The authors declare no conflicts of interest.

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References

Aiym, Y., Galiya, K., Ademi, B., Meirambek, A., Kamshat, Z., & Gulmira, K. (2022). Development of the logical thinking of future mathematics teachers through the use of digital educational technologies. *Cypriot Journal of Educational Sciences*. https://doi.org/10.18844/cjes.v17i6.7548

Allen, K. A., Kern, M. L., Rozek, C. S., McInerney, D. M., & Slavich, G. M. (2021). Belonging: a review of conceptual issues, an integrative framework, and directions for future research. *Australian Journal of Psychology*. https://doi.org/10.1080/00049530.2021.1883409

Alme, H., & Reime, M. A. (2021). Nature kindergartens: a space for children's participation. *Journal of Outdoor and Environmental Education*. https://doi.org/10.1007/s42322-021-00081-y

Antón-Solanas, I., Tambo-Lizalde, E., Hamam-Alcober, N., Vanceulebroeck, V., Dehaes, S., Kalkan, I., Kömürcü, N., Coelho, M., Coelho, T., Nova, A. C., Cordeiro, R., Sagarra-Romero, L., Subirón-Valera, A. B., & Huércanos-Esparza, I. (2021). Nursing students' experience of learning cultural competence. *PLoS ONE*. https://doi.org/10.1371/journal.pone.0259802

Bagea, I., Ausat, A. M. A., Kurniawan, D. R., Kraugusteeliana, K., & Azzaakiyyah, H. K. (2023). Development of Effective Learning Strategies to Improve Social-Emotional Skills in Early Childhood. *Journal on Education*, *5*(4), 14378–14384. https://doi.org/10.31004/joe.v5i4.2474

Bao, X., Qu, H., Zhang, R., & Hogan, T. P. (2020). Modeling Reading Ability Gain in Kindergarten Children during COVID-19 School Closures. *International Journal of Environmental Research and Public Health*, *17*(17), 6371. https://doi.org/10.3390/ijerph17176371

Barratt, J., Dudley, D., Stylianou, M., & Cairney, J. (2024). A conceptual model of an effective early childhood physical literacy pedagogue. *Journal of Early Childhood Research*, *22*(3), 381–394. https://doi.org/10.1177/1476718X231219580

Beer, T., Cook, A., & Kantor, K. (2018). Running Wild: engaging and empowering future custodians of place through creative nature-based play. *Journal of*

Public Pedagogies. https://doi.org/10.15209/jpp.1143

Bronkhorst, H., Roorda, G., Suhre, C., & Goedhart, M. (2020). Logical Reasoning in Formal and Everyday Reasoning Tasks. *International Journal of Science and Mathematics Education*. https://doi.org/10.1007/s10763-019-10039-8

Brownell, C. A., Ramani, G. B., & Stephanie Zerwas. (2006). Becoming a social partner with peers: Cooperation and social understanding in one- and two-year-olds. *Child Development*, *77*(4), 803–821. https://doi.org/10.1111/j.1467-8624.2006.00904.x

Buzzelli, C. A. (2015). The capabilities approach: Rethinking agency, freedom, and capital in early education. *Contemporary Issues in Early Childhood*. https://doi.org/10.1177/1463949115600030

Cecchini, J. A., Fernandez-Rio, J., Mendez-Gimenez, A., Gonzalez, C., Sanchez-Martínez, B., & Carriedo, A. (2021). High versus low-structured cooperative learning. Effects on prospective teachers' regulation dominance, motivation, content knowledge and responsibility. *European Journal of Teacher Education*. https://doi.org/10.1080/02619768.2020.1774548

Chapman, S. N., & O'Gorman, L. (2022). Transforming Learning Environments in Early Childhood Contexts Through the Arts: Responding to the United Nations Sustainable Development Goals. *International Journal of Early Childhood*. https://doi.org/10.1007/s13158-022-00320-3

Direktorat Statistik Kesejahteraan Rakyat. (2023). *Profil anak usia dini 2023 volume 4*. Badan Pusat Statistik.

Dzakadzie, Y., & Agbayisah, S. (2022). Evaluation of Available Resources for Early Childhood Education Programme in Adaklu District, Volta-Region, Ghana. *European Journal of Education and Pedagogy*. https://doi.org/10.24018/ejedu.2022.3.1.250

Erdogan, F. (2019). Effect of cooperative learning supported by reflective thinking activities on students' critical thinking skills. *Eurasian Journal of Educational Research*. https://doi.org/10.14689/ejer.2019.80.5

Faisal, A., Dewi, A. P., Syafitri, I., Bahri, M. Z., Priyotomo, R., & Nurfadlia, S. S. (2024). COLLABORATIVE LEARNING UPAYA PENCEGAHAN GLOBAL WARMING DI PAUD CAHAYA KASIH IBU KOTA TANGERANG SELATAN. *PENTAHELIX*, *2*(1), 83. https://doi.org/10.24853/penta.2.1.83-90

Falzon, D., & Conrad, E. (2023). Designing primary school grounds for Nature-based learning: A review of the evidence. In *Journal of Outdoor and Environmental Education*. https://doi.org/10.1007/s42322-023-00142-4

Grecu, V. (2023). Investigating Critical Thinking Among Engineering Students in Romania. *Acta Universitatis Cibiniensis. Technical Series*, *75*(1), 21–29. https://doi.org/10.2478/aucts-2023-0003

Horanska, T. V., Bakumenko, T. K., Polishchuk, V. L., Atamanchuk, I. M., & Turchyn, T. M. (2022). Development of Students' Verbal and Logical Thinking in the Course of Research Work. *Journal of Curriculum and Teaching*. https://doi.org/10.5430/jct.v11n1p185

Hsu, C. C., & Wang, T. I. (2018). Applying game mechanics and student-generated questions to an online puzzle-based game learning system to promote algorithmic thinking skills. *Computers and Education*. https://doi.org/10.1016/j.compedu.2018.02.002

Inoue, M., Elliott, S., Mitsuhashi, M., & Kido, H. (2019). Nature-based early childhood activities as environmental education?: A review of Japanese and Australian perspectives. *Japanese Journal of Environmental Education*. https://doi.org/10.5647/jsoee.28.4_21

Jeti, L. J., & Manan, M. (2022). Coastal parents Perceptions of the Implementation of Early Childhood Education in Buton Islands. *Jurnal Obsesi : Jurnal Pendidikan Anak Usia Dini*. https://doi.org/10.31004/obsesi.v6i4.2240

Jiang, Z., & Hussain, Y. (2023). 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*. https://doi.org/10.59021/ijetech.v1i3.24

Johnstone, A., Martin, A., Cordovil, R., Fjortoft, I., Iivonen, S., Jidovtseff, B., Lopes, F., Reilly, J. J., Thomson, H., Wells, V., & McCrorie, P. (2022). Nature-Based Early Childhood Education and Children's Social, Emotional and Cognitive Development: A Mixed-Methods Systematic Review. In *International Journal of Environmental Research and Public Health*. https://doi.org/10.3390/ijerph19105967

Johnstone, A., McCrorie, P., Cordovil, R., Fjørtoft, I., Iivonen, S., Jidovtseff, B., Lopes, F., Reilly, J. J., Thomson, H., Wells, V., & Martin, A. (2022). Nature-Based Early Childhood Education and Children's Physical Activity, Sedentary Behavior, Motor Competence, and Other Physical Health Outcomes: A Mixed-Methods Systematic Review. In *Journal of Physical Activity and Health*. https://doi.org/10.1123/jpah.2021-0760

Jordan, C., & Chawla, L. (2019). A coordinated research agenda for nature-based learning. *Frontiers in Psychology*. https://doi.org/10.3389/fpsyg.2019.00766

Khoroshukha, M., Griban, G., Terentieva, N., Tkachenko, P., Petrachkov, O., Semeniv, B., Otravenko, O., Dikhtiarenko, Z., Yeromenko, E., Khurtenko, O., & Lytvynenko, A. (2021). Influence of different training activities on development of junior athletes' logical thinking. *International Journal of Human Movement and Sports Sciences*. https://doi.org/10.13189/saj.2021.090109

Kochenderfer-Ladd, B., Ladd, G. W., & Thibault, S. A. (2022). Children's interpersonal skills and school-based relationships: Links to school adjustment in early and middle childhood. In *The Wiley-Blackwell Handbook of Childhood Social Development*. https://doi.org/10.1002/9781119679028.ch20

Koroll, R. S. (2022). Leisure activities in the outdoors: learning, developing and challenging. *Leisure Studies*. https://doi.org/10.1080/02614367.2022.2066713

Kulic, N., Skopek, J., Triventi, M., & Blossfeld, H. P. (2019). Social Background and Children's Cognitive Skills: The Role of Early Childhood Education and Care in a Cross-National Perspective. In *Annual Review of Sociology*. https://doi.org/10.1146/annurev-soc-073018-022401

Kuo, M., Barnes, M., & Jordan, C. (2019). Do experiences with nature promote learning? Converging evidence of a cause-and-effect relationship. *Frontiers in Psychology*. https://doi.org/10.3389/fpsyg.2019.00305

Lanza, K., Alcazar, M., Chen, B., & Kohl, H. W. (2023). Connection to nature is associated with social-emotional learning of children. *Current Research in Ecological and Social Psychology*. https://doi.org/10.1016/j.cresp.2022.100083

Lee, J., Joswick, C., Pole, K., & Jocius, R. (2022). Algorithm design for young children. *Contemporary Issues in Early Childhood*. https://doi.org/10.1177/14639491211033663

Lyesmaya, D., Musthafa, B., & Sunendar, D. (2020). Local wisdom value's-based literacy education learning model in elementary school. *Journal of Physics: Conference Series*. https://doi.org/10.1088/1742-6596/1470/1/012030

Maflah Alharbi, J. (2023). Insight into the Role of Interaction in Language Acquisition: Vygotsky's Interactionist Theory of Language. *Arab World English Journal*. https://doi.org/10.24093/awej/vol14no2.20

Mann, J., Gray, T., Truong, S., Brymer, E., Passy, R., Ho, S., Sahlberg, P., Ward, K., Bentsen, P., Curry, C., & Cowper, R. (2022). Getting Out of the Classroom and Into Nature: A Systematic Review of Nature-Specific Outdoor Learning on School Children's Learning and Development. In *Frontiers in Public Health*. https://doi.org/10.3389/fpubh.2022.877058

Micklo, S. J. (1995). Developing Young Children's Classification and Logical Thinking Skills. *Childhood Education*, *72*(1), 24–28.

https://doi.org/10.1080/00094056.1995.10522639

Mustajab, M., Baharun, H., & Iltiqoiyah, L. (2020). Manajemen Pembelajaran melalui Pendekatan BCCT dalam Meningkatkan Multiple intelligences Anak. *Jurnal Obsesi : Jurnal Pendidikan Anak Usia Dini*. https://doi.org/10.31004/obsesi.v5i2.781

Ningsih, T. (2020). Mental Revolution Education Strategy in Realizing Child-Friendly Schools Based on Character Education Strengthening. *Akademika*.

Page, J., & Eadie, P. (2019). Coaching for continuous improvement in collaborative, interdisciplinary early childhood teams. *Australasian Journal of Early Childhood*. https://doi.org/10.1177/1836939119855542

Prins, J., van der Wilt, F., van der Veen, C., & Hovinga, D. (2022). Nature play in early childhood education: A systematic review and meta ethnography of qualitative research. In *Frontiers in Psychology*. https://doi.org/10.3389/fpsyg.2022.995164

Rasidi, R., Istiningsih, G., Masithoh, R. F., & Rosyidi, M. I. (2025). Education Based on Local Wisdom: An Alternative Model for the Integration of Cultural Values in The School Curriculum In Indonesia. *International Journal of Contemporary Studies in Education (IJ-CSE)*, *4*(2), 114–135. https://doi.org/10.56855/ijcse.v4i2.1521

Ruiz-Garzón, F., Olmos-Gómez, M. D. C., & Estrada-Vidal, L. I. (2021). Perceptions of teachers in training on water issues and their relationship to the SDGs. *Sustainability (Switzerland)*. https://doi.org/10.3390/su13095043

Santillán-Iñiguez, J. J., & Rodas-Pacheco, F. D. (2022). Developing Academic Writing Skills in EFL University Students through Haiku Composition. *Revista Electronica Educare*. https://doi.org/10.15359/ree.26-1.11

Speldewinde, C., & Campbell, C. (2024). More than a cluster of sawflies: understanding young children's application of science skills in nature-based learning. *Research in Science & Technological Education*, 1–22. https://doi.org/10.1080/02635143.2024.2435342

Thomas, M. S. C., Ansari, D., & Knowland, V. C. P. (2019). Annual Research Review: Educational neuroscience: progress and prospects. In *Journal of Child Psychology and Psychiatry and Allied Disciplines*. https://doi.org/10.1111/jcpp.12973

Uge, S., Neolaka, A., & Yasin, M. (2019). Development of social studies learning model based on local wisdom in improving students' knowledge and social attitude. *International Journal of Instruction*. https://doi.org/10.29333/iji.2019.12323a

Wyver, S. (2022). Australian Preservice Early Childhood Teachers' Considerations of Natural Areas as Conducive and Important to Include in Educational Experiences. *Education Sciences*. https://doi.org/10.3390/educsci12070481

Yafie, E., Samah, N. A., Kustiawan, U., Tirtaningsih, M. T., Astuti, W., & Haqqi, Y. A. (2020). Design and Development Seamless learning Model to Improve Student Performance in Higher Education. *In 2020 6th International Conference on Education and Technology (ICET)*, 84–89.

Yafie, E., Ashari, Z. M., Samah, N. A., Widiyawati, R., Setyaningsih, D., & Haqqi, Y. A. (2023). Effectiveness of seamless mobile assisted real training for parents (SMART-P) usage to improve parenting knowledge and children's cognitive development. *International Journal of Interactive Mobile Technologies*, *17*(10), 92–117. https://doi.org/10.3991/ijim.v17i10.37883

Yousef, N. T., & Mahameed, M. I. (2022). Reading Yeats's 'A Prayer for My Daughter' in Light of Lev Vygotsky's Sociocultural Theory of Learning. *Theory and Practice in Language Studies*. https://doi.org/10.17507/tpls.1202.04