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A Comparison of the Effect of Sports Extracurricular Activities on Student Learning Concentration Levels

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ABSTRACT

This study examines the comparison of the effect of sports extracurricular activities on student learning concentration levels at SMP Negeri 1 Lembang during the 2021/2022 academic year. An ex post facto method was applied using saturated sampling, involving 110 students from grades VII, VIII, and IX who participated in various individual and team sports extracurricular programs. Concentration was measured using the Concentration Grid Exercise instrument, consisting of a 10×10 grid containing randomly arranged numbers that participants must identify sequentially within a one-minute time limit. Data were analyzed using Mann-Whitney and Kruskal-Wallis non-parametric tests. The results revealed four key findings: first, no significant difference in concentration based on gender; second, a significant difference based on grade level, with grade IX students demonstrating the highest concentration scores; third, no significant difference between individual and team sport participants; and fourth, no overall significant difference based on weekly training frequency, although post hoc analysis indicated that students training three times per week scored significantly higher than those training once or twice per week. These findings confirm that grade level is the primary determinant of learning concentration among students actively engaged in sports extracurricular activities, while regular physical activity through structured extracurricular programs positively supports cognitive function and academic readiness.

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1. INTRODUCTION

Education is a fundamental pillar in developing individual potential, where learning activities serve as a conscious and planned effort to create a learning atmosphere that allows students to actively develop their spiritual strength, self-control, and intelligence (Salsabilah et al., 2021). The ultimate success of this educational process is heavily dictated by the students' ability to absorb, process, and retain information, a cognitive process that depends almost entirely on their level of concentration. In a psychological context, concentration is defined as the ability of an individual to direct their mental focus and attention toward a specific stimulus while ignoring irrelevant distractions during a learning period. Without a high degree of concentration, the process of understanding complex instructional material becomes significantly hindered, leading to suboptimal academic achievement.

However, maintaining a consistent state of focus is a major challenge in the modern classroom. Empirical evidence suggests that students' attention spans are remarkably limited and prone to fluctuation. Generally, a student's attention reaches its peak during the first 15-20 minutes of a lesson, after which it tends to experience a sharp decline in the subsequent 15-20 minutes (Bradbury, 2016). This phenomenon suggests that traditional long-duration teaching methods without physical intervals may be counterproductive to the brain's natural cognitive rhythm.

This decline in concentration is frequently triggered by a combination of physical and psychological fatigue. From a physiological perspective, the habit of sitting for extended hours in a classroom environment can lead to significant nervous tension. Such prolonged sedentary behavior is known to reduce systemic blood flow and, consequently, the oxygen supply to the brain, which is essential for maintaining executive functions (Baker et al., 2018). On the psychological front, junior high school students are in a critical developmental transition. Typically aged 12-15, these students are navigating the "storm and stress" phase of early adolescence (Arnett, 1999). During this volatile period, students are highly susceptible to psychological pressure, with the largest percentage of stressors originating from academic demands and high parental expectations (Pascoe et al., 2020). This state of chronic academic anxiety creates a mental burden that undermines the students' ability to maintain focus and attention on their learning tasks (Masnia et al., 2022).

One of the most effective and scientifically proven interventions to restore brain function and improve concentration is through regular physical activity. Engaging in sports strengthens the cardiovascular and respiratory systems, optimizes the delivery of nutrients to brain cells, and triggers the release of neurotransmitters that enhance mood and mental clarity. In the Indonesian school system, these activities are channeled through the Physical Education, Sports, and Health (PJOK) curriculum and further enriched through extracurricular programs. Extracurricular activities are not merely supplementary; they are an integral part of the holistic educational process designed to channel students' interests and talents, while simultaneously contributing to the enhancement of their cognitive intelligence (Trudeau & Shephard, 2008). In sports extracurriculars, students are inherently trained to maintain high levels of focus and discipline, both during intense practice sessions and high-pressure competitions.

Despite these potential benefits, a significant gap was observed in the field. Initial observations conducted at SMP Negeri 1 Lembang revealed a striking disparity between students' attitudes during formal instruction and their participation in sports. While students appeared highly enthusiastic, disciplined, and focused during sports extracurricular programs which are held regularly 1-3 times a week they often exhibited the opposite behavior during

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mandatory classroom hours. During regular PJOK classes or indoor academic sessions, many students showed signs of fatigue, lack of enthusiasm, and an inability to follow teacher instructions, particularly during daytime lessons held in hot weather. This disparity suggests that the voluntary and structured nature of sports extracurriculars might provide a different cognitive stimulus compared to mandatory school activities.

Based on this problematic gap, the present study aims to examine the comparative effects of participation in various sports extracurricular activities on students' learning concentration levels. This research moves beyond general observations by utilizing a standardized measurement tool, the Grid Concentration Exercise instrument (Harris & Harris, 1998). The study specifically analyzes how concentration levels vary across different demographic and activity-based factors, including gender, grade level (transition from Grade VII to IX), characteristics of the sport (team vs. individual), and the frequency of weekly training. By exploring these variables, the findings are expected to provide a robust theoretical foundation for the benefits of sports on cognitive function and offer practical strategies for educators to design physical activities that can effectively sharpen student focus in the academic environment.

2. METHODS

2.1 Research Design

This study employed a quantitative approach with an ex post facto research design. This specific method was selected because the independent variables were not directly manipulated or controlled by the researcher; rather, the extracurricular participation had already occurred naturally within the school environment (Sappaile, 2010). The primary objective of this retrospective design is to examine the comparative effects of these pre-existing conditions on cognitive performance. In this analytical framework, the independent variable (X) was sports extracurricular activity, systematically categorized into four distinct dimensions: (1) gender, (2) grade level, (3) sport type (individual vs. team), and (4) weekly training frequency. Meanwhile, the dependent variable (Y) measured in this study was the students' learning concentration level.

2.2 Participant

The study was conducted at SMP Negeri 1 Lembang, West Bandung Regency, Indonesia, during the 2021/2022 academic year. The population consisted of all students actively participating in sports extracurricular activities. A saturated sampling technique was applied (Taherdoost, 2016), resulting in a total sample of 110 students from grades VII, VIII, and IX. The sample comprised both male and female students participating in individual sports (athletics, taekwondo, karate, badminton) and team sports (basketball, futsal, volleyball, football). By ensuring a comprehensive representation across different grade levels and sport categories, the collected data accurately reflects the extracurricular demographic of the school.

2.3 Instrument

Learning concentration was measured using the Concentration Grid Exercise instrument, adopted from Harris & Harris (1998). This instrument consists of a 10×10 grid containing numbers 00-99 arranged randomly. The Concentration Grid is widely recognized in sports psychology as a highly reliable tool for measuring selective visual attention, mental processing speed, and cognitive stamina under time-constrained pressure. By forcing the brain to systematically scan and locate consecutive numbers, the test effectively evaluates the

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executive functioning of the prefrontal cortex, which is responsible for sustained concentration.

To conduct this test, students were gathered in a designated classroom setting with a controlled ambient temperature to minimize external sensory distractions. Before the test began, a standardized five-minute briefing was provided to ensure all participants understood the rules. They were instructed to locate and mark the numbers sequentially from 00 to 99, either horizontally or vertically, within a strict one-minute time limit. The assessment process was actively supervised by two to three research assistants to maintain standardized testing conditions and ensure the integrity and honesty of the results. The final score is determined by the highest consecutive number successfully crossed out within the allotted 60 seconds. Scoring criteria are presented in Table 1.

Table 1. Learning Concentration Assessment Criteria

Score	Category	Grade
21 and above	Very Good Concentration	A
16 - 20	Good Concentration	B
11 - 15	Sufficient Concentration	C
6 - 10	Poor Concentration	D
5 and below	Very Poor Concentration	E

2.4 Data Analysis

The quantitative data obtained from the Concentration Grid Exercise were systematically analyzed using the Statistical Package for the Social Sciences (SPSS) version 22. Before conducting the primary hypothesis testing, prerequisite assumption tests were meticulously performed to determine the appropriate inferential statistical framework. The normality of the data distribution was evaluated using the Kolmogorov-Smirnov test ($\alpha = 0.05$), which is highly suitable for the sample size of this study. Subsequently, the homogeneity of variances among the different categorical groups was assessed utilizing Levene's Test ($\alpha = 0.05$). Executing these prerequisite tests is a crucial methodological step to ensure the validity and reliability of the subsequent analytical procedures.

Because the results of the normality test indicated that the majority of the data groups were not normally distributed despite exhibiting homogeneous variances the researchers opted for non-parametric statistical procedures. Specifically, the Mann-Whitney U Test was utilized for comparative analyses between two independent groups (gender and sport type). Conversely, the Kruskal-Wallis H Test was applied for categories consisting of three or more groups (grade level and weekly training frequency). Furthermore, in cases where the Kruskal-Wallis test yielded a statistically significant overall result, further post hoc analyses (such as the Least Significant Difference and Tukey's HSD) were conducted to pinpoint the exact differences between specific group pairs. A significance level of $p < 0.05$ was established for all inferential tests to determine statistical significance.

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3. RESULTS

3.1 Descriptive Statistics

This study measured the concentration levels of 110 students based on four main categories. A summary of the descriptive statistics for the collected data is presented in Table 2.

Table 2. Descriptive Statistics of Concentration Across All Categories

Category	Group	N	Mean ± SD
Gender	Male	75	7.97 ± 3.040
	Female	35	8.80 ± 3.027
Grade Level	Grade VII	46	6.54 ± 2.605
	Grade VIII	34	7.65 ± 2.173
	Grade IX	30	11.50 ± 1.737
Sport Type	Individual	47	8.57 ± 3.282
	Team	63	7.98 ± 2.860
Training Freq.	1x/week	19	7.79 ± 3.207
	2x/week	77	8.04 ± 3.002
	3x/week	14	9.93 ± 2.702

3.2 Normality and Homogeneity Tests

Kolmogorov-Smirnov normality test results showed that almost all data groups were not normally distributed ($p < 0.05$), except for the 3x/week training frequency group ($p = 0.111$). Levene's Test homogeneity results across all categories confirmed homogeneous data ($p > 0.05$). Given the non-normal but homogeneous distribution, non-parametric hypothesis testing was firmly applied to ensure robust statistical conclusions.

3.3 Hypothesis Testing

Hypothesis testing was performed using the Mann-Whitney test (for two groups) and the Kruskal-Wallis test (for more than two groups). A summary of the final results is presented in Table 3.

Table 3. Summary of Hypothesis Testing Results

Hypothesis	Test	Sig.	Decision
Gender	Mann-Whitney	0.144	H0 Accepted Not Significant
Grade Level	Kruskal-Wallis	0.000	H0 Rejected Significant
Sport Type	Mann-Whitney	0.300	H0 Accepted Not Significant
Training Frequency	Kruskal-Wallis	0.109	H0 Accepted Not Significant

4. DISCUSSION

Based on gender, there was no significant difference in concentration scores between male and female students ($p = 0.144$). Descriptively, female students achieved a slightly higher average score (8.80) compared to male students (7.97). Although some previous studies have

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found gender-based disparities in cognitive ability, these differences were not large enough to be statistically significant in the context of this study. This suggests that the physical and mental stimuli provided by sports extracurricular activities are capable of providing equivalent benefits in terms of concentration improvement for both genders. The rigorous nature of sports training appears to equalize their cognitive performance by providing the same level of aerobic stimulus, which effectively breaks down any baseline physiological barriers to mental focus (Bailey, 2006).

The grade level variable yielded the most significant findings (p = 0.000). Grade IX students showed the highest average concentration (11.50 ± 1.737), followed by Grade VIII (7.65 ± 2.173) and Grade VII (6.54 ± 2.605). The Tukey HSD Post Hoc test confirmed the existence of significant differences between Grade VII and Grade IX, as well as between Grade VIII and Grade IX. This pattern firmly aligns with cognitive development theory; older students (Grade IX) possess a higher level of psychological maturity and better-developed executive functions of the brain, particularly in areas governing working memory and cognitive flexibility (Best, 2010). Furthermore, they have undergone structured physical routines for a longer period at school. This cumulative exposure to disciplined physical training results in significantly more refined focus, emotional regulation, and overall academic adaptability compared to their younger peers.

Regarding the type of sport, statistical analysis showed no significant difference between students participating in individual and team sports (p = 0.300). Although students in individual sports (such as taekwondo, karate, and athletics) achieved a slightly higher average score (8.57 versus 7.98) given the nature of these sports, which demand independence and intense personal concentration this difference is not statistically meaningful. This strongly indicates that the cognitive benefits of physical activity are universal, albeit achieved through different cognitive pathways. Team sports require strategic thinking, spatial awareness, and anticipation of teammates' movements, whereas individual sports emphasize self-regulation and sustained singular focus. Ultimately, both types of sports have been shown to be equally effective in stimulating brain function and impacting students' cognition and intelligence regardless of the specific branch (Tomporowski et al., 2008).

Regarding training frequency, the overall Kruskal-Wallis test did not reveal comprehensive significance (p = 0.109). However, further analysis using the LSD post hoc test revealed a crucial finding: there was a significant difference between the group exercising 1x/week and 3x/week (p = 0.046), as well as between 2x/week and 3x/week (p = 0.033). These findings demonstrate the existence of a specific physiological threshold for optimal physical exercise volume. These results align with the view that intense and sustained physical activity is vital for maintaining mental health (Biddle & Asare, 2011). From a neurobiological perspective, engaging in moderate-to-vigorous physical exercise three times a week optimally increases the heart rate, maximizing the delivery of oxygen-rich blood to the brain. This sustained aerobic activity stimulates the release of essential neurochemicals that directly trigger neural plasticity, synaptic growth, and cognitive enhancement (Hillman et al., 2008).

Furthermore, these findings offer practical implications for the school curriculum. Given the significant cognitive benefits of regular physical activity, physical education teachers and school administrators are encouraged to integrate more structured, moderate-to-vigorous physical activities into the weekly schedule to ensure students reach that optimal threshold of physical exertion. Students who frequently struggle with focus and attention in the classroom should be actively encouraged to participate in sports extracurricular programs as a non-pharmacological, practical approach to improving their academic concentration and overall well-being.

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5. CONCLUSION

This study found that grade level is the primary determinant of learning concentration among students actively participating in sports extracurricular activities, with Grade IX students consistently demonstrating superior concentration abilities. Gender and sport type (individual vs. team) did not produce significant differences in concentration, suggesting that the cognitive benefits of sports are universal. While overall training frequency did not yield a blanket significant result, students training 3x/week showed meaningfully higher concentration than those training only 1x or 2x per week. These findings strongly support the implementation and enhancement of sports extracurricular programs in schools as a strategic method for developing student learning concentration and overall academic performance.

6. AUTHORS' NOTE

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