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Implementation of Game Models to Improve Coordination of Children Participating in Traditional Sports Extracurricular Activities

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Abstract

Motor coordination is an essential component of adolescent physical development; however, traditional sports extracurricular programs often employ repetitive and less structured training methods that limit optimal motor skill development. This study aimed to determine the effectiveness of a game-based learning model in improving motor coordination among students participating in traditional sports extracurricular activities. The study used a one-group pretest-posttest design and a quasi-experimental methodology. Purposive sampling was used to choose 30 students between the ages of 15 and 17. Over the course of four weeks, observations, documentation, and motor coordination tests (hand-eye and foot-eye coordination) were used to gather data. Descriptive statistics and the paired sample t-test were used to analyze the data. The mean scores for hand-eye coordination and foot-eye coordination increased from 14,37 to 17,37 and 3,03 to 3,67, respectively, according to the data. The results of the hypothesis test indicate a significance level of 0,000 ($p<0,05$), which indicates a significant difference between the pre-test and post-test. In addition, the effect size indicates a large category for hand-eye coordination ($d=0,88$) and a medium category for foot-eye coordination ($d=0,72$). In conclusion, the game-based learning model can be used as a creative strategy in conventional sports extracurricular programs and is successful in enhancing students' motor coordination.

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INTRODUCTION

The lack of improvement in motor coordination in children who participate in traditional sports extracurricular activities is a significant problem in fostering physical activity in schools. In fact, various studies have shown that traditional sports and game-based activities can improve basic motor skills if designed systematically (Figueiredo et al., (2025), (2025); Intani et al., (2025); Trongjitpituk, (2024); Vandorpe et al., (2012). In practice, traditional sports extracurricular activities still tend to use repetitive and less varied training patterns, so they are not fully able to accommodate students' motor development needs optimally. As a result, children experience delays in mastering coordination skills, low self-confidence, lack of active participation, and decreased motivation during training (Caçola, (2016); Farhat et al., (2015); K. Kane & Bell, (2009); KJ Kane & Staples, (2016); Sujatha, Somasundaram, Alagesan, & Vikram Adhitya, (2022).

The findings of Sgrò et al. (2022) even confirmed that an unstructured learning approach can hinder the development of children's motor skills To overcome this, innovative ideas are needed in the form of developing a game-based learning model that is more interesting, adaptive, and directly stimulates coordinative skills . The urgency of developing this new approach is very high because motor coordination is an important foundation for physical activity performance and the formation of an active lifestyle at school age Through improving the training system, traditional sports extracurricular activities can provide a more optimal contribution to children's motor development and learning experiences, Rachmawati, Muhyi, & Wiyarno, (2020).

Various previous studies have shown that traditional games and game-based models are highly effective in improving children's motor skills Bakti et al., (2023) examined the integration of traditional games into physical education for 10–11-year-old students and found significant improvements in physical fitness and vestibular stabilization. Another study by Kusuma & Sudijandoko, (2022) evaluated a traditional game intervention in first-grade elementary school students and reported significant improvements in motor skill components, including agility and balance. Julio, Pradana, & Zawawi, (2025) developed a Game-Based Motor Coordination (GBMC) model and demonstrated that this approach improves motor coordination, particularly lateral movement and eye-hand coordination. Similar findings were reported by Cahya, Zakaria, & Kurnia, (2022), who demonstrated that an eight-week game-based intervention resulted in consistent improvements in motor coordination in early childhood. Zhang et al., (2025) examined the use of augmented reality (AR) in balance training and found that the technology increased engagement and effectiveness of coordination training. Research by Palangkara, n.d expanded on these findings by showing that traditional games like Gobak Sodor improve not only physical but also social skills. Overall, these findings confirm that game-based approaches, both traditional and technology-based are effective in improving children's motor coordination, fitness, and social development. Irmansyah, Lumintuarso, Sugiyanto, & Sukoco, (2020); Prabowo, (2025); Purwanto, Sianto, & Perdana, (2025); Tanja, Bartol, & Dario, (2023); Thuc, Hieu, Suong, & Bang, (2024).

Motor coordination can be understood as an individual's ability to coordinate sensory functions and body movements to produce controlled, precise, and efficient physical activity. At school age, this ability develops through movement experience, practice, and interaction with the physical and social environment. This ability involves various components such as balance, agility, eye-hand coordination, eye-foot coordination, movement rhythm, and the ability to change direction (lateral movement). In school-age children, motor coordination develops along with neurological maturity, movement experience, and exposure to structured physical activity. Good coordination enables children to perform complex motor tasks, such as catching a ball, jumping, or running while changing direction.

Experts state that motor coordination is an important foundation for mastering sports skills because it plays a role in movement efficiency, , injury prevention, and increasing children's confidence in physical activity Liu, Ren, Shi, Du, & Zhao, (2009); Mota, Afonso, Sá, & Clemente, (2022); Mota et al., (2022); Selvakumar, Xin, & Vasu, (2025).

Research shows that traditional game activities and game-based learning models can significantly improve the quality of motor coordination because they require spontaneous movement responses, problem solving, and social interaction (Okilanda, Utama, & Putra, (2025) .

Cognitively, these games train quick decision-making, strategy, and problem-solving skills (Irmansyah et al., (2020); Kuswanto & Rahmat, (2024); Nasrulloh, Hermawan, &

Ihsan, (2024); Thuc et al., (2024) . Therefore, traditional games are a potential medium in physical education because they provide authentic, meaningful, and child-specific learning experiences.

The game-based learning (GBL) model is an approach that places play at the core of the learning process to achieve learning objectives. GBL is based on constructivism theory, which emphasizes that children construct knowledge through real-life experiences, social interactions, and problem-solving. In the context of physical education, this model helps students develop motor skills through fun, challenging, and variable play situations. Compared to conventional methods that often focus on direct instruction and repetitive practice, GBL offers advantages in the form of increased intrinsic motivation, creativity, active engagement, and the ability to transfer skills to real-life situations. (Azmi, Baharudin, Ahmad, & Diah, (2024); Nahar & Storey, (2023) . Traditional games are highly relevant in this approach because they naturally stimulate motor coordination components such as balance, agility, reaction time, and eye-hand coordination through dynamic and unpredictable play situations. Thus, the combination of traditional games and game-based learning models is an effective strategy for developing children's motor coordination holistically. Extracurricular activities at the high school level are non-formal educational activities held outside of class hours to broaden students' potential, interests, and talents. In the context of traditional sports, extracurricular activities serve as a forum for developing physical abilities, strengthening character, and preserving local culture through competitive and collaborative game activities. The goals of physical development in these activities include improving physical fitness, mastering motor skills, and instilling the values of sportsmanship and discipline. Learning in extracurricular activities is more flexible than formal classes, allowing for a variety of training models that emphasize hands-on experience, movement exploration, and social interaction. However, the effectiveness of the training depends heavily on the program design, the quality of the trainer, and the suitability of the methods to the characteristics of the students. Damayani, Saepudin, Budiono, & Rachmawati, (2019); Damayani et al., (2019); Hananingsih, Isnaini, & Irmansyah, (2024); Huda, Widodo, & Aseri, (2024);Tripathi, (2024).and synthetic surfaces (Çımenlı et al., 2016). Therefore, appropriate learning design is a key factor in the success of traditional sports extracurricular activities.

In practice, many extracurricular sports activities still face several problems, such as monotonous, lack of variety,and unstructured training patterns. Training often focuses solely on movement repetition or drilling without a pedagogical approach that encourages creativity, problem-solving, and active student participation. This situation can reduce motivation, hinder the development of coordinative skills, and limit meaningful learning experiences. . In this context, game-based learning models offer a more effective alternative because they are able to integrate competitive elements, challenges, and movement variations in a game format relevant to traditional sports. This approach has been shown to improve the quality of interaction, physical engagement, and motor skill development through dynamic and stimulus-rich game conditions (Akil, Top, Güngör, & Bek, (2025); Caldas, Mauledoux, Aviles, & Rodriguez-Guerrero, (2023); Mace et al., (2017); Tanja et al., (2023). Therefore, this study seeks to strengthen the effectiveness of traditional extracurricular sports programs through the implementation of a more systematic and adaptive game-based model.

Although various previous studies have shown that traditional games and game-based models can improve children's motor skills, these studies generally focused on the context of physical education learning in the classroom or on short-term interventions. Few studies have specifically explored the effectiveness of game-based models for improving motor coordination in traditional extracurricular sports activities, which have different characteristics, motivational dynamics, and participation patterns than formal learning. The novelty of this research lies in the development of a motor coordination model adapted specifically for extracurricular contexts, taking into account the need for varied movement stimulation, a more flexible learning environment, and broader opportunities for motor exploration. This research also contributes to the achievement of SDG 3 (Good Health and Well-being). and SDG 4 (Quality Education) by providing an approach that promotes safe, enjoyable, inclusive, and culturally based physical activity. Thus, this research not only strengthens the literature on motor coordination but also offers a practical model that schools can implement. Research question: How effective is the game-based model in improving the motor coordination of children participating in traditional sports extracurricular activities?.

METHOD

This study employed a quasi -experimental approach with a one-group pretest–posttest design. This design was chosen because it fits the school context, where researchers cannot perform strict random assignment but can still compare changes in abilities before and after treatment Referring to the thinking of Lemons, Fuchs, Gilbert, & Fuchs (2014); López et al. (2020) quasi-experimental designs are effective in educational research because they can provide a limited picture of causality through repeated measurements, while maintaining control of the natural learning environment. This design was also chosen based on the research need to test the impact of the intervention directly, measurably, and systematically without having to disrupt the existing extracurricular structure Thus, this design facilitates the analysis of changes in motor coordination while allowing the intervention to be realistically implemented in the school context (Handley, Lyles, McCulloch, & Cattamanchi, 2018); Lee, 2024).

The research procedure is structured into four main steps, namely: including coordination with the school, instrument validation, and training of trainers/observers namely initial measurement of participants' motor coordination abilities using standardized instruments, in the form of implementing a game-based learning model during several extracurricular practice sessions; and namely a repeat measurement to see if there is an increase in coordinative ability. Each step is focused on ensuring a systematic process, from instrument preparation to analysis of changes in learning outcomes. Research procedures must be designed sequentially and logically to produce valid, comparable data.Satria et al., (2024).

Participants in this study were 30 students who participated in traditional sports extracurricular activities at State Senior High School 1 Majalaya, with an age range of 15–17 years , consisted of 15 boys and 15 girls, . All participants came from the Bandung Regency area and had been actively enrolled as extracurricular activity members for at least one semester. The selection of participants used a purposive sampling technique, because the study required subjects with specific characteristics, namely having experience practicing traditional sports but showing variations in motor coordination abilities. Demographic information was collected to ensure the diversity of student characters that could provide a complete picture of the effectiveness of the intervention. Referring to Campbell et al., (2020) . purposive sampling is appropriate when researchers need individuals who truly represent the research objectives. Thus, the selected participants are relevant to evaluate the impact of game-based models on motor coordination development in extracurricular contexts. Cenizo-Benjumea, Gálvez-González, Ramírez-Lechuga, & Ferreras-Mencía, (2024); Terrazzo-Luna et al., (2024). Data collected included motor coordination scores from the test instrument, observation notes during the intervention, and documentation of participant activities. The data collection process was carried out by the researcher together with two trained observers to ensure consistency of recording. Referring to the opinion of Bender, (2007); Yamada et al., (2022) . a sufficiently long data collection period allows researchers to capture changes in participant performance more consistently and reduce situational bias. Therefore, a four-week duration is considered ideal for providing training stimuli while measuring the results of motor coordination improvements that occur naturally during the game-based training process. Satria et al., (2024). The research instrument used for data collection in this study was a test. The instrument used in this study was an instrument compiled by Subagyo Irianto, et al. which had a validity of 0.779 and a reliability of 0.559.1 (Vocational High School & City, 2023).

RESULTS AND DISCUSSION

Table 1. Descriptive Test

	N	Min	Max	Mean	Standard Deviation
Eye-Hand Pre-test	30	6	20	14.37	3,399
Ankle and Foot Pre-test	30	2	4	3.03	0.890
Eye-Hand Posttest	30	10	24	17.37	3,810
Ankle Posttest	30	3	4	3.67	0.479

Table 1, it is known that all 30 participants took the pre-test and post-test. The analysis results showed an increase in the average scores in both aspects of motor coordination. Eye-hand coordination increased from 14.37 to 17.37, with a difference of 3.00, while eye-foot coordination increased from 3.03 to 3.67, with a difference of 0.64. This increase indicates a change in motor coordination abilities after participants received treatment in the form of a game-based learning model.

Table 2. Normality Test Shapiro-Wilk

	Statistics	df	Sig
MT pre-test	0.970	30	0.543
Pre-test MK	0.967	30	0.466
MT Posttest	0.762	30	0,000
MK Posttest	0.597	30	0,000

Table 2. The results of the normality test showed that the pre-test data on eye-hand and eye-foot coordination were normally distributed ($p > 0.05$). However, the post-test data were not normally distributed ($p < 0.05$). However, the analysis was continued using parametric tests because the number of samples was ≥ 30, so that based on the Central Limit Theorem, the data distribution can be assumed to be close to normal .

Table 3. Paired Sample t-test Results

Variables	Mean Pre-test	Mean Posttest	Mean Difference	df	Sig. (2-tailed)
Eyes and Hands	14.37	17.37	3.00	29	0,000
Ankle	3.03	3.67	0.64	29	0,000

Table 3. Based on the results of the paired sample t-test, a significance value of 0.000 ($p < 0.05$) was obtained, which indicates that there is a significant difference between the pre-test and post-test values for both variables. Thus, it can be concluded that the game-based learning model is effective in improving the motor coordination abilities of participants in traditional sports extracurricular activities.

Table 4. Effect Size Results

Variables	Mean Pre-Test	Mean Post-test	Mean Difference	Std. Deviation	Cohen's d	Category
Eye-Hand Coordination	14.37	17.37	3.00	3,399	0.88	Big
Eye-Foot Coordination	3.03	3.67	0.64	0.890	0.72	Currently

The analysis results showed that the effect size for eye-hand coordination was 0.88 (large category), while for eye-foot coordination it was 0.72 (medium category). This indicates that the treatment was not only statistically significant but also had a strong practical impact on improving motor coordination.

The study's findings show that students' motor coordination is much enhanced by the game-based learning approach. This result is in line with earlier research that suggests game-based activities can improve motor skills by providing dynamic and interesting movement experiences Nuriman et al., (2016). The nature of game-based activities, which call for pupils to react fast to moving objects and modify their actions in real time, can account for the improvement in hand-eye coordination. In the meantime, improved control over lower body motions through repeated yet different game circumstances is reflected in the development in foot-eye coordination. The game-based paradigm offers a more engaging and interactive learning environment than traditional teaching techniques. This lends credence to the idea that meaningful and pleasurable physical activity improves student engagement and motor learning. Nevertheless, there are certain drawbacks to this study, including the lack of a control group and the intervention's brief duration. To support causal results, it is advised that future studies employ longer intervention periods and experimental designs with control groups.

CONCLUSION

According to the study's findings, children who participate in traditional sports extracurricular activities can improve their motor coordination by using a game-based learning paradigm. Through dynamic and captivating activities, the model offers meaningful movement experiences that improve hand-eye and foot-eye coordination.

The results also show that game-based learning boosts student engagement and motivation during training in addition to improving motor abilities. As a result, this method can be employed as a substitute tactic for creating extracurricular sports programs that are more flexible, entertaining, and successful.

It is advised that future research examine this model's long-term effects and its use in various educational settings.

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