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Implementation of Station Rotation Learning Strategy in Improving Physical Activity and Learning Participation in Physical Education for Elementary School Students

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Abstract. This study aims to determine the effect of implementing a station-based learning strategy (station rotation) on increasing physical activity and participation among fifth-grade students in physical education classes at elementary schools. This study uses a quantitative approach with a quasi-experimental design in the form of a pretest-posttest Control Group Design. The sample consisted of 31 fifth-grade students at State Elementary School 113 Banjarsari, Bandung, divided into an experimental group (n = 16) and a control group (n = 15), selected using purposive sampling. Physical activity was measured using the Physical Activity Questionnaire for Children (PAQ-C), and student participation was measured using an observation sheet. Data analysis included descriptive statistics, the Shapiro-Wilk normality test, the Levene homogeneity test, the Mann-Whitney U test for the physical activity variable, and N-Gain Score analysis. The results of the study showed that the experimental group experienced an increase in physical activity scores from an average of 2.68 (moderate category) to 3.44 (high category), while the control group's scores decreased from 2.89 to 2.69. For the participation variable, the absolute posttest scores did not show a statistically significant difference (p = 0.40). However, the N-Gain Score analysis revealed a highly significant difference in the effectiveness of the improvement between the two groups (p = 0.000). The conclusion of this study is that a learning strategy based on evidence has proven effective in improving physical.

Keywords: Physical Activity; student participation; PJOK; Elementary School; Rotation Station

INTRODUCTION

Physical Education, Sports, and Health is an integral subject in the education system that aims to increase physical activity and improve overall physical, mental, and emotional well-being, as well as foster a healthy lifestyle throughout one's life. Effective PJOK learning strategies involve humanistic and constructivist learning processes to achieve educational goals (Kamaruddin et al., 2024; Rahmawati et al., 2024; Sari et al., 2024). However, recent studies highlight the low levels of physical activity among elementary school students in Indonesia. A study in Bandung found that fifth-grade students had a low average level of physical activity, at 502.2 (±24.3) Metabolic Equivalent of Task (MET) (Hasan et al., 2020). This situation is exacerbated by a shift in the behavior of today's children, who tend to spend their free time in front of electronic screens (sedentary behavior) and have abandoned traditional physical games. On the other hand, Physical Education instruction in the field is still dominated by conventional, teacher-centered methods, resulting in students becoming passive recipients of material who quickly become bored. This low student participation and limited interaction pose a serious challenge that affects learning outcomes (Fitriani et al., 2020).

This condition is exacerbated by a shift in children's behavior who now tends to abandon physical play and replace it with passive activity in front of electronic screens (Harahap et al., 2013). On the other hand, the lack of student involvement in the PJOK learning process is also a serious challenge. In teacher-centered learning, teachers tend to dominate instructional activities, while students often become passive recipients of information (Wororomi et al., 2024). Low student participation and limited interaction between teachers and students are among the main factors influencing learning outcomes (Mulyana et al., 2024). This is consistent with the findings of (Putra et al., 2024) which emphasize that teachers' ability to establish effective communication is a key determinant in creating a physical education and health learning environment that encourages students to engage actively and fully. Furthermore, low levels of cooperation among students also pose a challenge in implementing physical education instruction, which fundamentally emphasizes collaborative aspects (Kamil et al., 2024).

Traditional instructional designs in physical education which rely heavily on explanations, demonstrations, and repetitive drills often trap students in learning situations that tend to be passive (Chen et al., 2025). Evidence-based learning strategies (station rotation) emerged as one of the innovative alternatives that are considered able to overcome these problems. This strategy focuses on the management of a learning environment that allows students to carry out two or more activities simultaneously through a systematically arranged inter-station transfer mechanism (Dwiyogo, 2018). Various studies show that the application of station rotation effective in improving learning outcomes, which was shown by the increase in the average score of students from 64.17 to 83.50 in the experimental group (Lidya et al., 2025). This strategy provides opportunities for the implementation of differentiated learning while encouraging the development of student learning independence (Anggraini & Insani, 2025).

However, previous research has tended to focus more on application studies station rotation in academic subjects, such as language (Mahalli et al., 2019). In addition, the studies that have been carried out generally focus more on the cognitive aspects and social skills of students (Ba'it & Suyanto, 2025). There has been no research that specifically examines the contribution of this strategy to increasing physical activity and student participation in PJOK learning at the elementary school level. This research gap is what prompted this study. The purpose of this study is to determine the effect of implementing the station rotation learning strategy on increasing the physical activity and participation of fifth-grade students in Physical Education lessons at the elementary school level.

METHOD

This study employs a quantitative approach using a quasi-experimental pretest-posttest control group design. This design allows for the measurement of baseline conditions prior to the intervention via a pretest, followed by a comparison with post-intervention conditions via a posttest, while utilizing a control group as a reference to evaluate the effectiveness of the applied treatment (Creswell, 2017). The research was conducted at SD Negeri 113 Banjarsari, Bandung City, during the even semester of the 2025/2026 academic year.

This study involved a population of 64 fifth-grade students from SD Negeri 113 Banjarsari, Bandung City, distributed across two parallel classes. Using an intact-class purposive sampling technique, Class V-A was designated as the experimental group (16 students: 9 boys and 7 girls) to implement the station rotation strategy, while Class V-B served as the control group (15 students: 8 boys and 7 girls) and followed instruction that did not utilize the station rotation strategy. Homogeneity between the two groups was ensured through similarities in age (10–11 years), the curriculum employed, and the physical education teacher; this was empirically corroborated by statistical test results on pretest data regarding physical activity and learning participation, which yielded p-values greater than 0.05. Sample selection was conducted using purposive sampling, taking into account pre-established inclusion and exclusion criteria. The inclusion criteria required students to be in the fifth grade of elementary school, free from severe cognitive impairments, and willing to participate in the entire research process with the consent of a parent or guardian.

The exclusion criteria in this study include students who have injuries that limit physical activity, have certain diseases or medical conditions, and do not participate in predetermined measurement sessions. Based on these criteria, the number of samples obtained was 31 students, which were then divided into an experimental group of 16 students and a control group of 15 students.

The experimental group received treatment in the form of the application of station-based learning strategies (station rotation) given for 6 weeks with 12 meetings. In each learning session, the activity is divided into several stations that contain different movement tasks, then students move from one station to another in turns according to the predetermined rotation system. Meanwhile, the control group continued to participate in Physical Education (PE) instruction using a conventional, teacher-oriented design or method, without any special intervention.

The instruments used to measure the level of physical activity in this study were Physical Activity Questionnaire for Children (PAQ-C) developed by (Kowalski et al., 2004). The instrument consists of nine questions each of which is assessed using a 5-point likert scale. The Indonesian version of PAQ-C has been declared valid and reliable, with a coefficient value Cronbach's Alpha by 0.705 to 0.712 (Andriyani et al., 2024). Student participation was measured using observation sheets developed based on theory (Davis, 1962). It covers five sub-variables: participation, engagement, willingness, and activeness, with a total of 15 observable behavioral indicators. The validity of the participation instrument is obtained through expert assessment expert judgment.

Data analysis in this study was conducted using IBM SPSS Statistics software. Student participation data were collected using an observation sheet that had been validated through content validity testing (expert judgment) and confirmed reliable via inter-rater reliability testing. All statistical analyses in this study were conducted at a significance level of $\alpha = 0.05$. As the physical activity data were neither normally distributed nor homogeneous, the non-parametric Mann-Whitney U test was used to compare post-test scores between groups. Conversely, the learning participation variable which met the assumptions of normality and homogeneity was analyzed using the parametric Independent Samples t-test. In addition to comparing absolute post-test scores, the effectiveness of the improvement for both variables was also comparatively assessed using the N-Gain score calculation.

Research Ethics Statement

This research has obtained ethical approval from the authorized institutional review board. All research procedures are carried out in accordance with applicable ethical standards, accompanied by the provision of informed consent to all participants, as well as maintaining the confidentiality of participants' identities and data during the research process.

RESULT AND DISCUSSION

Result

After the data is collected, the researcher conducts the process of processing and analyzing the data. Statistical descriptions of the research data are presented in Table 1.

Table 1. Statistical Results Description

Variabel	Groups	N	Mean Pretest	Mean Posttest	SD Pretest	SD Posttest
Physical Activity (PAQ-C)	Eksperimen	16	2,68	3,44	0,79	0,45
	Control	15	2,89	2,69	0,11	0,32
Student Participation (%)	Eksperimen	16	45,06	58,31	11,53	11,51
	Control	15	47,60	54,73	11,78	12,18

Based on Table 1, the experimental group experienced an increase in the average physical activity score from 2.68 in the medium category to 3.44 in the high category. In contrast, the control group showed a decrease in scores from 2.89 to 2.69. In the participation variable, the experimental group increased from 45.06% to 58.31%, while the control group increased from 47.60% to 54.73%. Although both groups showed an increase in participation rates, the increase in the experimental group was relatively larger, at about 13.25 points, compared to the control group, which only experienced an increase of about 7.13 points. This is further explained in Table 2.

Table 2. Shapiro-Wilk Physical Activity Normality Test Results

Groups	Statistic	df	Say.
Physical Pretest			
Eksperimen	0.91	16	0.15
Control	0.76	15	0.00
Physical Posttest			
Eksperimen	0.92	16	0.18
Control	0.89	15	0.07

Based on table 2, in the pretest the physical activity test results showed that the experimental group had a significance value of 0.15 while the control group had a significance value of 0.00. Because the significance value of the experimental group was greater than 0.05 ($p > 0.05$) the data pretest the group is declared to be normally distributed, on the other hand, the data pretest The control had an abnormal distribution because the significance value was smaller than 0.05 ($p < 0.05$). On the results posttest The physical activity of the experimental group showed a significance value of 0.18 and the control group of 0.07. Both groups had a significance value greater than the alpha standard of 0.05 ($p > 0.05$), so it can be concluded that the data posttest Physical activity for both groups was normally distributed.

Table 3. Shapiro Test Results - Wilk Normality Participation

Groups	Statistic	df	Say.
Participation Pretest			
Eksperimen	0.94	16	0.36
Control	0.90	15	0.10
Posttest Participation			
Eksperimen	0.97	16	0.86
Control	0.91	15	0.17

Based on table 3, the results of the analysis on the student participation pretest data showed a Sig value of 0.36 for the experimental group and 0.10 for the control group. Meanwhile, in the participation posttest data, a Sig value of 0.86 was obtained for the experimental group and 0.17 for the control group. All significance values obtained were above the alpha value of 0.05 ($p > 0.05$), so it can be concluded that all student participation data, both in the pretest and posttest stages for both groups had a normal distribution of data. So then the hypothesis test is carried out using parametric statistics, namely the independent sample t-test, because the requirements for using parametric statistics have been met.

Table 4. Mann - Whitney U Physical Activity Test Results

Groups	**Mann-Whitney U**	**Mean Rank Experiment**	**Mean Rank Control**	**Asymp. Sig. (2-tailed)**
Physical Activity Pretest	67,000	12,75	19,47	0,03
Physical Activity Posttest	14,000	22,63	8,93	0,00

Based on Table 4, the *results of the Mann-Whitney U* test on *the pretest* data show *the value of Asymp. Sig*. = 0.03 ($p < 0.05$), which indicates that there are differences in initial conditions that need to be considered in the interpretation of the results. Meanwhile, in the *posttest* data, a significance value of 0.00 ($p < 0.001$) was obtained, with the Mean Rank of the experimental group (22.63) much higher than that of the control group (8.93). These results prove that there was a very significant difference in physical activity between the two groups after the intervention, where the experimental group consistently outperformed the control group.

Table 5. Independent Sample T-Test Results for Participation

Variabel	**Mean Experiments**	**Mean Control**	**t-count**	**Sig. (2-tailed)**
Student Participation	58,31	54,73	0,84	0,40

Based on table 5, the comparison of the participation posttest scores between the two groups showed a value of $t = 0.84$ with Sig. = 0.40 ($p > 0.05$), which means that there was no statistically significant difference. However, the higher mean difference in the experimental group prompted the researchers to conduct further analysis using the N-Gain Score to see the true quality of the improvement.

Table 6. Results of N-Gain Score Analysis of Physical Activity and Participation

Variabel	**Mean N-Gain Eksperimen**	**Mean N-Gain Control**	**t / U**	**Sig. (2-tailed)**
Physical Activity	0,25	-0,08	4.246	0,00
Student Participation	0,25	0,14	4.423	0,00

Table 6 shows that on the physical activity variable, the experimental group had a positive average N-Gain of 0.25, while the control group showed a negative number of -0.08. This negative number indicates that without special treatment, students' physical activity tends to decrease. In the participation variable, the experimental group recorded an average N-Gain of 0.25 compared to the control group of 0.14. The difference in N-Gain in the two variables proved to be very significant ($p = 0.00 < 0.001$), which proves that the station rotation strategy is significantly more effective in encouraging increased physical activity and student participation than other learning strategies.

Discussion

The initial profiles of the two groups showed relatively equal conditions, where the physical activity and participation level of students in each group were both in the moderate category. The findings are in line with the results of the study (Hasan et al., 2020) which states that the average level of physical activity of grade V students in the city of Bandung is in the low to medium category. The low level of physical activity and student participation in the early stages is related to the application of learning strategies that tend to be monotonous and have minimal variation in the learning process (Yustiyati et al., 2024). as well as lifestyle tendencies sedentary which is getting stronger among school-age children (Umarba, 2021).

The significant increase in physical activity in the experimental group can be explained through structural mechanisms in the strategy station rotation which encourages each student to remain actively involved in learning activities. The interstation switching system allows for reduced waiting times and optimizes active learning time in each student (Iriani & Hidayah, 2025). The diversity of movement tasks at each station is proven to be able to maintain students' intrinsic motivation to stay active in moving, because each station move provides a new movement experience that is interesting and not monotonous (Rahmah & Sukmara, 2022). This condition is fundamentally different from learning using the standard teacher-centered method, where students tend to play a passive role in the learning process (Wororomi et al., 2024). Emergence of value N-Gain negative in the control group showed that in the absence of structured and active learning interventions, students' physical activity levels not only stagnated, but also had the potential to decrease. These findings are in line with opinion

(Fitriani et al., 2020) which highlights the long-term health risks due to low physical activity in children.

The findings of this study strengthen and expand the results of the study (Mauludiyah et al., 2024) which shows a significant influence of the implementation station rotation to the physical performance of students in PJOK learning. In addition, these results are also in line with research (Supriyono et al., 2015) who found that there was an increase in learning outcomes through the application of similar learning strategies. This study adds empirical evidence at the elementary school level which has been very minimally studied in the literature of PJOK in Indonesia. Furthermore, the increase in physical activity achieved in this study has significant long-term implications, considering that regular physical activity has been proven to be able to reduce the risk of various degenerative diseases (Shalahuddin, 2024). As well as improving the motor skills of elementary school students (Pandiangan et al., 2024).

In the participation variable, the pattern of findings obtained showed more complex characteristics but still had important meaning. Despite the results of the score comparison posttest between groups did not show a statistically significant difference (p = 0.40), analysis N-Gain Score shows a very significant difference in the rate of increase (p = 0.00). The findings indicate that the implementation of station rotation able to accelerate the development of student participation in real terms, even though these changes take longer to be fully reflected in the absolute score. Participation is a multidimensional variable that includes behavioral and psychological aspects (Davis, 1962); Wihartanti, 2022) So significant changes can't always be seen directly in a relatively short period of time.

There are several mechanisms underlying increased participation in the experimental group. First, the diversity of activities at each station is able to reduce student boredom which has been one of the main factors for the low level of participation in learning (Yustiyati et al., 2024). Second, the implementation of a rotation system in small groups is able to increase the intensity of interaction between students because each member has contributions and responsibilities that are directly felt by his group (Kamil et al., 2024). Third, flexible learning station arrangements provide opportunities for teachers to adjust learning activities according to different abilities and characteristics of students' learning styles (Marlina et al., 2022). Fourth, the reduction of teacher dominance gives room for student initiative and creativity (Prince, 2024). These results are in line with the findings (Mulyana et al., 2024) which shows that active learning strategies contribute positively to increasing student participation in PJOK learning. More specifically, (Zulfikar & Budiana, 2019) proving that the cooperative learning model in PJOK was able to significantly increase the participation of 5th grade elementary school students in Bandung, from 50.82% to 83.06% at the end of the cycle. This confirms the great potential of active learning models in encouraging student involvement in a sustainable manner. (Scott, 2021) emphasizing that students' mental engagement, such as questioning, discussing, and working together, is an important aspect of learning that can develop optimally through the application of strategies station rotation.

Overall, the consistent change pattern differences between the experimental group and the control group on both study variables showed that the application of the station rotation provide a comprehensive influence, not limited to just one aspect of learning. The consistency of the findings indicates that station rotation has broad potential in improving the quality of PJOK learning as a whole. This is in line with the view (Dwiyogo, 2018) which states that the learning model is able to optimize various learning functions in an integrated manner if applied appropriately and continuously. Thus, the development of PJOK learning strategies through the implementation of station rotation it is no longer seen as just an alternative learning method, but an important need in answering the challenge of low levels of physical activity and student participation in the current digital era.

CONCLUSION

This study proves that the implementation of station rotation-based learning strategies has a significant effect on increasing students' physical activity in PJOK learning in elementary school, as shown by a very significant difference between the experimental group and the control group on the posttest ($p < 0.001$) and the N-Gain value positive value of the experimental group (0.25) compared to the negative value of the control group (-0.08). In the student participation variable, the station rotation strategy was shown to significantly accelerate the rate of increase in participation based on the N-Gain Score analysis ($p = 0.00$), although the difference in absolute score of the posttest has not reached a significant level. Thus, station rotation can be recommended as an effective PJOK learning strategy to increase physical activity and participation of elementary school students.

The limitations of this study include: (1) the relatively short duration of the intervention, so that changes in multidimensional participation variables have not been fully reflected in the absolute score; (2) no follow-up measurements to determine the sustainability of the impact of the intervention; and (3) there is a significant difference in the initial condition of physical activity between the two groups. Further research is suggested to extend the duration of the intervention, involve follow-up measurements, and control the group's initial condition more tightly through randomization.

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