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Traditional Games Festival Enhances Fundamental Movement Skills in Elementary School Students

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Abstract

Fundamental movement skills (FMS) support children's motor competence and participation in physical activity, yet schools require structured approaches that provide repeated practice while remaining meaningful within the local context. This study evaluated whether a Traditional Games Festival improved immediate FMS outcomes in elementary school students compared with conventional physical education. A quantitative experimental pretest-posttest control-group design with matched-pairs random assignment involved 108 students in Grades IV-VI from six elementary schools in Bajawa District, Ngada Regency, Indonesia (experimental n = 54; control n = 54). The experimental group completed three weekly festival sessions of approximately 168 minutes each, with seven traditional games organized through station rotation, whereas the control group continued conventional physical education. FMS was assessed using a study-specific composite score for run, hop, horizontal jump, slide, catch, overhand throw, and underhand throw, with performance criteria referenced to the TGMD-3. ANCOVA adjusted posttest scores for baseline FMS. Experimental scores increased from 62.80 ± 5.46 to 84.69 ± 6.33, while control scores increased from 62.47 ± 4.74 to 64.32 ± 5.89. The adjusted group effect was significant, $F(1,105) = 698.127$, $p < .001$, partial $\eta^2 = .869$, with adjusted means of 84.54 and 64.47. The findings support a large immediate between-group difference within this sample. Because the outcome was study-specific, posttesting was immediate, inter-rater reliability was unavailable, and the study lacked formal ethics-committee approval and documented written parental consent, the magnitude and generalizability of the effect should be interpreted cautiously.

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INTRODUCTION

Fundamental movement skills (FMS) comprise locomotor and object-control patterns that children use to move through space, stabilize the body, and interact with objects in play, physical education, and sport. Their relevance extends beyond technical movement performance because motor competence is associated with physical activity and multiple components of health-related fitness during childhood and adolescence (Lubans et al., 2010; Cattuzzo et al., 2016; Jones et al., 2020; Liu et al., 2023; Burton et al., 2023). Longitudinal evidence links childhood motor competence and coordination with later physical activity, fitness, perceived competence, and weight-related outcomes, although these relationships develop along different pathways rather than a single deterministic sequence (Lopes et al., 2011; Barnett et al., 2022). Recent synthesis further indicates that motor competence is related to cognitive and social-emotional outcomes, but these associations should likewise be interpreted cautiously (Hill et al., 2024). For elementary-school physical education, this evidence positions FMS as teachable movement competencies whose development depends on the quality and continuity of opportunities provided to children.

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FMS proficiency does not necessarily reach an optimal level through maturation alone. Children differ in prior movement experience, environmental opportunities, instruction, and the amount of purposeful practice available to them, which can produce substantial variation in motor development (Fumagalli et al., 2022; Hurtado-Almonacid et al., 2024). Systematic reviews show that structured FMS interventions can improve locomotor and object-control skills, particularly when programs provide repeated practice, skill variety, and clear instructional organization (Su et al., 2022; Koolwijk et al., 2024; Zhang et al., 2024). School-based interventions likewise produce positive FMS outcomes, although effect sizes vary across program duration, content, and implementation conditions (Moon et al., 2024; Yin et al., 2025). Evidence from parent-engagement and PE delivery studies also indicates that movement opportunities depend on how practice is organized across settings (Flynn et al., 2023; Tapo et al., 2021; Nopembri et al., 2022). Meta-analytic evidence comparing structured and unstructured approaches further suggests that organization and accumulated practice time influence intervention outcomes (Chen et al., 2024; Yang et al., 2025). These patterns make the design of movement experiences, rather than activity exposure alone, a central issue for school-based FMS development.

Game-based activities provide one way to organize repeated movement practice without separating skills from the situations in which children use them. A meta-analysis of sports-game interventions found better FMS outcomes than control conditions, supporting the instructional potential of games when movement demands are intentionally designed (Sun & Chen, 2024). Similar evidence has emerged from modified invasion games and other school-based programs that require children to run, change direction, receive objects, and make movement decisions in dynamic contexts (Neira-Navarrete et al., 2024; Lin et al., 2022). Systematic reviews of football practice and structured active play also report improvements in several FMS domains (Mao et al., 2022; Liu et al., 2025; Zhang et al., 2025), while comparative work indicates that structured gross-motor practice and outdoor free play should not be treated as identical movement environments (Palmer et al., 2022). Interventions centered on motor-skill practice may also support wider developmental outcomes, but the strength of evidence varies and does not justify assuming that every game produces the same benefits (Jylänki et al., 2022). The pedagogical value of games therefore lies in the movement opportunities they create and how those opportunities are organized, not in the game format by itself.

Traditional games are especially relevant in this context because they combine movement demands with activities that are already recognizable within local social and cultural settings. Indonesian studies have reported positive FMS or gross-motor outcomes from traditional-game interventions, including bebentengan, boy-boyan, engklek, gobag sodor, and boi-boinan (Fauzi et al., 2023; Jannah et al., 2024; Fitri et al., 2024; Afif et al., 2025). Other work has shown that traditional games can be developed as physical-education learning activities and as a means of promoting physical literacy (Gustian et al., 2019; Bile et al., 2021; Sudarwo et al., 2023). These studies support traditional games as plausible instructional resources, but cultural familiarity should not be treated as evidence of effectiveness on its own. The intervention still requires a defined dose, organization, movement focus, and comparison condition if its effect on FMS is to be evaluated. A festival format may offer a useful structure because several games with different movement demands can be delivered repeatedly through station rotation.

Measurement is another important consideration because conclusions about motor improvement depend on what is assessed and how scores are constructed. The TGMD-3 is widely used to evaluate locomotor and ball skills, and studies have reported evidence for its reliability and validity across several populations and scoring applications (Webster & Ulrich, 2017; Magistro et al., 2020; Valentini et al., 2021). Rasch analysis has also shown that TGMD-3 performance criteria vary in difficulty across skills and age groups, reinforcing the need for careful interpretation of criterion-based scores (Valentini et al., 2022). A recent systematic review concluded that several TGMD-3 measurement properties are supported, while also identifying areas in which evidence remains inconsistent or incomplete (Zhu et al., 2025). Indonesian research has likewise emphasized the value of identifying and systematically assessing motor competence in school-age populations as a basis for understanding students' movement profiles (Kusnandar et al., 2021; Apriyani et al., 2018; Mardiansyah et al., 2023). In the present study, these considerations are addressed by describing the outcome explicitly as a study-specific seven-skill composite referenced to TGMD-3 performance criteria rather than as a full TGMD-3 score.

Despite growing evidence for game-based and traditional-game approaches, two gaps remain relevant to the present study. First, prior Indonesian studies have often examined a single game, a small group of games, or designs in which intervention-related change is difficult to separate from ordinary physical-education exposure and repeated testing (Gustian et al., 2023; Supriadi, 2019; Ariyanto et al., 2020). Second, international reviews show considerable heterogeneity in intervention dose, content, setting, and assessment, making it difficult to infer how a short, multi-game package functions when several locomotor and ball-skill demands are combined (Koolwijk et al., 2024; Zhang et al., 2024; Yin et al., 2025). Evidence is therefore more limited for a rotation-based package that exposes the same students to multiple traditional games across repeated sessions and evaluates outcomes against a concurrent control group. Such a design can test whether post-intervention differences remain after baseline FMS is taken into account. It also allows the contribution of a culturally grounded activity package to be examined without claiming that any single game is responsible for the observed change.

The present study evaluated a Traditional Games Festival consisting of seven games, hadang, juru, boy, gebok, gasing, tali merdeka, and moriang, delivered in three weekly station-rotation sessions to elementary-school students in Bajawa District, Ngada Regency. The primary question was whether students who participated in the festival would obtain higher immediate post-intervention study-specific FMS scores than students who continued conventional physical education after baseline performance was controlled. It was hypothesized that the experimental group would show significantly higher adjusted posttest FMS scores than the control group. Methodologically, the study used pretest-based matched pairs followed by random assignment within each pair, providing a stronger comparison than a one-group pretest-posttest design. Practically, the study examines whether several locally meaningful games can be organized as a structured movement package that gives students repeated exposure to locomotor and ball-skill demands. The contribution is therefore located in the intervention structure, comparison design, and explicit boundary placed around the study-specific FMS outcome rather than in claiming novelty for traditional games themselves.

METHOD

Research Design

The study used a quantitative experimental pretest-posttest control-group design with matched-pairs random assignment. Participants first completed an FMS pretest, after which students within each school were paired according to similar baseline scores and randomly allocated within each pair to the experimental or control group. The experimental group then completed three Traditional Games Festival sessions across three consecutive weeks, while the control group continued the physical-education activities normally provided by their schools. The three festival sessions were conducted on November 15, 22, and 29, 2025, at UPTD SD Inpres Beiposo, UPTD SD Inpres Bobou, and UPTD SD Inpres Loboleke, respectively. Both groups completed the same FMS assessment before the intervention and immediately after the three-session period. The design was selected to compare immediate post-intervention FMS performance while controlling statistically for baseline differences.

Table 1. Experimental pretest-posttest control-group design with matched-pairs random assignment

Group	Pretest	Group formation	Condition	Posttest
Experimental	O_1	M-R	X_1-X_2-X_3	O_2
Control	O_3	M-R	C_1-C_2-C_3	O_4

Notes: O_1 and O_3 = FMS pretest; M = matching based on pretest scores; R = random assignment within each pair; X_1-X_3 = three Traditional Games Festival sessions; C_1-C_3 = conventional physical education during the study period; O_2 and O_4 = immediate FMS posttest.

Participants and Group Formation

Participants were 108 students in Grades IV-VI from six elementary schools in Bajawa District, Ngada Regency, East Nusa Tenggara, Indonesia. Each school contributed 18 students, giving a total sample of 108. After the pretest, scores were ranked within each school and students were matched on score proximity, with an approximate maximum difference of 1-2 points within a pair. One student from each pair was randomly assigned to the experimental group and the other to the control group, so each school contributed nine students to each condition. The procedure produced 54 matched

pairs, with 54 students in the experimental group and 54 in the control group. The available study documentation did not provide a broader population sampling frame, formal inclusion or exclusion criteria, or participant age and sex distribution; therefore, these characteristics are not inferred in this manuscript.

Study Variables and FMS Outcome

The independent variable was participation in the Traditional Games Festival, and the primary outcome was the study-specific FMS composite score. In the primary ANCOVA model, posttest FMS was specified as the dependent variable, group as the fixed factor, and pretest FMS as the covariate. The composite covered seven selected skills: run, hop, horizontal jump, slide, catch, overhand throw, and underhand throw. Run, hop, horizontal jump, and slide represented locomotor skills, while catch, overhand throw, and underhand throw represented ball skills. These skills were selected because their movement patterns were salient within the intervention package. The outcome is interpreted only as a composite of these seven assessed skills and not as a measure of the entire domain of motor competence.

FMS Measurement Instrument and Scoring

FMS was assessed using a study-specific composite whose performance criteria were referenced to the Test of Gross Motor Development-Third Edition (TGMD-3) (Ulrich, 2019). Each of the seven skills was evaluated against four performance criteria and performed in two trials. A criterion received a score of 1 when demonstrated and 0 when not demonstrated, producing a maximum raw score of 56 across seven skills, four criteria, and two trials. Raw scores were converted to a 0-100 scale using the formula FMS score = (obtained score / 56) × 100. Before data collection, experts in physical education and educational assessment reviewed the instrument content and performance criteria, and observers were briefed on movement characteristics, the two-trial procedure, application of criteria, and scoring. Because this procedure used only seven selected skills, the resulting score is not the standard, total, or full-battery TGMD-3 score; quantitative inter-rater reliability was not available and is treated as a limitation.

Traditional Games Festival and Control Condition

The same 54 experimental-group students attended all three festival sessions. Each session was scheduled from 08:00 to 10:48, or approximately 168 minutes, comprising about 20 minutes of warm-up, 10 minutes of explanation and organizational instruction, approximately 120 minutes of core festival activities, 10 minutes of cool-down and reflection, and about 8 minutes of closing activities. Across the three sessions, scheduled intervention exposure was approximately 504 minutes. Every session included hadang, juru, boy, gebok, gasing, tali merdeka, and moriang, which were organized into stations with approximately 10-15 minutes allocated to each station before rotation. The activities required combinations of running, stopping, changing direction, lateral movement, jumping, balance and body control, dodging, throwing, catching, and whole-body coordination, but the intervention was not designed as isolated rehearsal of the seven test items. The 54 control-group students did not participate in the festival and continued conventional physical education at their respective schools; detailed control-group lesson content and exposure time were not available in the study records and are therefore not reconstructed.

Table 2. Traditional Games Festival intervention schedule

Session	Location	Date	Experimental participants	Scheduled duration
X_1	UPTD SD Inpres Beiposo	Nov 15, 2025	Same 54 students	≈168 min
X_2	UPTD SD Inpres Bobou	Nov 22, 2025	Same 54 students	≈168 min
X_3	UPTD SD Inpres Loboleke	Nov 29, 2025	Same 54 students	≈168 min

Measurement Procedure and Study Flow

FMS was measured twice using the same administration and scoring procedures: once before group formation and once immediately after completion of the three-session intervention period. At each assessment, students performed the seven skills sequentially, completed two trials per skill, and were scored against the same four dichotomous performance criteria. The pretest was used both as the baseline outcome and as the basis for within-school matching. After matching, random allocation occurred within each pair, followed by three weeks of experimental or control activities. The posttest therefore represents an immediate intervention outcome rather than evidence of long-term

retention or transfer. Figure 1 summarizes the documented study sequence without adding procedures that were not reported in the original study records.

108 Grade IV-VI students from six elementary schools	
↓	
FMS pretest using the seven-skill study-specific composite	
↓	
Within-school matching by pretest-score proximity (54 matched pairs)	
↓	
Experimental group (n = 54)	**Control group (n = 54)**
Three Traditional Games Festival sessions (approximately 504 scheduled minutes)	Conventional physical education at participating schools
↓	
Immediate posttest using the same seven-skill composite	
ANCOVA: posttest FMS adjusted for pretest FMS	

Figure 1. Study procedure and group allocation

Ethical and Institutional Considerations

The researchers coordinated implementation with the participating schools and obtained institutional permission from school principals. Physical-education teachers and school personnel assisted with student supervision during measurement and festival activities. The study did not have a formal ethics-committee clearance number and did not use individually signed written parental informed-consent documents; accordingly, the manuscript does not claim ethics-committee approval or documented written parental consent. Safety procedures included inspection of play areas, supervision by teachers and activity staff at each station, termination of activities when injury risk was identified, and availability of first-aid equipment. These arrangements describe the procedures documented for the study but do not replace the prospective ethics and consent procedures normally expected for research involving minors. This issue is retained transparently as a limitation rather than being reconstructed from unavailable information.

Data Analysis

Data were analyzed using IBM SPSS Statistics version 23. Descriptive statistics included the mean (M), standard deviation (SD), and pretest-posttest change for the overall FMS composite and descriptive scores for the seven individual skills. Shapiro-Wilk tests were used to examine the observed pretest and posttest score distributions, Levene's tests assessed homogeneity of variance, and an independent-samples t test examined baseline equivalence between groups. The primary effectiveness analysis was ANCOVA with posttest FMS as the dependent variable, group as the fixed factor, and pretest FMS as the covariate; the Group × Pretest interaction was used to evaluate the homogeneity-of-regression-slopes assumption. ANCOVA results are reported using F statistics, degrees of freedom, p values, partial eta squared (partial η^2), adjusted means, and model R^2, with statistical significance set at $\alpha = .05$. Paired-samples t tests within each group and an independent-samples t test of gain scores were retained as supporting analyses, with Cohen's dz and Cohen's d reported as effect sizes; residual-based normality diagnostics and cluster-adjusted or pair-adjusted models were not available in the original analysis and are not newly created here.

RESULTS AND DISCUSSION

Results

Complete pretest and posttest data were available for all 108 students, with 54 participants in each group. The experimental group increased from 62.80 ± 5.46 at pretest to 84.69 ± 6.33 at posttest, a descriptive change of 21.89 points. The control group increased from 62.47 ± 4.74 to 64.32 ± 5.89, a change of 1.85 points. The difference in descriptive change between groups was therefore approximately 20.04 points. These values describe the raw score pattern before baseline adjustment and do not replace the primary ANCOVA comparison.

Table 3. Descriptive statistics for overall FMS scores

Group	n	Pretest M ± SD	Posttest M ± SD	Change
Experimental	54	62.80 ± 5.46	84.69 ± 6.33	+21.89
Control	54	62.47 ± 4.74	64.32 ± 5.89	+1.85

Descriptive analysis of the seven component skills showed improvement in every assessed skill for the experimental group. The largest increase was observed for catch (+24.54), followed by hopping (+22.92), slide (+22.69), underhand throw (+21.99), run and overhand throw (both +21.30), and horizontal jump (+18.52). Changes in the control group were smaller, ranging from -0.69 for overhand throw to +3.47 for horizontal jump and slide. These skill-level values were descriptive and were not analyzed as separate inferential outcomes in the reported primary model. Their main value is to show that the overall composite change was not restricted to only one assessed skill.

Table 4. Descriptive changes across the seven FMS

Skill	Exp. Pre	Exp. Post	Δ	Control Pre	Control Post	Δ
Run	63.43	84.72	+21.30	62.73	63.66	+0.93
Hopping	61.81	84.72	+22.92	62.27	65.51	+3.24
Horizontal jump	64.81	83.33	+18.52	62.27	65.74	+3.47
Slide	61.34	84.03	+22.69	63.43	66.90	+3.47
Catch	62.96	87.50	+24.54	62.96	65.28	+2.31
Overhand throw	62.96	84.26	+21.30	62.96	62.27	-0.69
Underhand throw	62.27	84.26	+21.99	60.65	60.88	+0.23

The observed pretest and posttest distributions did not show statistically significant departures from normality in the Shapiro-Wilk tests, with all p values greater than .05. Levene's tests yielded $p = .337$ at pretest and $p = .838$ at posttest. Baseline FMS scores were also similar between the experimental group (62.80 ± 5.46) and control group (62.47 ± 4.74), $t(106) = 0.336$, $p = .737$. The Group × Pretest interaction was not significant, $F(1,104) = 0.097$, $p = .756$, supporting the homogeneity-of-regression-slopes assumption for the reported ANCOVA. These assumption checks support the reported model, although residual normality diagnostics were not available and the Shapiro-Wilk tests reported here concern observed score distributions.

Table 5. Shapiro-Wilk normality test results for observed FMS scores

Group	Measurement	W	p
Experimental	Pretest	0.976	0.360
Experimental	Posttest	0.972	0.235
Control	Pretest	0.966	0.124
Control	Posttest	0.979	0.445

ANCOVA showed a statistically significant group effect on posttest FMS after controlling for baseline performance, $F(1,105) = 698.127$, $p < .001$, partial $\eta^2 = .869$. Pretest FMS was also significantly associated with posttest FMS in the model, $F(1,105) = 149.607$, $p < .001$, partial $\eta^2 = .588$. The full model yielded $R^2 = .892$. Adjusted posttest means were 84.54 for the experimental group and 64.47 for the control group, corresponding to an adjusted difference of approximately 20.07 points. Within the reported model, students who participated in the Traditional Games Festival therefore had substantially higher immediate post-intervention composite scores than students who continued conventional physical education.

Table 6. ANCOVA results for posttest FMS

Source	df	F	p	Partial η^2
Pretest FMS	1,105	149.607	< .001	.588
Group	1,105	698.127	< .001	.869

Table 7. Adjusted posttest FMS means by group

Group	Adjusted posttest mean
Experimental	84.54
Control	64.47

Supporting analyses were consistent with the primary ANCOVA pattern. Within the experimental group, the paired-samples comparison showed a significant pretest-posttest change, $t(53) = 39.739$, $p < .001$, Cohen's $dz = 5.41$. The control group also showed a statistically significant but much smaller change, $t(53) = 3.538$, $p = .001$, Cohen's $dz = 0.48$. The gain-score comparison between groups was significant, $t(106) = 26.371$, $p < .001$, Cohen's $d = 5.08$. Because these effect sizes

are exceptionally large, they are interpreted in the Discussion in relation to task specificity, intervention exposure, and the study-specific measurement approach rather than as population-wide estimates of the effect of traditional games.

Discussion

The primary finding was a large immediate difference in the study-specific FMS composite between students who completed the Traditional Games Festival and those who continued conventional physical education. The difference remained after pretest FMS was entered as a covariate, which strengthens the interpretation that the observed posttest separation was related to the intervention period rather than to an obvious baseline score imbalance. This pattern is consistent with meta-analytic evidence showing that structured FMS and school-based physical-activity interventions can improve children's locomotor and object-control performance (Zhang et al., 2024; Moon et al., 2024; Yin et al., 2025). It also accords with evidence that game-based interventions can produce better FMS outcomes than comparison conditions when games are organized around repeated movement demands (Sun & Chen, 2024). The present study extends that evidence to a short package of seven local traditional games delivered repeatedly through station rotation. The finding should nevertheless be read as evidence for immediate change in the assessed seven-skill composite rather than for generalized motor competence.

One plausible explanation for the experimental group's improvement is the amount and organization of repeated practice. Across three sessions, students received approximately 504 minutes of scheduled festival exposure and repeatedly encountered running, changing direction, jumping, throwing, catching, and body-control demands. Reviews of FMS interventions indicate that structured practice, accumulated exposure, and clear instructional organization are recurring features of effective programs (Koolwijk et al., 2024; Chen et al., 2024). Zhang et al. (2024) similarly found that interventions for typically developing children are generally more effective when they are structured and delivered with sufficient practice opportunities. The festival format may therefore have concentrated multiple movement demands into a relatively intensive short period. However, the study did not measure active movement time within each scheduled session, so the 504-minute figure should not be interpreted as 504 minutes of continuous skill practice. This distinction is important when comparing the present effect with interventions that report objectively measured activity or task-engagement time.

A second explanation concerns practice variation and the functional use of movement skills across different game situations. The seven games did not require identical movement solutions, so students moved between tasks involving locomotion, lateral repositioning, object control, balance, and responses to other players or game constraints. International evidence suggests that different physical-activity programs can affect specific FMS in different ways, with intervention content influencing which skills improve most strongly (Yang et al., 2025). Modified invasion games and football-based practice also support motor competence by embedding locomotor and object-control actions in changing activity environments (Neira-Navarrete et al., 2024; Mao et al., 2022). In the present study, improvement occurred descriptively across all seven assessed skills, with the largest increase in catch and the smallest in horizontal jump. This pattern is compatible with varied practice, but the study did not test whether variation itself mediated the outcome. Repetition, variation, and contextual movement are therefore interpretive mechanisms supported by the intervention structure rather than empirically measured causal mediators.

The use of traditional games adds a contextual dimension to the intervention, but its role should also be stated carefully. Previous Indonesian studies have reported FMS or gross-motor improvements following traditional-game activities, including bebentengan, boy-boyan, engklek, gobag sodor, and related forms of play (Fauzi et al., 2023; Fitri et al., 2024; Afif et al., 2025). Research has also used traditional games as physical-education learning resources and as activities associated with physical-literacy development (Bile et al., 2021; Sudarwo et al., 2023). The present findings are consistent with that literature while differing in intervention structure because seven games were combined into one repeated station-rotation package and evaluated against a concurrent control condition. Cultural familiarity may have supported participation or ease of implementation, but neither cultural identification nor engagement was measured. The study therefore supports

traditional games as usable movement contexts, not the stronger claim that cultural familiarity itself caused the observed FMS improvement.

The magnitude of the reported effect requires particular caution. The ANCOVA group effect was partial η^2 = .869 and the gain-score comparison produced Cohen's d = 5.08, values that are unusually large for school-based motor interventions. One likely contributor is task specificity: the seven assessed skills were selected because they were salient to the movement demands embedded in the festival, which creates close conceptual alignment between intervention activities and the outcome measure. Measurement research on the TGMD-3 shows that skill criteria differ in difficulty and that interpretation depends on the structure and scoring of the instrument (Valentini et al., 2022; Zhu et al., 2025). The present outcome further differed from full TGMD-3 administration because it was a study-specific seven-skill composite, and no quantitative inter-rater reliability estimate was available. These features do not invalidate the between-group difference, but they narrow what the effect size can represent. The effect should therefore not be interpreted as showing that the festival independently explains 86.9% of all motor development or that a similarly large effect would necessarily occur with a broader validated motor battery.

Several design features also limit the precision of causal interpretation despite random assignment within matched pairs. Participants came from six schools and matching occurred within schools, yet the reported ANCOVA treated students as individual observations without a cluster-adjusted or matched-pair model. The available analysis also did not provide detailed exposure time or lesson content for the conventional-PE control condition, so equivalence of instructional dose cannot be established. Control students increased by 1.85 points and may have benefited from ordinary PE, repeated testing, or activity outside school, none of which was measured directly. In addition, the posttest occurred immediately after the three-week intervention, which leaves retention and transfer unknown. These factors suggest that the reported result is strongest as evidence of an immediate group difference under the specific implementation conditions used in the six participating schools. Replication with cluster-aware analysis, better characterization of the comparison condition, and delayed follow-up would provide a more stable estimate of intervention effectiveness.

Within these boundaries, the study contributes a practical model for organizing culturally familiar games as structured movement experiences in elementary physical education. The value of the format lies in combining several games with different movement demands, rotating students through stations, and repeating the package across multiple sessions while retaining explicit measurement of locomotor and ball skills. This organization is compatible with international intervention literature emphasizing purposeful practice and program structure rather than relying on unstructured activity alone (Graham et al., 2022; Chen et al., 2024). For teachers, the findings suggest that traditional games can supplement conventional PE when games are selected according to targeted movement demands, sufficient practice is provided, and safety and assessment procedures are explicit. The intervention should not be interpreted as a replacement for the broader PE curriculum because the study examined only seven skills over three weeks. Its conceptual contribution is narrower: culturally situated games can be organized as a repeatable instructional package and evaluated with a controlled design, while the mechanisms and longer-term transfer remain open questions. Future research should test this format with fuller motor assessments, documented reliability, equivalent comparison doses, delayed retention measures, and prospective ethics and consent procedures.

Limitation

The findings are subject to several limitations that constrain both interpretation and generalization. The intervention lasted only three weeks and posttesting was immediate, so the study does not establish retention, transfer to unassessed motor tasks, or longer-term participation effects. FMS was measured with a study-specific composite of seven selected skills referenced to TGMD-3 performance criteria rather than the full TGMD-3 battery, and quantitative inter-rater reliability was unavailable. The intervention was delivered as one seven-game package, preventing estimation of the contribution of individual games, while activity outside the program, potential between-group contamination, actual active time during sessions, and detailed control-condition exposure were not measured. Participants were drawn from six schools in one geographical area, and the available

records did not provide participant age and sex distribution, a broader sampling frame, formal inclusion or exclusion criteria, or analyses that accounted for school clustering and matched pairs. The study also lacked formal ethics-committee approval and documented individually signed written parental consent, which is a substantive limitation for research involving minors. Future studies should address these issues prospectively rather than attempting to reconstruct unavailable information after data collection.

CONCLUSION

Within this study, students who participated in the three-session Traditional Games Festival achieved substantially higher immediate posttest scores on the study-specific seven-skill FMS composite than students who continued conventional physical education after baseline FMS was controlled. The intervention combined hadang, juru, boy, gebok, gasing, tali merdeka, and moriang in a repeated station-rotation format that exposed students to varied locomotor and ball-skill demands. The result supports the festival as a promising culturally grounded strategy for organizing structured movement practice in elementary physical education. The exceptionally large effect should not be generalized beyond the study conditions because the outcome was task-specific, posttesting was immediate, inter-rater reliability was unavailable, control exposure was incompletely documented, and the analysis did not account for school clustering or matched pairs. The absence of formal ethics-committee approval and documented written parental consent is an additional limitation that should be addressed in any replication. Longer interventions with validated broader outcomes, retention testing, documented scoring reliability, comparable control exposure, and prospective ethical procedures are needed to determine the durability and generalizability of the observed difference.

AUTHOR CONTRIBUTION STATEMENT

YBOT was responsible for conceptualization, methodology, overall supervision, formal analysis, software, and preparation of the original manuscript. **RLB** and **JMR** contributed to methodology, investigation, data curation, and technical support for data analysis. **FR** and **ANK** contributed to investigation, project administration, resources, and visualization.

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