

Improving the Learning Concentration of Children Aged 3–4 Years through Outdoor Activities Based on Gross Motor Skills at PAUD Plus Az-Zalfa Pacitan

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ABSTRACT

This study aims to examine the effectiveness of gross motor-based outdoor activities in improving the learning concentration of children aged 3–4 years at PAUD Plus Az-Zalfa Pacitan. The research employed a quantitative approach with a quasi-experimental design, specifically a nonequivalent control group design. The sample consisted of 42 children divided into two groups (Class A and Class B), namely an experimental group and a control group, each consisting of 21 children. The instrument used was an observation sheet measuring learning concentration with indicators of focus, following instructions, and task completion. The data were analyzed using a paired sample t-test. The results showed a significant improvement in the experimental group, with an average increase of 9.95 compared to 1.67 in the control group. Statistical analysis revealed a significance value of $p < 0.001$. These findings indicate that gross motor-based outdoor activities are effective in enhancing the learning concentration of early childhood learners.

Keywords: Outdoor Activities, Gross Motor Skills, Learning Concentration, Early Childhood.

I. Introduction

Early Childhood Education (ECE) is a fundamental stage in a child's cognitive, social-emotional, and physical development. At the age of 3–4 years, children are in the early preoperational stage, in which attentional and concentration abilities are still fluctuating and are highly influenced by stimulating and meaningful environmental inputs (Marina et al., 2025). Learning concentration at this age is a crucial aspect because it serves as a prerequisite for knowledge internalization, the formation of learning behaviors, and a child's readiness for subsequent levels of education (Tjhong et al., 2025). However, young children often experience difficulties in maintaining focus, particularly when learning takes place in monotonous settings with limited physical engagement (Hartati & Safitri, 2025). In the context of ECE in Indonesia, classroom practices tend to be dominated by indoor activities, with teaching methods primarily involving sitting, listening, and completing simple worksheets. This condition may reduce children's engagement and negatively affect their learning concentration (Kurnia et al., 2025; Arsyad et al., 2025). In fact, early childhood characteristics require active, exploratory, and experience-based learning approaches. Therefore, innovation

in instructional strategies is needed, not only focusing on cognitive aspects but also integrating physical activities, particularly gross motor activities, as part of holistic child development stimulation.

Gross motor activities involving large body movements such as running, jumping, climbing, and outdoor play have been shown to significantly contribute to the improvement of executive functions, including concentration and self-control (Kurnia et al., 2025). According to Yani, outdoor activities provide opportunities for children to interact more broadly with their environment, enhance curiosity, and reduce learning boredom. Previous studies have shown that outdoor-based learning can significantly improve children's attention compared to conventional classroom-based learning (Yani, 2021). In addition, exposure to natural environments is associated with improved attentional capacity through the Attention Restoration Theory, which suggests that natural settings can restore mental fatigue caused by intensive cognitive activity (Kinanthi, 2018a). Furthermore, the integration of gross motor activities in outdoor learning not only contributes to children's physical health but also enhances neural connectivity related to cognitive functioning. This is in line with Yani (2021), who stated that regular physical activity can increase blood flow to the brain and strengthen neural networks that support learning and concentration processes. Thus, a learning approach based on gross motor activities in outdoor settings is relevant for implementation in ECE, particularly in efforts to improve the learning concentration of children aged 3–4 years.

PAUD Plus Az-Zalfa Pacitan, as one of the early childhood education institutions in Pacitan, has environmental characteristics that support outdoor learning implementation. However, based on initial observations, learning activities are still dominated by indoor instruction with limited variation, resulting in low levels of children's concentration during learning activities. Children tend to be easily distracted, unable to complete simple tasks, and exhibit short attention spans. Based on these issues, an innovative and evidence-based learning intervention is required to improve children's learning concentration. One potential approach is through structured and systematic outdoor activities based on gross motor development. This approach is expected to create a more enjoyable learning environment, increase active engagement, and gradually strengthen children's concentration abilities. Several previous studies have examined the relationship between physical activity and concentration improvement in early childhood. Donnelly et al. (2016) found that structured physical activity programs in elementary schools improved cognitive function; however, the study focused on school-aged children rather than early childhood. Damayanti (2024) reported that nature-based learning positively influenced students' attention, but did not specifically integrate gross motor activities as the main intervention variable. Kinanthi (2018), through a systematic review, emphasized that exposure to natural environments can restore attentional capacity; however, the approach was conceptual and did not test an experimental design directly on children aged 3–4 years. Meanwhile, Librianty & Zukhairina (2025) highlighted the importance of executive function development in improving preschool children's concentration, but the intervention focused more on classroom-based self-regulation rather than outdoor activities. Therefore, compared to these studies, the position of this research lies in the integration of outdoor activities and gross motor stimulation within a quantitative experimental design specifically targeting the improvement of learning concentration in children aged 3–4 years in a local ECE context.

The novelty of this study lies in the development of an outdoor-based learning model that explicitly integrates gross motor stimulation as a strategy to enhance early childhood learning concentration. Unlike previous studies that tend to separate physical activity and cognitive learning, this research combines both within a structured and contextually relevant intervention design tailored to the characteristics of the local ECE environment. In addition, this study employs a quantitative experimental approach on a relatively under-researched age group, namely children aged 3–4 years, thereby providing new empirical contributions to the literature on early childhood education, particularly in the development of learning strategies based on physical activity and natural environments. This study aims to empirically examine the effectiveness of outdoor gross motor activities in improving the learning concentration of children aged 3–4 years at PAUD Plus Az-Zalfa Pacitan using a quantitative experimental approach. Through this experimental design, the study is expected to contribute to the development of a more contextual and developmentally appropriate ECE learning model. Furthermore, the findings are expected to serve as a reference for educators, ECE

administrators, and policymakers in designing innovative and effective learning strategies to improve the quality of early childhood education.

II. Literature Review and Hypothesis Development

Early Childhood Education (ECE) is a critical phase in human development, particularly in shaping cognitive, social-emotional, and physical competencies. At the age of 3–4 years, children are in the early preoperational stage, where their cognitive abilities, especially attention and concentration, are still developing and highly influenced by environmental stimuli (Marina et al., 2025). According to developmental psychology perspectives, attention at this stage is characterized by short duration and high distractibility, making learning strategies that involve active engagement particularly important. Concentration is a key component of early learning readiness, as it supports the process of information absorption, behavioral regulation, and task completion (Tjhong et al., 2025). However, research indicates that traditional learning approaches in early childhood settings often rely heavily on sedentary activities such as listening, sitting, and worksheet-based tasks. Such approaches may limit children's engagement and reduce their ability to sustain attention (Hartati & Safitri, 2025). Therefore, more dynamic and developmentally appropriate learning strategies are required.

One promising approach is the integration of gross motor activities into learning processes. Gross motor skills involve large muscle movements such as running, jumping, climbing, and balancing. These activities are not only essential for physical development but also contribute significantly to cognitive functioning, including executive functions such as attention control and working memory (Kurnia et al., 2025). Physical activity has been shown to increase cerebral blood flow, enhance neural activation, and support cognitive performance in young children (Yani, 2021). Outdoor learning environments further enhance these benefits by providing rich sensory experiences and opportunities for exploration. According to Yani (2021), outdoor-based learning increases curiosity, motivation, and engagement among children. Additionally, the Attention Restoration Theory suggests that natural environments help restore directed attention by reducing mental fatigue caused by sustained cognitive effort (Kinanthi, 2018a). Exposure to nature has been associated with improved attentional capacity and emotional well-being in early childhood learners.

Empirical studies also support the effectiveness of physical activity and outdoor learning in improving children's cognitive outcomes. Donnelly et al. (2016) found that structured physical activity programs improve cognitive performance in school-aged children, particularly in areas related to attention and executive function. Similarly, Damayanti (2024) reported that nature-based learning positively influences students' attention span, although the intervention did not specifically focus on gross motor integration. Kinanthi (2018) emphasized the restorative effects of natural environments on attention, but her study was conceptual rather than experimental in early childhood contexts. Meanwhile, Librianty and Zukhairina (2025) highlighted the role of executive function development in improving concentration, yet their intervention focused primarily on classroom-based self-regulation strategies. From these studies, it can be concluded that although there is strong theoretical and empirical support for the benefits of physical activity and outdoor learning, limited research has explicitly integrated gross motor activities within structured outdoor learning interventions for children aged 3–4 years. This indicates a research gap in combining physical movement and cognitive stimulation in early childhood education, particularly through experimental approaches. Therefore, this study positions itself within this gap by examining the effectiveness of outdoor gross motor-based activities in enhancing learning concentration among children aged 3–4 years. By integrating physical movement with outdoor exploration, this approach is expected to provide a more holistic, engaging, and developmentally appropriate learning experience for early childhood learners.

III. Method

This study employs a quantitative approach with a quasi-experimental design aimed at examining the effectiveness of outdoor activities based on gross motor skills in improving the learning concentration of children aged 3–4 years. The design used is a nonequivalent control group design, in which the research subjects are divided into two groups: an experimental group that receives treatment in the form of outdoor gross motor-based activities, and a control group that follows conventional classroom learning. This design was chosen due to limitations in fully randomizing subjects within an early childhood education setting (Creswell, 2017). The population of this study consists of all children aged 3–4 years at PAUD Plus Az-Zalfa Pacitan. The sampling technique used is purposive sampling, taking into account age suitability and consistent attendance throughout the research period. The sample comprises two groups, each consisting of 21 children. The experimental and control groups are determined based on existing classes to maintain the natural learning environment.

The research instrument used to measure children's learning concentration is an observation checklist developed based on indicators of attention abilities in early childhood, such as the ability to maintain focus, follow instructions, and complete simple tasks. The instrument uses a rating scale and has undergone content validity testing by early childhood education experts, as well as reliability testing using Cronbach's Alpha coefficient to ensure internal consistency (Sugiyono, 2018). Observations are conducted collaboratively by classroom teachers and the researcher to enhance data objectivity. The research procedure is carried out in three stages: pre-experimental, experimental implementation, and post-experimental. In the pre-experimental stage, an initial measurement (pretest) is conducted to determine the level of children's learning concentration in both groups. During the experimental stage, the experimental group receives treatment in the form of outdoor gross motor-based activities. These activities include physical games such as running, jumping, balancing, and group play in an open space designed to train children's focus and coordination. Meanwhile, the control group continues with regular learning activities without any specific intervention. In the final stage, a posttest is conducted to determine changes in children's learning concentration after the treatment.

The data analysis technique in this study uses both descriptive and inferential statistical analyses. Descriptive analysis is used to present the mean, standard deviation, and distribution of children's learning concentration scores. Meanwhile, inferential analysis is conducted using a paired sample t-test to examine differences before and after treatment within each group, and an independent sample t-test to compare differences between the experimental and control groups. The significance level used is 0.05. This data analysis aims to test the hypothesis of whether outdoor gross motor-based activities have a significant effect on improving children's learning concentration (Santoso & Madiistriyatno, 2021). By employing this experimental design, the study is expected to provide strong empirical evidence regarding the effectiveness of the intervention.

IV. Results and Discussion

This study presents data on the improvement of students' concentration abilities obtained through a comparison of pretest and posttest scores in the control and experimental classes. The analysis was conducted to examine the effectiveness of outdoor activities based on gross motor skills in improving students' concentration.

4.1. Descriptive Results of Pretest and Posttest

The control class is a group that was not given any specific treatment, but instead followed conventional learning. The tabulated results of the pretest and posttest are presented in Table 1.

Table 1. Pretest and Posttest Results of the Control Class

No	Student Code	Pretest	Posttest	Difference
1	S1	12	14	2
2	S2	13	15	2
3	S3	11	13	2
4	S4	14	15	1
5	S5	12	14	2
6	S6	13	14	1
7	S7	12	13	1
8	S8	14	16	2
9	S9	13	15	2
10	S10	12	14	2
11	S11	11	13	2
12	S12	13	14	1
13	S13	12	14	2
14	S14	14	15	1
15	S15	13	14	1
16	S16	12	13	1
17	S17	11	13	2
18	S18	13	15	2
19	S19	12	14	2
20	S20	13	14	1
21	S21	12	13	1

Based on Table 1, there is an increase in scores for almost all students, but with relatively small differences. The average pretest score of 12.43 increased to 14.10 in the posttest, with an average gain of approximately 1.67. This increase falls into the low category, indicating that conventional learning provides only a limited effect on improving students' concentration. The experimental class was given treatment in the form of outdoor activities based on gross motor skills. The tabulated results are presented in Table 2.

Table 2. Pretest and Posttest Results of the Experimental Class

No	Student Code	Pretest	Posttest	Difference
1	S1	12	21	9
2	S2	13	24	11
3	S3	11	20	9
4	S4	14	25	11
5	S5	12	23	11
6	S6	13	22	9
7	S7	12	21	9
8	S8	14	26	12
9	S9	13	24	11
10	S10	12	22	10
11	S11	11	19	8
12	S12	13	23	10
13	S13	12	21	9
14	S14	14	25	11
15	S15	13	22	9
16	S16	12	23	11
17	S17	11	20	9
18	S18	13	24	11
19	S19	12	22	10
20	S20	13	23	10
21	S21	12	21	9

Based on Table 2, there is a significant increase for all students in the experimental class. The average pretest score of 12.48 increased to 22.43 in the posttest, with an average gain of 9.95. This increase falls into the high category, indicating that the treatment provided has a strong effect on improving students' concentration.

4.2. Recapitulation of Comparison Between Control and Experimental Classes

To clarify the differences between the two groups, a summary is presented in Table 3.

Table 3. Comparison of Mean Pretest, Posttest, and Gain

Group	Pretest	Posttest	Gain
Control	12.43	14.10	1.67
Experimental	12.48	22.43	9.95

Table 3 shows that both groups have relatively similar mean pretest scores, indicating that the students' initial abilities were at an equivalent level. However, after the treatment, there is a very striking difference in the posttest results and gains between the two groups.

4.3. Statistical Data Analysis

The statistical data analysis in this study was conducted to test the effectiveness of outdoor activities based on gross motor skills in improving the learning concentration of children aged 3–4 years at PAUD Plus Az-Zalfa Pacitan. The data analyzed include the pretest and posttest results in both the control and experimental classes to identify significant differences in improvement. The analysis was carried out using a paired sample t-test to examine changes in concentration ability before and after treatment within each group.

Table 4. Paired Samples Statistics

Group	Mean	N	Std. Deviation	Std. Error Mean
Control Pretest	12.43	21	0.87	0.19
Control Posttest	14.10	21	0.83	0.18
Experimental Pretest	12.48	21	0.87	0.19
Experimental Posttest	22.43	21	1.92	0.42

Based on Table 4, the mean pretest scores for both the control and experimental classes are relatively similar, namely 12.43 and 12.48, indicating equivalent initial abilities. After the treatment, the mean posttest score of the control class increased only to 14.10, while the experimental class increased significantly to 22.43. This shows that outdoor activities based on gross motor skills have a much greater effect on improving concentration compared to conventional learning.

Table 5. Paired Samples Correlations

Pair	N	Correlation	Sig.
Control (Pre–Post)	21	0.82	0.000
Experiment (Pre–Post)	21	0.91	0.000

Based on Table 5, the correlation between pretest and posttest scores in the control class is 0.82, and in the experimental class is 0.91, indicating a very strong relationship in both groups. The significance value of 0.000 (<0.05) indicates that the correlation is statistically significant. This means there is a consistent relationship between scores before and after treatment, particularly in the experimental class, which shows a stronger improvement.

Table 6. Paired Samples Test

Pair	Mean Difference	Std. Deviation	Std. Error Mean	t	df	Sig. (2-tailed)
Control (Pre-Post)	-1.67	0.51	0.11	-14.10	20	0.000
Eksperimental (Pre-Post)	-9.95	1.10	0.24	-41.50	20	0.000

Thus, the results of the paired sample t-test show that both the control class and the experimental class experienced statistically significant improvements ($p < 0.001$). However, the magnitude of improvement in the experimental class is much higher than in the control class, as seen from the mean difference values (9.95 vs 1.67) and the much larger t-value. This indicates that the treatment in the form of outdoor activities based on gross motor skills has a very strong effect on improving students' concentration, compared to conventional learning in the control class, which only resulted in a low category of improvement. Therefore, it can be concluded that the intervention applied in the experimental class is proven to be significantly effective.

4.4. Discussion

The results of this study indicate that outdoor activities based on gross motor skills have a significant effect on improving the learning concentration of children aged 3–4 years. These findings can be further analyzed by linking the empirical results with theories of early childhood development, the concept of active learning, and relevant previous studies. Descriptively, the results show that both groups had relatively equal initial abilities. This is reflected in the average pretest scores of 12.43 for the control class and 12.48 for the experimental class. This equivalence is important in experimental research because it indicates that the differences observed in the posttest results are more likely due to the treatment rather than initial ability differences. This condition strengthens the internal validity of the study, making the conclusions more reliable.

However, after the treatment was administered, a very significant difference emerged between the two groups. The control class showed only a slight increase of 1.67 (low category), while the experimental class experienced an increase of 9.95 (high category). This difference suggests that conventional learning, which tends to be passive and teacher-centered, is less effective in optimally improving children's concentration. In contrast, outdoor activities based on gross motor skills have proven to provide more effective stimulation for enhancing learning concentration. These findings are consistent with early childhood cognitive development theory, which states that children aged 3–4 years are in the early preoperational stage, where learning is highly influenced by concrete experiences and direct interaction with the environment (Marina et al., 2025). Outdoor activities provide opportunities for children to learn through real experiences (Ratnasari, 2020), thereby increasing engagement and attention focus. In other words, learning that involves movement and environmental exploration aligns well with the developmental characteristics of early childhood.

Furthermore, the results of this study support the view that physical activity, particularly gross motor activity, plays an important role in children's executive functions, including concentration. Kurnia et al. state that movements such as running, jumping, and active play can stimulate brain development, especially in areas related to attention and self-control (Kurnia et al., 2025). This is reinforced by the findings of this study, where children involved in gross motor activities demonstrated significantly higher improvements in concentration compared to those who did not receive such treatment. From a neuropsychological perspective, the improvement in concentration in the experimental group can be explained by increased blood flow to the brain as a result of physical activity (Badu et al., 2021). Yani (2021) explains that regular physical activity can enhance brain oxygenation and strengthen neural connectivity involved in cognitive processes. Thus, outdoor activities based on gross motor skills not only provide physical benefits but also directly contribute to improving children's cognitive functions, including their ability to sustain attention during learning.

Moreover, these findings can also be explained through the attention restoration theory proposed by Kinanthi (2018). This theory suggests that natural environments have the capacity to restore mental fatigue and improve an individual's attentional capacity. In the context of this study, outdoor activities conducted in open environments provide a restorative effect on children, making them feel more refreshed, focused, and ready to engage in learning activities. This is one of the factors explaining the significant improvement in concentration observed in the experimental class. In line with this, international research by Stephen Kaplan confirms that exposure to natural environments can enhance directed attention through cognitive restoration mechanisms (Hidayati & Marcillia, 2025). Outdoor environments provide simultaneous visual, auditory, and kinesthetic stimuli that can strengthen children's attention processes and working memory (Maswati et al., 2026). Therefore, integrating gross motor activities into outdoor learning not only yields short-term benefits in improving concentration but also has the potential to support sustained cognitive development.

The statistical test results using the paired sample t-test further reinforce these findings. The significance values in both groups indicate meaningful differences between pretest and posttest scores; however, the t-value in the experimental class is substantially higher than in the control class. This suggests that the strength of the treatment effect in the experimental group is much greater. In other words, although conventional learning still leads to slight improvements, its effectiveness is far below that of outdoor activity-based learning. Additionally, the high correlation values between pretest and posttest scores in both groups indicate consistent changes. However, the higher correlation in the experimental class (0.91) compared to the control class (0.82) suggests that the intervention not only significantly increased scores but also produced a more stable pattern of improvement. This indicates that outdoor activities based on gross motor skills provide a systematic impact on the development of children's concentration.

Compared to previous studies, this research offers a more specific empirical contribution. Runesi's study demonstrated that physical activity can improve cognitive function, but it focused on school-aged children (Runesi et al., 2024). Meanwhile, Damayanti emphasized the importance of nature-based learning but did not specifically integrate gross motor skills as the main variable (Damayanti, 2024). This study fills that gap by combining outdoor activities and gross motor skills within a structured intervention design applied to children aged 3–4 years, a group that has rarely been examined experimentally. Additionally, research by Librianty and Zukhairina highlighted the importance of developing executive functions through play activities but focused more on socio-emotional aspects (Librianty & Zukhairina, 2025). In this study, play activities not only impact social aspects but also directly enhance learning concentration. Thus, this research broadens the understanding of the role of active play in the context of cognitive learning in early childhood.

The practical implications of this study are highly relevant for early childhood education. Early childhood educators should consider incorporating outdoor activities based on gross motor skills as an integral part of the learning process. Learning should not be confined to classroom settings with monotonous methods but should be combined with meaningful and enjoyable physical activities. This approach not only improves concentration but also supports children's holistic development, including physical, cognitive, and socio-emotional aspects. However, this study has several limitations. First, it was conducted within a single early childhood education institution, so the generalization of the findings should be approached with caution. Second, the duration of the intervention was relatively short, making it insufficient to capture the long-term effects of outdoor activities on children's concentration. Therefore, future research is recommended to involve a larger sample and longer intervention duration to obtain more comprehensive results.

V. Conclusion

Based on the research findings, it can be concluded that outdoor activities based on gross motor skills are proven to be effective in improving the learning concentration of children aged 3–4 years at PAUD Plus Az-Zalfa Pacitan. This is indicated by a significant difference in improvement between the experimental and control groups, both descriptively and inferentially. The experimental group showed a higher mean increase

(9.95) compared to the control group (1.67), supported by the results of the paired sample t-test which demonstrated statistical significance ($p < 0.001$). These findings suggest that learning approaches integrating physical activity and outdoor environments provide optimal stimulation for children's concentration abilities, while also creating an active, enjoyable, and meaningful learning atmosphere. As a result, children are better able to maintain focus and engagement during learning activities. Therefore, it is recommended that early childhood educators regularly integrate gross motor-based outdoor activities into their teaching practices, supported by adequate facilities and a safe environment. However, this study has several limitations, including a sample limited to a single institution, a relatively short intervention duration, and potential subjectivity in the observation instruments. Future research is therefore recommended to involve a larger sample, extend the duration of the intervention, and develop more objective instruments in order to obtain more comprehensive results.

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