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Improving Students' Endurance Through Project-Based Circuit Training

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ABSTRACT

This study aimed to examine the improvement of students' endurance through the implementation of Project Based Learning combined with a circuit training program in Physical Education, Sports, and Health (PJOK) learning at SMPN 11 Banjarbaru. This study employed a quantitative approach with a pretest-posttest design involving 32 students. The students' final grades were determined using a 1.600 meter linear test that was administered before and after the actual grade. Observation is also done to determine the impact on student participation and performance in the learning process. Research and statistical inference. The results showed that the average time to complete the task decreased from 10,9584 minutes in the pretest to 10,4881 minutes in the posttest, indicating a 4.29% improvement in the task performance. The data is normally distributed, according to the Shapiro-Wilk normality test, which yielded a significance level of 0.162. There is a significant difference between the pretest and posttest results, as indicated by the p-value of 0.009 ($p < 0.05$) from the paired-samples t-test. In addition, 22 students (68.75%) reported improved academic performance, while 10 students (31.25%) did not report improvement. These findings indicate that the implementation of Project Based Learning combined with circuit training was associated with a significant improvement in students' endurance performance in PJOK learning at SMPN 11 Banjarbaru.

Keywords: Project Based Learning, circuit training, endurance, physical education, students

INTRODUCTION

Education is a structured effort to develop students' cognitive, affective, and psychomotor abilities. In Physical Education, Sports, and Health (PJOK), learning also contributes to the development of physical abilities and fitness (Wibowo et al., 2023). Physical fitness is important because it supports students in performing physical activities without excessive fatigue (Hassan & Nurharsono, 2023). Therefore, appropriate learning approaches are needed to encourage active participation in physical activities (Amirudin, 2019).

Endurance is an important component of physical fitness that needs to be developed through systematic physical activity (Tambunan et al., 2024). Physical fitness testing can provide objective information about students' physical condition and serve as a basis for planning PJOK learning (Rahmadi. Tri Irianto, 2020). One assessment that can be used to measure endurance is the 1,600-meter running test. Students' fitness is also influenced by the frequency, duration, and type of physical activity performed (Irianto et al., 2022).

One training method that can be applied is circuit training, which involves several exercise stations performed sequentially. This method offers a variety of physical activities and can encourage active student participation (Kuncoro et al., 2024). According to (Raguan et al., 2024)), circuit training can also promote physical and social development through group activities. According to (Rakhman & Amirudin, 2025), such activities can also improve teamwork and discipline in Physical Education (PJOK). Project-Based Learning

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(PjBL) and Circuit Training can be integrated to facilitate, maximize, and evaluate learning projects.

Circuit training can be integrated with Project Based Learning (PjBL), in which students participate in planning, implementing, and evaluating learning projects. The PjBL approach encourages active student participation and has been shown to improve learning outcomes in physical education (Febriyanti et al., 2024). Therefore, this integration can make the learning process more conducive to structured physical exercise for students.

Previous studies indicate that students' physical fitness remains a concern. (Prayoga et al., 2025) Contrary to what (Tambunan et al., 2024) discovered, the majority of students in their study were classified as having less than excellent physical fitness. Additionally, it should be noted that (Rachma et al., 2025) that students' physical fitness should be consistently monitored. Several studies have also reported the application of circuit training to improve physical fitness, cardiovascular endurance, and other physical abilities (Fernanda et al., 2025).

Circuit training consists of varied and structured exercises that can be adjusted to specific training objectives (Khomariyah et al., 2026). Repeated circuit activities can also support the development of students' motor skills (Prayoga et al., 2025). Furthermore, varied learning activities are important because the learning model and activities provided can affect students' participation in PJOK (Harfia & Kusumawardana, 2025). However, previous research has generally examined circuit training in relation to general physical fitness, specific physical components, or elementary school students. Research specifically integrating PjBL and circuit training to improve endurance among junior high school students remains limited.

Some pupils at SMPN 11 Banjarbaru grew tired during dynamic warm-ups and jogging rather rapidly, according to first observations. Movements involving changes in direction, as well as push-ups and sit-ups, were also found to be challenging. This highlights the importance of incorporating a range of scheduled physical exercises into the curriculum to help pupils build endurance. This study set out to fill that need by investigating how PJOK instruction at SMPN 11 Banjarbaru, Indonesia, combines project-based learning with circuit training to increase the stamina of ninth graders. The purpose of this research is to offer empirical data about the efficacy of integrating student-centered project activities with structured physical workouts in enhancing students' endurance.

METHOD

This study's quantitative analysis was carried out by researchers using a pre-test and post-test design with one group of participants. The academic year of SMPN 11 Banjarbaru begins on August 3 and ends on September 7, 2026. Because the sun and moon failed to cover the research area, schools had to resort to using ad hoc teaching methods.

The research sample consisted of 301 students from SMPN 11 Banjarbaru's intermediate class. A group consisting of three hundred and twenty-two students from a single class was selected as a sample using the technique of purposive sampling. Intervention that is provided to all participants.The primary tool for measuring students' tahan cardiorespiratory capacity is the 1.600 meter lunge test. The participants are instructed to use a stopwatch to keep track of the time as they complete the task, whether it is before or after an intervention. ((Musdalifah et al., 2022) cites Morrow, Jackson, Disch, and Mood (2000) as reference materials for data evaluation based on usia and type of kelamin. A higher rate of processing indicates a better quality of life. Evaluations are based on performance criteria such as

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physical stamina, consistency in work, generation technique, speed of exercise, and discipline and participation.

The intervention is carried out in one session with right-side exercises (circuit training) and project-based learning (Project Based Learning or PjBL) in every session for a month. This red carpet features eight positions, including jumping jacks, butt kicks, mountain climbers, and front lunges. Students adapt their exercises to specific conditions by following the prescribed stretching and strengthening routines. Before the intervention begins, a pre-test is conducted; after each session of the keenam, using the same 1.600 meter protocol, a post-test is administered.

The data is analyzed using descriptive and inferential statistics. We used the Shapiro-Wilk test at a significance level of 0.05 to test for data normality. If the data does not follow a normal distribution, the Wilcoxon Signed-Rank test is used; if the data does follow a normal distribution, the Paired-Samples t-test is used. A significance level of $p < 0.05$ was used to ensure that there is a statistically significant difference between the pre-test and post-test scores.

RESULTS AND DISCUSSION

Results

The study examined changes in students' endurance following the implementation of Project-Based Learning (PjBL) integrated with circuit training. Endurance was assessed through a 1,600-meter running test administered before and after the intervention. Because the test was measured by completion time, a shorter running time indicated better endurance performance.

Table 1. Descriptive Statistics of 1,600-Meter Running Performance

Test	N	Mean (minutes)	SD	Minimum	Maximum
Pretest	32	10.9584	2.80653	6.10	18.16
Posttest	32	10.4881	2.42875	6.37	17.11

Table 1 shows a decrease in the mean completion time from 10.9584 minutes in the pretest to 10.4881 minutes in the posttest. The mean reduction was 0.4703 minutes, indicating that, on average, students completed the 1,600-meter run in less time after participating in the learning program. The lower posttest standard deviation also indicates a slight reduction in the variation of students' running times. The distribution of endurance categories provides additional information about the students' performance.

Table 2. Endurance Category Distribution

Category	Pretest n (%)	Posttest n (%)
Very Poor	19 (59.4%)	18 (56.3%)
Poor	7 (21.9%)	9 (28.1%)
Fair	3 (9.4%)	2 (6.3%)
Good	2 (6.3%)	3 (9.4%)
Very Good	1 (3.1%)	0 (0%)
Total	**32 (100%)**	**32 (100%)**

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The category distribution shows a modest redistribution of students across endurance levels. The number of students classified as very poor decreased from 19 to 18, while the good category increased from two to three students. At the individual level, 22 of the 32 students (68.75%) recorded faster posttest times, whereas 10 students (31.25%) did not show individual improvement. These findings indicate that students did not respond uniformly to the intervention. Before testing the research hypothesis, a normality test was conducted using the Shapiro-Wilk test.

Table 3. Shapiro-Wilk Normality Test

Variable	Statistic	df	Sig.
Difference between pretest and posttest	0.894	32	0.186

The significance value of 0.186 is greater than 0.05, indicating that the data met the normality assumption. Therefore, a paired-samples t-test was used to examine the difference between students' pretest and posttest running times.

Tabel 4. Paired Sample t-Test

Comparison	t	df	Sig. (2-tailed)
Pretest – Posttest	2.783	31	0.009

The paired-samples t-test produced a significance value of 0.009, which is below 0.05. This result indicates a statistically significant difference between students' 1,600-meter running times before and after the implementation of PjBL integrated with circuit training. The statistical finding is consistent with the decrease in mean running time shown in Table 1.

Discussion

The findings indicate that the implementation of PjBL integrated with circuit training was accompanied by an improvement in students' 1,600-meter running performance. The mean completion time decreased by 0.4703 minutes, while the paired-samples t-test showed a statistically significant difference ($p = 0.009$). Because of this, there was a statistically significant discrepancy between the two metrics in the population under consideration.

The use of circuit training provides students with repeated opportunities to perform various physical activities within a structured sequence. Exercises such as jumping jacks, butt kicks, mountain climbers, and front lunges require students to maintain continuous movement while engaging different muscle groups. (Muhammad Abdussalam et al., 2024) explains that circuit-based physical training can be organized through several exercise stations involving varied movement activities. This structure provides repeated physical stimuli during learning and is relevant to activities aimed at developing physical fitness.

Through the use of circuit training, pupils are given multiple chances to carry out different physical tasks in a predetermined order. Students must use several muscular groups in a continuous motion during exercises including jumping jacks, butt kicks, mountain climbers, and front lunges. A variety of movement activities can be incorporated into circuit-based physical training, according to (Muhammad Abdussalam et al., 2024). This design is applicable to fitness-related pursuits since it offers repetitive physical stimuli for the purpose of learning.

These results also line up with other studies that have looked at the benefits of circuit exercise. Structured physical training activities were found to increase fitness-related outcomes (Risnawan et al., 2024) and (Muhammad Abdussalam et al., 2024). These findings

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provide a basis for incorporating circuit training into PJOK learning when physical fitness development is one of the intended learning outcomes.

The learning context is also important. PJOK involves direct physical activity and the development of students' movement abilities rather than focusing only on theoretical knowledge. (F. Hendryanto, Arisman, dan Suhermon, 2025) emphasize the importance of physical activity in PJOK learning for supporting students' physical development. In the present study, the combination of project-based learning and circuit activities provided students with opportunities to participate directly in planned physical tasks.

The application of PjBL further supported student involvement during the learning process. Through project-oriented activities, students participated in planning, performing, and completing assigned physical activities. This approach places students in an active position during the learning process. (Febriyanti et al., 2024) also discuss the relevance of PjBL to active student involvement in learning activities. The present findings are consistent with previous studies concerning physical fitness and endurance development. Discussed the role of structured physical activity in physical fitness development. (Risnawan et al., 2024) likewise reported findings related to physical fitness and structured exercise activities. These studies provide contextual support for the use of systematic physical activities in developing students' physical performance.

Similar considerations can be found in (Fernanda et al., 2025), which highlight the contribution of systematic physical activity programs to students' physical performance. The present study extends this discussion by applying circuit-based exercises within a PjBL learning context in PJOK.

While there was a statistically significant difference, the individual data reveal that not all students made progress. Ten pupils showed no change or a slowdown in their posttest running times. This diversity suggests that the same physical education curriculum can elicit varying responses from students. Variation in posttest findings may be due to differences in starting physical condition, exercise adaptation, intervention participation, and individual performance. Consequently, rather than seeing the results as proof of an improvement for each and every student, the results should be seen as proof of a substantial change at the group level.

As the standard deviation fell from 2.80653 to 2.42875, it became clear that the posttest findings were marginally less scattered than the pretest ones. Although this change does not imply that all students reached the same endurance level, it does imply that the students' running performances got slightly more focussed following the intervention. Students' 1,600-meter running performance changed significantly after PjBL combined with circuit training was implemented, according to the results. Consistent with earlier studies, this one suggests that PJOK might benefit from the addition of active learning, circuit-based exercise, and structured physical activity.

CONCLUSION

Students' endurance in PJOK learning was significantly improved when Project-Based Learning (PjBL) integrated with circuit training was implemented at SMPN 11 Banjarbaru. The paired-samples t-test demonstrated a statistically significant difference between the pretest and posttest findings, which was corroborated by the fact that the average 1,600-meter running time decreased following the intervention. The project-based learning model promoted active engagement all through the learning process, and the learning strategy offered students direct and organized physical activity via a set of circuit exercises. Thus, a viable substitute for PJOK instruction that focuses on building students' endurance could be

the combination of PjBL and circuit training. However, it should be modified according to the physical capacities of pupils, the learning environment, and the resources that are accessible. To gain more comprehensive data for its use in PJOK, future studies may test the method with different samples, longer intervention durations, or other fitness-related variables.

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