

Komering Creative Gymnastics: Culture-Based Learning Innovation in Physical Education

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ABSTRACT - The low level of physical fitness among elementary school students in Indonesia and the fading appreciation for local culture represent two problems that demand an integrative learning solution. This study aims to determine the effect of Komering Creative Gymnastics on the physical fitness of students aged 10–12 years. The method used was a true experiment with a pretest-posttest control group design. The research subjects were 40 students of grades IV–V at a State Elementary School in East OKU Regency, South Sumatra, divided into an experimental group ($n = 20$) and a control group ($n = 20$). The experimental group received Komering Creative Gymnastics treatment for eight weeks (3 sessions per week, 60 minutes per session), while the control group followed regular physical education lessons. Physical fitness was measured using the Indonesian Physical Fitness Test (TKJI) for children aged 10–12 years, covering five components: 40-meter sprint, flexed-arm hang, 30-second sit-ups, vertical jump, and 600-meter run. Paired t-test results showed a significant increase in total TKJI score in the experimental group (mean pre = 12.80 to post = 17.65; $t = 9.74$; $p = 0.000$), while the control group showed no significant improvement ($p = 0.082$). The independent t-test between the two groups at posttest also revealed a significant difference ($t = 8.21$; $p = 0.000$). These findings prove that Komering Creative Gymnastics is effective in improving the physical fitness of students aged 10–12 years across all TKJI components, while simultaneously serving as a medium for the preservation of Komering local culture in physical education learning at the elementary school level.

INTRODUCTION

Physical fitness in childhood serves as a crucial foundation for optimal physical, cognitive, and psychosocial development. However, national data indicate that the physical fitness levels of elementary school students in Indonesia remain low, with the proportion of students categorized as "poor" and "very poor" exceeding 50% in some regions (Alfatah et al., 2024; Marsuna et al., 2024). This situation is further compounded by the rise of sedentary behavior among children due to uncontrolled

device use and the lack of structured physical activity outside school hours (Anggraini et al., 2022; Berloff, 2022).

Physical education in elementary schools also faces another challenge: the fading appreciation among younger generations for local cultural heritage. Traditional dances and movements part of the ancestral legacy are increasingly abandoned as they are perceived as irrelevant to modern life. This situation demands educational innovations capable of addressing both challenges in an integrative manner (Darong, 2022; Helvana & Hidayat, 2020).

Komerang Creative Gymnastics emerges as an innovative solution that integrates the movements of the Dang Lupa Komerang dance a cultural tradition from South Sumatra rich in aesthetic value, rhythm, and local wisdom into a systematic and measurable fitness training program. This approach aligns with the paradigm of contextual learning, which emphasizes that learning experiences become more meaningful when connected to the socio-cultural context of learners (Fathan et al., 2022). For children aged 10–12, culture-based learning has been shown to enhance intrinsic motivation, a sense of belonging, and active participation in physical activity (Aliriad et al., 2023; Rakhman et al., 2024).

Prior research by Sukmawati et al. (2025) has demonstrated the effectiveness of a gymnastics program based on Dang Lupa Komerang movements in improving the physical fitness of adult women. However, no study has specifically examined the effect of Komerang Creative Gymnastics on the physical fitness of elementary school-aged students using an instrument appropriate for that age group. Filling this research gap is important, given that the physiological characteristics and movement needs of children aged 10–12 differ significantly from those of adult populations (Wang, 2024; Aliriad, 2024). Based on this background, this study aims to determine the effect of Komerang Creative Gymnastics on the physical fitness of students aged 10–12 years as measured by the Indonesian Physical Fitness Test (TKJI).

METHODS AND MATERIALS

2.1 Research Design

This study employed an experimental method using a pretest-posttest control group design (Creswell, 2014). This design was chosen because it allows comparison between the group receiving treatment (experimental group) and the group not receiving treatment (control group), enabling a more valid examination of the treatment effect while controlling for threats to internal validity. Measurements were conducted twice: before the treatment (pretest) and after eight weeks of treatment (posttest). Table 1 shows the pretest-posttest control group design applied in this study. The experimental group ($n = 20$) received the Komerang Creative Gymnastics treatment for eight weeks, three times per week, while the control group ($n = 20$) followed regular Physical Education (PJOK) lessons. Both groups were given an initial TKJI measurement as a pretest and a final TKJI measurement as a posttest.

Table 1. Pretest-Posttest Control Group Design

Group	Pretest	Treatment	Posttest
Experimental ($n = 20$)	Initial TKJI	Komerang Creative Gymnastics (8 weeks, 3×/week)	Final TKJI
Control ($n = 20$)	Initial TKJI	Regular Physical Education (PJOK)	Final TKJI

2.2 Research Subjects

The research subjects were 40 students from grades IV–V at a State Elementary School in Kayuagung District, Ogan Komering Ilir Regency, South Sumatra, aged 10–12 years. Sampling used a purposive sampling technique with the following criteria: (1) enrolled as active students; (2) aged 10–12 years; (3) no history of injury or medical conditions limiting physical activity; and (4) written parental or guardian consent obtained. Subjects were then randomly divided into two groups: the experimental group ($n =$

20), which received Komering Creative Gymnastics, and the control group (n = 20), which followed regular physical education in accordance with the curriculum.

2.3 Treatment Procedure

The experimental group received Komering Creative Gymnastics for eight weeks at a frequency of three sessions per week, with each session lasting 60 minutes. Each session comprised three phases: (1) a 10-minute warm-up with light movements based on Komering movement motifs; (2) a 40-minute core workout consisting of a choreographic sequence of Komering creative gymnastics adapted to the capabilities of children aged 10–12, with progressively increasing intensity from week to week; and (3) a 10-minute cool-down accompanied by reflection on the cultural values of the Komering tradition embedded in the movements. Exercise intensity was gradually controlled from a light-to-moderate zone (50–65% of maximum heart rate) in weeks one through three, progressing to a moderate zone (65–75% of maximum heart rate) in weeks four through six, and reaching a moderate-to-vigorous zone (75–85% of maximum heart rate) in weeks seven and eight.

The control group followed regular physical education in accordance with the syllabus and curriculum, without receiving Komering Creative Gymnastics. During the study period, neither group was permitted to participate in any other structured physical training outside the designated schedule.

2.4 Research Instrument

Physical fitness was measured using the Indonesian Physical Fitness Test (TKJI) for children aged 10–12 years, published by the Ministry of National Education (2010). The TKJI is a nationally standardized instrument with established validity and reliability for measuring the physical fitness of Indonesian children. It consists of five test items, each measuring a different fitness component. Table 2 shows the five components and their corresponding test items in the Indonesian Physical Fitness Test (TKJI) for children aged 10–12 years. These components include speed, arm muscle strength and endurance, abdominal muscle strength and endurance, leg muscle explosive power, and cardiorespiratory endurance. Each test item is scored on a scale of 1 to 5 based on the established scoring norms, with a total TKJI score ranging from 5 to 25. The final total score is then classified into five categories: Very Poor, Poor, Fair, Good, and Excellent.

Table 2. Components and Test Items of the Indonesian Physical Fitness Test (TKJI) for Ages 10–12

No.	Fitness Component	Test Item	Unit	Scoring Norm
1	Speed	40-meter sprint	Seconds	Score 1–5
2	Arm Muscle Strength & Endurance	Bent-arm hang	Seconds	Score 1–5
3	Abdominal Muscle Strength & Endurance	30-second sit-ups	Reps/30 sec	Score 1–5
4	Leg Muscle Explosive Power	Vertical jump	Centimeters	Score 1–5
5	Cardiorespiratory Endurance	600-meter run	Min/sec	Score 1–5
Total TKJI Score		Sum of 5 test items	Score 5–25	Classification: Very Poor – Excellent

Source: Ministry of National Education (2010). *Indonesian Physical Fitness Test for Children Aged 10–12 Years*

Each test item is scored from 1 (very poor) to 5 (excellent) based on the standard TKJI norms for the applicable age and sex group. The total TKJI score is obtained by summing the scores of all five items (range 5–25), then classified into five categories: Excellent (22–25), Good (18–21), Average (14–17), Poor (10–13), and Very Poor (5–9).

2.5 Data Analysis Technique

Data were analyzed using descriptive and inferential statistical techniques. Descriptive statistics included mean, standard deviation, and frequency distribution of TKJI classifications. Prior to inferential testing, data normality was assessed using the Shapiro-Wilk test ($n < 50$) and variance homogeneity

was assessed using the Levene test. Hypothesis testing was conducted using a paired t-test to examine pretest-posttest differences within each group, and an independent t-test to examine posttest differences between the experimental and control groups. All analyses were performed at a significance level of $\alpha = 0.05$ using SPSS version 26.

RESULTS AND DISCUSSION

3.1 Prerequisite Test Results

Normality testing using the Shapiro-Wilk test indicated that all pretest and posttest data from both groups were normally distributed ($p > 0.05$). Variance homogeneity testing using the Levene test showed that the pretest variances between the experimental and control groups were homogeneous ($p = 0.847 > 0.05$). With the assumptions of normality and homogeneity satisfied, hypothesis testing using the t-test could proceed.

3.2 Descriptive Statistics and Comparison of TKJI Scores

Table 3 presents a summary of descriptive statistics for TKJI scores per test item in both groups before and after treatment. Overall, the experimental group showed substantial score improvements across all test items, while the control group experienced only minimal gains.

Table 3. Summary of Mean TKJI Scores per Test Item in the Experimental and Control Groups

TKJI Test Item	Pre-Exp	Post-Exp	Pre-Con	Post-Con	Exp Change (%)	Con Change (%)
40-m sprint (score)	2.65	3.55	2.70	2.85	+33.96%*	+5.56%
Bent-arm hang (score)	2.40	3.45	2.45	2.60	+43.75%*	+6.12%
Sit-ups 30 sec (score)	2.55	3.60	2.50	2.65	+41.18%*	+6.00%
Vertical jump (score)	2.70	3.65	2.65	2.80	+35.19%*	+5.66%
600-m run (score)	2.50	3.40	2.55	2.70	+36.00%*	+5.88%
Total TKJI Score (mean)	12.80	17.65	12.85	13.60	+37.89%*	+5.84%

Note: Exp = Experimental; Con = Control; * = significant improvement ($p < 0.05$)

The largest improvement in the experimental group occurred in the bent-arm hang item (+43.75%), reflecting a significant increase in arm muscle strength and endurance. This can be explained by the choreographic characteristics of Komeri Creative Gymnastics, which extensively involves arm-swinging, flicking, and elbow-bending movements that are hallmarks of the Dang Lupa Komeri movement motifs. These movements provide repetitive and progressive training stimuli to the arm and shoulder muscle groups, thereby promoting significant neuromuscular adaptation (Hunter et al., 2023).

Improvements in the sit-up component (+41.18%) and the 40-meter sprint (+33.96%) were also notably high. The increase in abdominal muscle strength is closely linked to the core movement patterns in the Komeri choreography, which involve trunk rotation, forward-backward motion, and body stabilization during positional transitions. Meanwhile, the improvement in the speed component of the 40-meter sprint reflects the indirect effect of agility and coordination training stimulated by the dynamic traditional step patterns (Aliriad et al., 2023).

The cardiorespiratory endurance component, measured through the 600-meter run, improved by 36.00% in the experimental group. This finding is consistent with research by Gaspari et al. (2024), which states that music-based rhythmic gymnastics with controlled intensity can improve aerobic capacity by continuously stimulating the cardiovascular system. The adaptive tempo of Komeri music (100–130 BPM) proved capable of maintaining students' heart rates within an effective aerobic training zone throughout each session.

3.3 Hypothesis Testing Results

To test the research hypotheses, a paired t-test was conducted to compare the pretest and posttest total TKJI scores within each group (experimental and control), and an independent t-test was performed to compare the posttest scores between the two groups. The paired t-test results for the experimental group showed a significant increase in total TKJI scores from pretest (Mean = 12.80) to posttest (Mean = 17.65), with a mean difference of +4.85, $t(19) = 9.74$, and $p = 0.000$ ($p < 0.05$). In contrast, the control group showed no significant improvement from pretest (Mean = 12.85) to posttest (Mean = 13.60), with a mean difference of +0.75, $t(19) = 1.83$, and $p = 0.082$ ($p > 0.05$). Furthermore, the independent t-test comparing the posttest scores between the experimental group (Mean = 17.65) and the control group (Mean = 13.60) revealed a significant difference, with a mean difference of +4.05, $t(38) = 8.21$, and $p = 0.000$ ($p < 0.05$). These results are summarized in Table 4 below.

Table 4. Results of Paired t-Test and Independent t-Test for Total TKJI Scores

Test	Pre-Mean	Post-Mean	Difference	t-value	t-table	Sig.
Experimental Group (Pre–Post)	12.80	17.65	+4.85	9.74	2.09	0.000*
Control Group (Pre–Post)	12.85	13.60	+0.75	1.83	2.09	0.082
Between Groups (Post-Exp vs Post-Con)	17.65	13.60	+4.05	8.21	2.02	0.000*

Note: * = significant at $\alpha = 0.05$; t-table df = 19 (paired) and df = 38 (independent)

The paired t-test results for the experimental group showed a highly significant increase in mean total TKJI score, from 12.80 (Poor category) to 17.65 (Average category approaching Good), with a t-value of 9.74 greatly exceeding the t-table value of 2.09 at a significance level of 0.05 ($p = 0.000$). Conversely, the control group experienced only a marginal increase from 12.85 to 13.60 (remaining in the Poor category), with a t-value of 1.83 that did not exceed the t-table value ($p = 0.082$), and thus was not statistically significant.

The independent t-test comparing posttest scores between the two groups yielded a t-value of 8.21 with $p = 0.000$, indicating a highly significant difference between the experimental and control groups following treatment. These results firmly demonstrate that Komereng Creative Gymnastics had a significant effect on improving the physical fitness of students aged 10–12 years. Accordingly, the research hypothesis is accepted.

3.4 Changes in Physical Fitness Classification

To further illustrate the changes that occurred, Table 5 presents the frequency distribution of subjects by TKJI classification before and after treatment.

Table 5. Frequency Distribution of TKJI Classifications Before and After Treatment

TKJI Classification	Pre-Exp (n)	Post-Exp (n)	Pre-Con (n)	Post-Con (n)	Score Range
Excellent	0	3	0	0	22–25
Good	2	9	2	3	18–21
Average	8	7	8	9	14–17
Poor	9	1	9	7	10–13
Very Poor	1	0	1	1	5–9

The data in Table 5 reveal dramatic changes in the experimental group. Before treatment, 10 out of 20 students (50%) were in the Poor and Very Poor categories. After eight weeks of Komereng Creative Gymnastics, only 1 student (5%) remained in the Poor category, while 12 students (60%) advanced to the Good and Excellent categories. This distributional shift demonstrates the tangible and meaningful impact of the Komereng Creative Gymnastics intervention in elevating students' fitness levels from low to higher categories.

The control group showed no meaningful distributional change: the majority of students remained in the Average and Poor categories, with only 1 student moving up a category. This confirms that the improvements observed in the experimental group were a genuine effect of the Komerang Creative Gymnastics treatment, rather than merely a maturation effect or other external factors.

CONCLUSIONS

This study demonstrates that Komerang Creative Gymnastics had a significant effect on improving the physical fitness of students aged 10–12 years. The experimental group, which received Komerang Creative Gymnastics for eight weeks, experienced a mean increase in total TKJI score of 37.89% — from the Poor category (12.80) to the Average category approaching Good (17.65) — which was statistically significant ($t = 9.74$; $p = 0.000$). This improvement occurred consistently across all five TKJI components: speed (40-meter sprint), arm muscle strength-endurance (bent-arm hang), abdominal muscle strength-endurance (sit-ups), leg muscle explosive power (vertical jump), and cardiorespiratory endurance (600-meter run).

Komerang Creative Gymnastics proved effective not only as a physical fitness program but also as a medium for preserving the local Komerang culture within the context of physical education in elementary schools. The integration of Dang Lupa Komerang dance movements into a systematic training structure creates a holistic, contextual, and meaningful learning experience for students, in line with four pedagogical principles: cultural contextualization, structured progressiveness, wholeness of experience, and intrinsic sustainability.

The practical implication of this research is that Komerang Creative Gymnastics can be recommended as an alternative physical education program or extracurricular activity in elementary schools in the South Sumatra region, with support from standardized learning modules and adequate instructor training. Its alignment with the Merdeka Curriculum framework particularly in strengthening the Pancasila Student Profile and local content makes it a strategically valuable model for the development of culture-based physical

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CONFLICT OF INTEREST

The authors declare no conflicts of interest.

AUTHORS CONTRIBUTION

Fanni Nurrahma: Conceptualization, Methodology, Data Curation, Writing—Original Draft Preparation. Noviria Sukmawati: Conceptualization, Supervision, Writing—Reviewing and Editing, Project Administration. Wahyu Rahmanda: Investigation, Formal Analysis, Visualization, Writing—Reviewing and Editing.

AVAILABILITY OF DATA AND MATERIALS

Data are available on request from the corresponding author due to privacy and ethical restrictions related to the involvement of minor participants. Requests for access to anonymized datasets may be directed to noviria.sukmawati@binadarma.ac.id.

DECLARATION OF GENERATIVE AI

During the preparation of this work, the authors used an AI-assisted writing tool to enhance the clarity and readability of the manuscript. After using the tool, the authors reviewed and edited all content as needed and take full responsibility for the content of the publication.

ETHIC STATEMENTS

This study was conducted with human participants (elementary school students aged 10–12 years) and was approved by the Research Ethics Committee of Bina Darma University (Reference No.: [Ethics Approval Number]). All procedures were performed in accordance with the ethical principles of the Declaration of Helsinki. Written informed consent was obtained from the parent or legal guardian of each participating student prior to commencement of the study. Participation was voluntary, and all data were anonymized and handled in strict confidence.

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