Published Version

JPPI (Jurnal Penelitian Pendidikan Indonesia)
Volume 12, Number 1 2026



Contextual physical education through traditional games: developing students' motor skills in the disaster-prone area

Author Name(s): Ridho Gata Wijaya, Guntur Guntur, Willy Ihsan Rizkyanto, Ebtana Sella Mayang Fitri

Publication details, including author guidelines
URL: https://jurnal.iicet.org/index.php/jppi/about/submissions#authorGuidelines

Article History
Received Sep 12th, 2026
Revised Sep 25th, 2026
Accepted Oct 04th, 2026

How to cite this article (APA)
Wijaya, R.G., Guntur, G., Rizkyanto, W.I., & Fitri, E.S.M. (2026). Contextual physical education through traditional games: developing students' motor skills in the disaster-prone area. Jurnal Penelitian Pendidikan Indonesia, 12(2), 10-18. https://doi.org/10.29210/020267212

The readers can link to article via https://doi.org/10.29210/020267212

SCROLL DOWN TO READ THIS ARTICLE

We are Crossref Member

Indonesian Institute for Counseling, Education and Therapy (as publisher) makes every effort to ensure the accuracy of all the information (the "Content") contained in the publications. However, we make no representations or warranties whatsoever as to the accuracy, completeness, or suitability for any purpose of the Content. Any opinions and views expressed in this publication are the opinions and views of the authors and are not the views of or endorsed by Indonesian Institute for Counseling, Education and Therapy. The accuracy of the Content should not be relied upon and should be independently verified with primary sources of information. Indonesian Institute for Counseling, Education and Therapy shall not be liable for any losses, actions, claims, proceedings, demands, costs, expenses, damages, and other liabilities whatsoever or howsoever caused arising directly or indirectly in connection with, in relation to, or arising out of the use of the content.

JPPI (Jurnal Penelitian Pendidikan Indonesia) is published by Indonesian Institute for Counseling, Education and Therapy comply with the Principles of Transparency and Best Practice in Scholarly Publishing at all stages of the publication process. JPPI (Jurnal Penelitian Pendidikan Indonesia) also may contain links to web sites operated by other parties. These links are provided purely for educational purpose.

This work is licensed under a Creative Commons Attribution 4.0 International License.

Copyright © 2026 by the author(s)

The author(s) whose names are listed in this manuscript declared that they have NO affiliations with or involvement in any organization or entity with any financial interest (such as honoraria; educational grants; participation in speakers' bureaus; membership, employment, consultancies, stock ownership, or other equity interest; and expert testimony or patent-licensing arrangements), or non-financial interest (such as personal or professional relationships, affiliations, knowledge or beliefs) in the subject matter or materials discussed in this manuscript. This statement is signed by all the authors to indicate agreement that the all information in this article is true and correct.

JPPI (Jurnal Penelitian Pendidikan Indonesia)
ISSN: 2502-8103 (Print) | ISSN: 2477-8524 (Electronic)

JPPI (Jurnal Penelitian Pendidikan Indonesia)
ISSN: 2502-8103 (Print) ISSN: 2477-8524 (Electronic)
Vol. 12, No. 2, 2026, pp. 10-18
DOI: https://doi.org/10.29210/020267212



Contextual physical education through traditional games: developing students' motor skills in the disaster-prone area

Ridho Gata Wijaya*), Guntur Guntur, Willy Ihsan Rizkyanto, Ebtana Sella Mayang Fitri
Faculty of Health and Sport Sciences, Universitas Negeri Yogyakarta, Indonesia

Article Info

Article history:

Received Sep 12th, 2026
Revised Sep 25th, 2026
Accepted Oct 04th, 2026

Keyword:

Traditional games,
Contextual physical education,
motor skills,
Disaster-prone areas,
Physical literacy

ABSTRACT

This study aims to analyze the effectiveness of integrating traditional games into contextual Physical Education, Sports, and Health learning for students in the Merapi disaster-prone area. The research design followed a quantitative one-group pretest posttest design as stipulated in the proposal. For the purposes of drafting the manuscript, the analysis used simulated data from 80 students from four schools in Cangkringan. The instrument consisted of six motor aspects with a performance scale of 1–4. Data were analyzed using descriptive statistics, paired-sample t-test, gain score, and Cohen's d. In the simulated data, the average motor score increased from 2.64 to 2.99, with a gain of 0.35 and a significant difference, $t(79) = 11.95$, $p < 0.001$, $d = 1.34$. Student and teacher responses indicated high acceptance. This manuscript presents a more detailed discussion by referring to the physical literacy framework, contextual learning based on local wisdom, and school-based disaster preparedness literature to explain the mechanisms and relevance of the findings. Empirical conclusions should be confirmed using actual field data.

© 2026 The Authors. Published by IICET.
This is an open access article under the CC BY-NC-SA license
(https://creativecommons.org/licenses/by-nc-sa/4.0)

Corresponding Author:

Ridho Gata Wijaya,
Yogyakarta State University,
Email: ridhogatawijaya@uny.ac.id

Introduction

The Special Region of Yogyakarta is characterized by considerable geological vulnerability, particularly due to the activity of Mount Merapi, one of Indonesia's most active volcanoes. Schools located within the Mount Merapi Disaster-Prone Areas (Kawasan Rawan Bencana/KRB) are exposed not only to direct physical hazards but also to disruptions in educational continuity caused by eruptions, temporary relocation, restricted activity spaces, and infrastructure damage. The official disaster-prone area map indicates that substantial parts of northern Sleman Regency are classified as KRB II and III, with exposure to pyroclastic flows, lava flows, and volcanic avalanches (BPPTKG, 2023). The Sleman Regency Medium-Term Development Plan further identifies Cangkringan, Ngemplak, Pakem, and Turi as areas affected by KRB II and/or III, while national education data confirm the presence of numerous elementary and secondary schools across these districts (Sleman Regency Government, 2021; Kemendikdasmen, 2025). Previous evidence from schools in Cangkringan also demonstrates

substantial differences in preparedness between schools registered and not registered as Disaster-Safe Education Units (SPAB), emphasizing the importance of systematic educational adaptation in disaster-prone environments (Kurniawan, Prasetya, & Maharani, 2021). Consequently, Physical Education, Sports, and Health (PJOK) requires adaptive learning strategies that remain feasible under limited facilities and changing environmental conditions.

Physical education is particularly relevant in this context because its educational contribution extends beyond physical fitness to cognitive, social, and affective development (Bailey, Armour, Kirk, Jess, Pickup, & Sandford, 2009). Quality physical education should provide inclusive, contextual, and developmentally appropriate opportunities for students to acquire fundamental movement competencies (UNESCO, 2015). Regular moderate-to-vigorous physical activity is also essential for supporting children's motor development, cardiometabolic health, and psychological well-being, positioning schools as important environments for structured physical activity (World Health Organization, 2020). Nevertheless, conventional physical education frequently emphasizes standardized sports that depend on specific equipment and facilities (Kirk, 2010), which may be difficult to maintain in disaster-prone schools. From a developmental perspective, school-aged children require diverse movement experiences because fundamental motor competence develops progressively before more specialized and complex skills can be mastered (Gallahue & Ozmun, 2006). Therefore, reflective and adaptive pedagogical approaches that utilize movement activities familiar to students are particularly important (Graham, Holt/Hale, & Parker, 2013).

Traditional games provide a potentially appropriate pedagogical alternative because they combine culturally familiar activities with diverse locomotor, non-locomotor, and manipulative movements while requiring relatively simple equipment and spaces. Games such as gobak sodor, engklek, bentengan, and stilts incorporate running, jumping, balancing, changing direction, throwing, and coordinated movements that are directly relevant to fundamental motor development. Empirical evidence increasingly supports their educational value. A systematic review showed that Indonesian traditional games can facilitate gross and fine motor development from preschool through elementary school (Yulianto, Saputra, Satria, & Risyanto, 2025), while traditional-game interventions have demonstrated improvements in fundamental motor skills and learning participation (Fauzi, Suherman, Saptani, Dinangsit, & Rahman, 2023). Similar benefits have been reported for gobak sodor (Febriansyah, Muhtarom, & Agustan, 2024), hopscotch (Darmawati & Widyasari, 2022), and traditional games targeting speed and agility (Pratama, Usra, Sumarni, Iyakrus, & Bayu, 2021). Traditional game models have also been developed to enhance basic locomotor skills (Wijaya & Fitri, 2023). These findings correspond with broader international evidence demonstrating positive effects of structured sports games and physical activity on children's fundamental motor and cognitive development (Sun & Chen, 2024; McDonough, Liu, & Su, 2020; Zeng, Ayyub, Sun, Wen, Xiang, & Gao, 2017).

The relevance of traditional games becomes more distinctive when considered within the educational needs of disaster-prone schools. Children should not be positioned solely as vulnerable populations during disasters; their capacities can also be strengthened through appropriate educational experiences (Peek, 2008). In the Merapi region, educational resilience has been supported through disaster education, technical training, evacuation simulations, and school contingency planning, although implementation continues to face constraints related to infrastructure, financial resources, and trained personnel (Simarmata & Kurniawan, 2026). Comprehensive school safety consequently requires an integrated approach encompassing safe facilities, disaster management, and disaster risk reduction education (Widowati, Koesyanto, Istiono, Sutomo, & Sugiharto, 2023). However, student participation and action-oriented dimensions remain less represented than knowledge-oriented components in school disaster risk reduction programs (Mutanda & Ngcamu, 2026), while cross-subject coordination remains a challenge in integrating disaster education into the Independent Curriculum (Kurniawan, Prasetyo, & Nur Fauziah, 2024). In this regard, physical activities that repeatedly stimulate balance, coordination, agility, strength, and rapid movement responses may complement but should not be interpreted as substitutes for formal disaster preparedness programs. Traditional games are therefore relevant as an adaptive form of PJOK learning that simultaneously addresses students' motor development and the practical constraints experienced by schools in disaster-prone environments.

The pedagogical rationale of this approach is further supported by the concepts of physical literacy and contextual learning. Physical literacy encompasses motivation, confidence, physical competence, and knowledge and understanding as interrelated foundations for lifelong engagement in physical activity (Whitehead, 2010). Traditional games provide diverse movement challenges within socially and culturally meaningful situations and may therefore support physical competence while maintaining students' motivation and confidence, consistent with the multidimensional educational benefits of physical education described by Bailey et al. (2009). From the perspective of contextual teaching and learning, meaningful learning emerges when educational content is connected with students' experiences and surrounding environments (Johnson, 2002; Yudanto & Kurniawan, 2021). Integrating local wisdom through traditional games represents one practical manifestation of this principle in PJOK (Suherman, 2017). Previous studies have demonstrated positive teacher and student acceptance of traditional game-based physical education because of its compatibility with local cultural contexts (Hidayat & Suherman, 2018), while similar approaches have been recognized as relevant for motor learning, pedagogical development, and cultural preservation (Marhani, 2026). This orientation is consistent with the principle of cultural and environmental proximity in Indonesian physical education (Lutan, 2001) and with the flexibility provided by the Independent Curriculum to integrate local content and culture-based learning activities (Kemendikbudristek, 2022).

Despite this growing body of evidence, an important research gap remains. Previous studies have predominantly examined traditional games as interventions for motor development, physical performance, participation, or character formation in general educational settings (Nugroho & Firmansyah, 2020; Hidayat & Suherman, 2018), whereas their integration into contextual PJOK learning within disaster-prone school environments remains insufficiently investigated. In particular, limited evidence connects traditional game pedagogy, physical literacy, contextual learning, and the adaptive educational needs of schools affected by disaster risk. This study addresses this gap by positioning traditional games not merely as motor activities but as culturally grounded, low-resource, and spatially flexible learning strategies appropriate for the distinctive conditions of the Mount Merapi disaster-prone area. Accordingly, the novelty of this study lies in integrating three interrelated dimensions traditional game-based pedagogy, contextual physical education, and school adaptation in disaster-prone environments within a single conceptual and empirical framework. Therefore, this study aims to examine changes in students' motor skills following contextual physical education through traditional games, describe students' and teachers' responses to the learning model, and interpret its pedagogical relevance through the perspectives of physical literacy, contextual learning, and school-based disaster preparedness.

Method

The study was designed using a quantitative approach with a quasi-experimental one-group pretest–posttest design. This design follows the research proposal, which stipulates the measurement of motor skills before and after the treatment of contextual physical education learning based on traditional games. The selection of this design was based on considerations of field feasibility in schools in disaster-prone areas, including the limited number of equivalent comparison schools and ethical considerations not to delay learning interventions in the control group. The locus of the article was narrowed for the needs of manuscript development to the Merapi area in Sleman Regency, with schools in Cangkringan District as examples. The original proposal had a scope of elementary and secondary schools in five districts/cities in the Special Region of Yogyakarta; this narrowing of the locus was a decision for article development and needed to be readjusted to the actual locus of the research.

This simulation used 80 students from four sample schools, 20 students each: Srunen Public Elementary School, Cangkringan 1 Public Elementary School, Cangkringan 1 Public Junior High School, and Cangkringan 2 Public Junior High School. These numbers are not listed in the proposal, but rather a synthetic dataset for testing the article's structure and statistical analysis. School selection refers to the Merapi area framework and the list of official educational units as presented in Table 1, which is compiled to show the variation in levels (elementary, junior high, and senior high) and the distribution of students in several villages affected by the KRB.

Table 1. Example of an educational unit framework in the Merapi area that can be used to determine research locations.

Subdistrict	School	Level	Learners	Year
Cangkringan	Srunen State Elementary School	Elementary School	109	2025
Cangkringan	Watuadeg State Elementary School	Elementary School	106	2025
Cangkringan	Umbulharjo State Elementary School	Elementary School	94	2025
Cangkringan	Pusmalang State Elementary School	Elementary School	147	2025
Cangkringan	Cangkringan 1 State Junior High School	Junior high school	376	2025
Cangkringan	Cangkringan 2 State Junior High School	Junior high school	288	2025
Cangkringan	Cangkringan 1 Senior High School	Senior high school	423	2025
Grip	Tawangharjo State Elementary School	Elementary School	60	2025
Grip	Srowolan State Elementary School	Elementary School	99	2025
Grip	Turen State Elementary School	Elementary School	60	2025
Grip	Experimental State Elementary School 3	Elementary School	335	2025
Grip	Pakem 1 State Elementary School	Elementary School	156	2025

The instrument uses six motor skills on a scale of 1–4: coordination, balance, agility, strength, precision, and rhythm. The selection of these six skills refers to the classification of basic motor skills that distinguishes between locomotor, non-locomotor, and manipulative components (Gallahue & Ozmun, 2006), and is in line with the performance observation-based assessment approach used in standardized instruments such as the Test of Gross Motor Development (Ulrich, 2000). The proposal outlines performance-based assessment as the assessment technique for all these skills, in line with the child movement assessment approach recommended by Graham, Holt/Hale, and Parker (2013), which emphasizes direct observation over a single standardized test to capture the variation in movement competencies of elementary and junior high school-aged children. The proposal also plans to test content validity through expert judgment by physical education lecturers and inter-rater reliability using two trained observers per measurement session.

The learning intervention is structured through a series of traditional games that emphasize basic movement variations, changes of direction, balance, cooperation, and accuracy, with the games mapping to the target motor aspects as presented in Table 2. The proposal plans to implement the learning over several meetings during regular PJOK class hours, with game rotation arrangements so that each motor aspect receives proportional emphasis. The frequency and intensity of activities in the intervention design refer to the recommendations for physical activity for school-aged children compiled by WHO (2020), which recommends regular and structured moderate-to-vigorous intensity physical activity. The structure of each session follows the stages of warm-up, the main game with gradual instructions (scaffolded instruction), and end-of-session reflection, as an adaptation of the principles of reflective learning proposed by Graham et al. (2013).

Table 2. Mapping of traditional games to the target motor aspects and focus of the learning session.

Game	Main Motor Aspects	Elements of Motion	Session Focus
Gobak Sodor	Agility, cooperation	Run, dodge, keep the line	Rapid change of direction & group strategy
Fortress	Agility, strength	Running, touching opponent, short sprint	Reaction speed & explosive power
Hopscotch	Balance, precision	One-legged jump, throwing the gacuk	Static-dynamic balance control
stilts	Balance, strength	Walking on bamboo slats	Leg strength & dynamic balance
Simple throw and catch	Accuracy, coordination	Throwing, catching, aiming at the target	Eye-hand coordination

Operational definitions covered six motor indicators: coordination, balance, agility, strength, accuracy, and rhythm. Data collection included observer training, pretest, traditional game-based learning, posttest, and response questionnaires. Data were analyzed using descriptive statistics, normality tests, paired-sample t-tests, gain scores, and Cohen's d, with the Wilcoxon test applied when normality assumptions were not met and significance set at $p<0.05$ (Cohen, 1988). Standardized assessment procedures were used to minimize observer bias and threats to internal validity. Field notes and photo/video documentation supported quantitative findings, while ethical approval, informed consent, safety procedures, and coordination with the Regional Disaster Management Agency regarding Mount Merapi's alert status were incorporated into the research procedures (Simarmata & Kurniawan, 2026).

Results and Discussions

In the simulation dataset, 80 students had an average pretest score of 2.64 (SD=0.40) and a mean posttest score of 2.99 (SD=0.43). The average increase was 0.35 points, equivalent to a relative increase of approximately 13.3% compared to the initial score. This pattern indicates a direction of change consistent with the intervention objectives formulated in the proposal.

The Shapiro-Wilk normality test on the simulated gain data showed no significant deviation from a normal distribution, thus the use of a paired-sample t-test as the primary test was statistically sound. A paired-sample t-test on the simulated data showed a significant difference between pretest and posttest scores, $t(79) = 11.95$, $p<0.001$. The 95% confidence interval for the mean gain was 0.29–0.41, while Cohen's d=1.34, which, according to Cohen (1988), is considered a large effect size. As a sensitivity check, the Wilcoxon test also yielded $p<0.001$, confirming the directional consistency of the results between the parametric and nonparametric methods. A summary of scores per school is presented in Table 3.

Table 3. Descriptive statistics of pretest and posttest motor scores on simulation data.

Group	n	Pretest M±SD	Posttest M±SD	Gain M
Cangkringan 1 Public Elementary School	20	2.56±0.39	2.88±0.44	0.32
Srunen State Elementary School	20	2.65±0.46	2.98±0.46	0.32
Cangkringan 1 State Junior High School	20	2.66±0.34	3.06±0.46	0.40
Cangkringan 2 State Junior High School	20	2.69±0.43	3.05±0.39	0.36
Total	80	2.64±0.40	2.99±0.43	0.35

At the school level, the four sample schools showed average gains ranging between 0.32 and 0.40 points, with the highest gains in the two junior high schools. This pattern is descriptive of the simulated data and cannot be interpreted as a systematic difference between levels without further statistical testing on actual data. As an additional note, the four sample schools were selected to represent a variety of educational levels (elementary and junior high) that are all located in Disaster-Prone Area III. Therefore, comparisons of gains between schools in the next stage should ideally take into account the length of time the school has been registered as a Disaster-Safe Education Unit, given that this status has been shown to be associated with the overall level of school preparedness (Kurniawan, Prasetya, & Maharani, 2021).

Table 4. Average changes in six motor aspects in simulation data.

Aspect	Pretest	Posttest	Ascension
Coordination	2.67	2.96	0.29
Balance	2.58	2.89	0.31
Agility	2.62	3.02	0.40
Strength	2.71	3.10	0.39
Accuracy	2.62	2.94	0.31
Rhythm	2.62	3.02	0.40

Average changes in motor skill levels are presented in Table 4. Increases were seen across all motor skills, with the greatest changes in agility and rhythm (0.40 points each), followed by strength (0.39), balance (0.31), accuracy (0.31), and coordination (0.29). Read in terms of relative increases to the pretest score, agility and rhythm showed the highest relative increases (approximately 15% each), followed by strength (~14%), balance and accuracy (~12%), and coordination (~11%). The pattern of changes in these six skills is visualized in Figure 1.

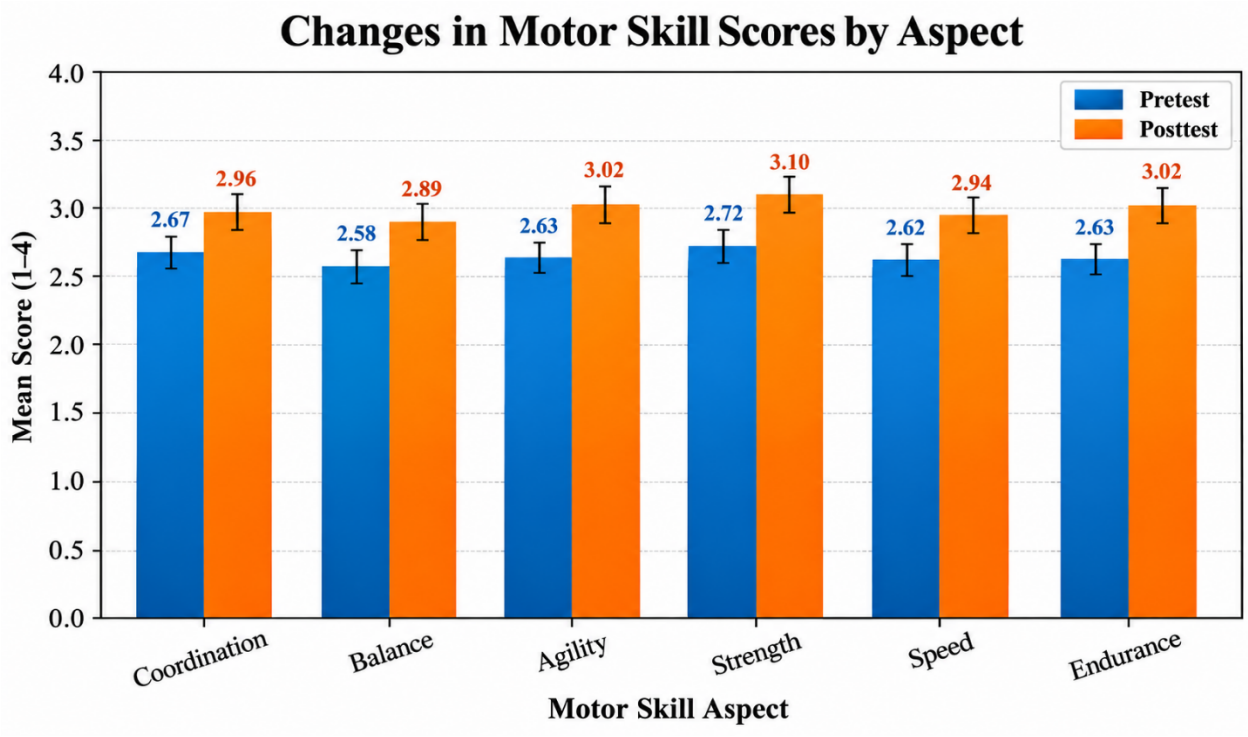

Figure 1. Changes in the average scores of six aspects of motor skills in the simulation data.

Table 5. Responses to learning on simulation data.

Respondents	n	Average
Learners	80	4.35/5
Teacher	8	4.59/5

The responses of students and teachers to the simulation dataset were also in the high category, as summarized in Table 5. The average student response was 4.35/5, while the average teacher response was 4.59/5. The indicators that most frequently received high scores were student engagement, the suitability of the activity to the PJOK material, and the ease of game adaptation.

The findings indicate a consistent improvement across all six motor skill components following the implementation of traditional game-based physical education, with particularly notable changes in agility and strength. Although the effect size observed in the simulation dataset (Cohen's d = 1.34) exceeded the pooled effect reported by Sun and Chen (2024) (standardized mean difference = 0.30), this difference should be interpreted cautiously because simulated data do not capture the variability and measurement error inherent in actual educational settings. Nevertheless, the direction of improvement is consistent with previous studies demonstrating that traditional games contribute positively to fundamental and gross motor development (Fauzi et al., 2023; Febriansyah et al., 2024; Darmawati & Widyasari, 2022; Yulianto et al., 2025; Pratama et al., 2021). The relatively greater improvement in agility and strength is also biomechanically plausible because games such as gobak sodor and Bentengan involve repeated acceleration, deceleration, and directional changes, whereas stilts require lower-limb strength and dynamic postural control. The slightly greater gains observed among junior high school students may additionally reflect more mature motor control and greater capacity to respond to complex movement instructions (Gallahue & Ozmun, 2006; McDonough et al., 2020), although differences between educational levels require confirmation using actual field data.

The observed changes can be conceptually explained through the physical literacy and contextual learning frameworks. Traditional games expose students to repeated and varied movement challenges involving balance, coordination, rapid directional changes, accuracy, and responses to environmental cues while maintaining an enjoyable and socially interactive learning environment. Such experiences may strengthen physical competence while simultaneously supporting motivation and confidence, which constitute central dimensions of physical literacy (Whitehead, 2010). This interpretation is consistent with Bailey et al. (2009), who emphasized that the educational benefits of physical education extend beyond technical competence to broader psychological and social outcomes. Furthermore, contextual learning emphasizes connecting educational experiences with students' cultural and environmental realities (Johnson, 2002; Yudanto & Kurniawan, 2021). Previous research has demonstrated the potential of traditional games to improve locomotor skills, cooperation, and acceptance of physical education learning (Wijaya & Fitri, 2023; Hidayat & Suherman, 2018; Marhani, 2026). Their low equipment requirements, spatial flexibility, and cultural familiarity further reinforce their suitability as local wisdom-based learning resources (Suherman, 2017; Lutan, 2001), particularly in educational environments where access to standardized sports facilities may be disrupted.

The contribution of this approach becomes particularly relevant when situated within disaster-prone school environments. International evidence demonstrates that structured play and physical activity generally improve children's fundamental motor competence (Sun & Chen, 2024; Zeng et al., 2017), while Indonesian studies specifically support the effectiveness of traditional games (Fauzi et al., 2023; Yulianto et al., 2025). However, these two bodies of literature have rarely addressed traditional games within the specific constraints of disaster-prone schools. Children in disaster contexts should be viewed not only in terms of vulnerability but also in terms of capacities that can be developed through education (Peek, 2008). Competencies such as balance, agility, coordinated movement, and rapid responses to instructions may be relevant to situations requiring physical mobility; nevertheless, improved motor competence should not be interpreted as direct evidence of disaster preparedness. School preparedness is shaped by broader institutional factors, including Disaster-Safe Education Unit status (Kurniawan, Prasetya, & Maharani, 2021), student participation in disaster risk reduction (Mutanda & Ngcamu, 2026), curriculum integration (Kurniawan, Prasetyo, & Nur Fauziah, 2024), and comprehensive school safety systems (Widowati et al., 2023). Thus, traditional game-based PJOK should be positioned as a complementary educational strategy rather than a substitute for formal disaster mitigation and preparedness programs.

Beyond motor development, the findings have pedagogical, cultural, and practical implications. Reintroducing gobak sodor, engklek, Bentengan, and stilts through structured physical education may simultaneously provide movement stimulation and strengthen students' exposure to local cultural heritage (Suherman, 2017; Marhani, 2026). This function is particularly relevant in communities

affected by relocation and post-disaster changes that may disrupt established social and cultural practices. Effective implementation, however, depends on teacher readiness and institutional support. PJOK teachers require the capacity to modify learning duration, location, and activities according to changing environmental and disaster-alert conditions (Graham et al., 2013), while local wisdom-based professional development can strengthen teachers' ability to implement culturally responsive learning (Suherman, 2017; Hidayat & Suherman, 2018). These implications are also consistent with the broader disaster risk reduction agenda, in which educational activities can complement formal preparedness initiatives (Mutanda & Ngcamu, 2026; Widowati et al., 2023). Nevertheless, structural mitigation, evacuation exercises, contingency planning, and formal disaster education remain indispensable components of school preparedness (Simarmata & Kurniawan, 2026). Traditional games should therefore be embedded within, rather than positioned as an alternative to, a comprehensive disaster-resilient school ecosystem.

The findings should ultimately be interpreted in light of several methodological limitations. The one-group pretest–posttest design cannot fully exclude maturation, repeated-testing effects, or other confounding influences; the limited number of schools restricts generalizability across different KRB levels, educational stages, and socioeconomic contexts; and performance-based assessment remains susceptible to observer subjectivity unless content validity and inter-rater reliability are rigorously established. More importantly, disaster preparedness was not directly measured, preventing causal inference between improved motor competence and preparedness, and the present findings remain based on simulated rather than actual field data. Future research should therefore employ comparison groups, validated observational measures, larger and more diverse samples, and direct indicators of disaster preparedness while examining cultural preservation and social cohesion as additional outcomes. Methodologically, combining paired-sample t-tests with Wilcoxon tests may provide a useful robustness check when sample sizes are limited and distributional assumptions are uncertain. Despite these constraints, the study offers an integrative framework linking traditional game pedagogy, physical literacy (Whitehead, 2010), contextual learning (Johnson, 2002; Suherman, 2017), and school-based disaster preparedness (Peek, 2008; Kurniawan et al., 2021; Mutanda & Ngcamu, 2026), thereby extending traditional game research from general motor development toward culturally responsive and context-sensitive physical education in disaster-prone settings.

Conclusions

The integration of traditional games into contextual physical education learning has a strong pedagogical and conceptual basis for implementation in schools in disaster-prone areas of Mount Merapi. In the simulation dataset, motor skills increased from an average of 2.64 to 2.99, with statistically significant differences across all six measured aspects, and traditional games received positive responses from students and teachers. These findings strengthen the argument that traditional game-based learning can be an adaptive, affordable, and culturally relevant alternative when standard sports facilities are limited, while also providing an indirect contribution to basic physical competencies relevant to the context of disaster-prone preparedness.

However, all figures in this manuscript are still simulated because the available proposal does not include actual field data. Articles should not be submitted as research results until the participant dataset, pretest–posttest results, teacher/student responses, and school information are replaced with data actually collected during the study. By confirming actual field data and implementing the methodological recommendations outlined, this research framework is expected to make a real contribution to the development of adaptive physical education and health learning in schools in other disaster-prone areas in Indonesia.

References

Bailey, R., Armour, K., Kirk, D., Jess, M., Pickup, I., Sandford, R., & BERA Physical Education and Sport Pedagogy Special Interest Group. (2009). The educational benefits claimed for physical education

and school sport: An academic review. Research Papers in Education, 24(1), 1–27.
Geological Disaster Technology Research and Development Agency (BPPTKG). (2023). Map of Mount Merapi disaster-prone areas. Ministry of Energy and Mineral Resources.
Cohen, J. (1988). Statistical power analysis for the behavioral sciences (2nd ed.). Lawrence Erlbaum Associates.
Darmawati, NB, & Widyasari, C. (2022). Traditional hopscotch games in improving gross motor skills in early childhood. Jurnal Obsesi: Jurnal Pendidikan Anak Usia Dini, 6(6), 6827–6836.
Fauzi, RA, Suherman, A., Saptani, E., Dinangsit, D., & Rahman, AA (2023). The impact of traditional games on fundamental motor skills and participation in elementary school students. International Journal of Human Movement and Sports Sciences, 11(6), 1368–1375.https://doi.org/10.13189/saj.2023.110622
Febriansyah, H., Muhtarom, D., & Agustan, B. (2024). The effect of the traditional game gobak sodor on improving gross motor skills in fourth-grade students of SDN 1 Cipedes. Indonesian Education Star Journal, 2(4), 344–354.https://doi.org/10.55606/jubpi.v2i4.3315
Gallahue, D. L., & Ozmun, J. C. (2006). Understanding motor development: Infants, children, adolescents, adults (6th ed.). McGraw-Hill.
Graham, G., Holt/Hale, S. A., & Parker, M. (2013). Children moving: A reflective approach to teaching physical education. McGraw-Hill.
Hidayat, T., & Suherman, A. (2018). Development of a physical education learning model based on traditional games. Journal of Physical Education and Sports, 3(2), 120–128.
Johnson, E. B. (2002). Contextual teaching and learning: What it is and why it's here to stay. Corwin Press.
Ministry of Education, Culture, Research, and Technology. (2022). Independent Curriculum for Primary and Secondary Education. Ministry of Education, Culture, Research, and Technology.
Ministry of Elementary and Secondary Education. (2025). Basic Education Data (Dapodik) of Sleman Regency. Ministry of Elementary and Secondary Education.
Kirk, D. (2010). Physical education futures. Routledge.
Kurniawan, FA, Prasetya, JD, & Maharani, YN (2021). School preparedness in facing the Mount Merapi eruption disaster: a case study at SMP Negeri 2 Cangkringan and SMP Sunan Kalijogo Cangkringan, Sleman Regency. KONSTELLASI: Convergence of Technology and Information Systems, 1(1), 155–167.https://doi.org/10.24002/konstellasi.v1i1.4310
Kurniawan, FA, Prasetyo, AB, & Nur Fauziah, R. (2024). Challenges and strategies for disaster education in the Independent Curriculum. Journal of Management Science Publication (JUPIMAN), 3(1), 143–150.https://doi.org/10.55606/jupiman.v3i1.3274
Lutan, R. (2001). Principles of physical education. Ministry of National Education.
Marhani, M. (2026). Traditional games as a local wisdom-based physical education learning strategy for PGSD students. MASALIQ, 6(4), 1465–1482.https://doi.org/10.58578/masaliq.v6i4.10366
McDonough, D. J., Liu, W., & Su, X. (2020). Effects of physical activity on children's motor skill development: A systematic review of randomized controlled trials. Sports Medicine, 50, 189–204.
Mutanda, G. W., & Ngcamu, B. S. (2026). Disaster risk reduction in schools: A systematic review of the implementation strategies and challenges. Frontiers in Sustainability, 7, Article 1795059.https://doi.org/10.3389/frsus.2026.1795059
Nugroho, A., & Firmansyah, H. (2020). Traditional games as a means of developing children's motor skills. Journal of Sports Education, 9(1), 45–54.
Peek, L. (2008). Children and disasters: Understanding vulnerability, developing capacities, and promoting resilience—An introduction. Children, Youth and Environments, 18(1), 1–29.
Sleman Regency Government. (2021). Regional Medium-Term Development Plan (RPJMD) of Sleman Regency 2021–2026. Sleman Regency Government.
Pratama, MARP, Usra, M., Sumarni, S., Iyakrus, I., & Bayu, WI (2021). The effect of traditional games on improving speed and agility. Journal of Sport Coaching and Physical Education, 6(2), 77–86.
Simarmata, RP, & Kurniawan, FA (2026). The role of the Regional Disaster Management Agency in strengthening educational resilience through a preparedness program for Mount Merapi eruptions in Sleman Regency. Journal of National Resilience.
Suherman, A. (2017). Implementation of local culture-based physical education learning. Cakrawala Pendidikan, 36(2), 314–325.
Sun, S., & Chen, C. (2024). The effect of sports game intervention on children's fundamental motor skills:

A systematic review and meta-analysis. Children, 11(2), 254.https://doi.org/10.3390/children11020254
Ulrich, D. A. (2000). Test of Gross Motor Development (2nd ed.). PRO-ED.
UNESCO. (2015). Quality physical education: Guidelines for policy makers. UNESCO.
Whitehead, M. (2010). Physical literacy: Throughout the life course. Routledge.
Widowati, E., Koesyanto, H., Istiono, W., Sutomo, AH, & Sugiharto. (2023). Disaster preparedness and school safety as a conceptual framework of comprehensive school safety. SAGE Open, 13(4).https://doi.org/10.1177/21582440231211209
Wijaya, RG, & Fitri, ESM (2023). Traditional game based on e-learning method to improve the basic locomotor movements. Indonesian Journal of Physical Education, 19(1), 14–21.https://doi.org/10.21831/jpji.v19i1.73698
World Health Organization. (2020). WHO guidelines on physical activity and sedentary behavior. World Health Organization.
Yudanto, Y., & Kurniawan, R. (2021). Contextual learning model in physical education. Journal of Sports, 9(1), 1–12.
Yulianto, AG, Saputra, YM, Satria, T., & Risyanto, A. (2025). Traditional Indonesian games as a medium for enhancing gross and fine motor skills in preschool children: A systematic literature review. Journal of Physical Education Health and Sport, 12(2).https://doi.org/10.15294/jpehs.v12i2.36811
Zeng, N., Ayyub, M., Sun, H., Wen, X., Xiang, P., & Gao, Z. (2017). Effects of physical activity on motor skills and cognitive development in early childhood: A systematic review. BioMed Research International, 2017, Article 2760716.https://doi.org/10.1155/2017/2760716