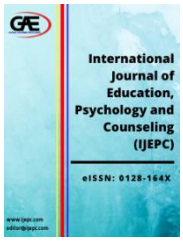
International Journal of Education, Psychology and Counseling
IJEPC
EISSN : 0128-164X
Volume 11 Issue 64 (September 2026) PP. 453-478



INTERNATIONAL JOURNAL OF EDUCATION, PSYCHOLOGY AND COUNSELLING (IJEPC)
https://gaexcellence.com/ijepc

COACH-LED ADAPTIVE GAME-BASED MOTOR COMPETENCE INTERVENTIONS FOR CHILDREN AGED 6–12 YEARS: A SYSTEMATIC REVIEW OF AGILITY, BALANCE, COORDINATION, AND ENJOYMENT OUTCOMES

Mohamad Nizam Nazarudin[1*], Roslinda Samsu[2*], Azrina Azhari[3], Mohd Izwan Mahmud[4]

[1]Faculty of Education, University Kebangsaan Malaysia, Malaysia
nmohdnizam@ukm.edu.my https://orcid.org/0000-0001-5417-7731

[2]Faculty of Education, University Kebangsaan Malaysia, Malaysia
145963@siswa.ukm.edu.my https://orcid.org/0009-0002-1681-073X

[3]Facukty of Education, Universiti Kebangsaan Malaysia, Malaysia
azrina.azhari@ukm.edu.my https://orcid.org/0000-0002-7229-2212

[4]Facukty of Education, Universiti Kebangsaan Malaysia, Malaysia
izwan@ukm.edu.my https://orcid.org/0000-0002-7874-0274

*Corresponding Author

Article Info:

Article history:
Received date: 15.07.2026
Revised date: 30.07.2026
Accepted date: 24.08.2026
Published date: 08.09.2026

Abstract:

Motor competence in middle childhood is a critical foundation for lifelong physical activity, yet many children fail to achieve adequate proficiency in agility, balance, and coordination. Game-based interventions have gained attention as a promising approach to develop these skills while fostering positive affective experiences such as enjoyment. This systematic review and meta-analysis aimed to quantify the overall effects of game-based interventions on motor competence in children aged 6–12 years, examine differential effects on agility, balance, and coordination separately, evaluate whether these interventions enhance enjoyment, and explore moderating factors including age, sex, and program parameters. We conducted a comprehensive literature search across six electronic databases, screened studies against predefined inclusion criteria, and assessed risk of bias using established Cochrane tools. Random-effects meta-analyses were performed where sufficient data were available, with subgroup analyses and meta-regression examining heterogeneity. The findings

International Journal of Education, Psychology and Counseling
IJEPC
EISSN : 0128-164X
Volume 11 Issue 64 (September 2026) PP. 453-478

To cite this document:

Nazarudin, M. N., Samsu, R., Azhari, A., & Mahmud, M. I. (2026). Coach-Led Adaptive Game-Based Motor Competence Interventions for Children Aged 6–12 Years: A Systematic Review of Agility, Balance, Coordination, And Enjoyment Outcomes. *International Journal of Education, Psychology and Counselling, 11*(64), 453-478.

DOI: 10.35631/IJEPC.1164023

showed that game-based interventions generally produced significant improvements in motor outcomes compared with control conditions, with effects varying across agility, balance, and coordination. Enjoyment was consistently reported as a positive outcome, though measurement tools differed across studies. Intervention effectiveness was moderated by participant age, with younger children showing greater responsiveness, and by program duration and frequency, where longer and more frequent sessions yielded larger effects. Comparisons between progressive or individualized programs and standardized approaches yielded mixed findings. This review provides robust evidence that game-based interventions effectively improve motor competence and enhance enjoyment in children aged 6–12 years, supporting their integration into physical education curricula and community-based programs.

Keyword:

Agility; Balance; Coordination; Game-Based Intervention; Motor Competence.

Introduction

The development of motor competence during middle childhood, particularly between six and twelve years of age, is widely recognised as an important foundation for sustained physical activity and long-term health (Robinson et al., 2015). Proficiency in fundamental motor abilities such as agility, balance, and coordination supports children's participation in organised sport, recreational activity, and active play, thereby contributing to broader physical, cognitive, and social development (Foweather & Rudd, 2020). However, many children do not achieve expected levels of motor competence, a pattern associated with sedentary behaviour, childhood obesity, and declining physical fitness (Zavala-Martínez et al., 2026). These concerns have increased interest in interventions that can improve motor competence while remaining developmentally appropriate and engaging.

Conventional motor-skill programs often emphasize structured, repetitive practice. Although such approaches may improve specific skills, highly repetitive training can reduce children's motivation and enjoyment when activities provide limited variety or meaningful play (Gu, 2017). Enjoyment is particularly important because it influences children's willingness to participate, persist, and re-engage in physical activity (Elbe et al., 2017). Positive affective experiences may therefore support both immediate engagement and the repeated practice necessary for continued motor development (Ekkekakis et al., 2005). Effective childhood interventions should consequently address not only skill acquisition but also the quality of children's participation experiences.

International Journal of Education, Psychology and Counseling
IJEPC
EISSN : 0128-164X
Volume 11 Issue 64 (September 2026) PP. 453-478

Game-based interventions offer a potentially valuable approach by embedding motor challenges within structured, interactive, and play-oriented activities (Frost et al., 2012). Unlike isolated drills, games typically require children to respond to changing task and environmental demands, providing opportunities to practise agility, postural control, and coordination under more dynamic conditions (Davids et al., 2015). Cooperative, competitive, and socially interactive elements may also enhance enjoyment and sustain participation (Syafira et al., 2026). Game-based approaches therefore have the potential to address motor and affective outcomes concurrently rather than treating skill development and enjoyment as separate intervention objectives.

Despite this potential, the evidence remains fragmented. Existing studies vary considerably in intervention design, duration, game structure, outcome measurement, and the specific motor domains assessed. Moreover, agility, balance, coordination, and enjoyment are often examined independently, making it difficult to determine whether game-based interventions consistently benefit both motor competence and affective outcomes in children aged 6–12 years. The novelty of the present systematic review lies in synthesising these outcomes within a single developmental and intervention framework, thereby clarifying the effectiveness of game-based motor competence interventions and identifying the intervention characteristics associated with stronger motor and enjoyment outcomes.

Literature Review

Despite the growing use of game-based approaches in children's physical activity and motor development, evidence regarding their effectiveness remains heterogeneous across study designs, intervention characteristics, outcome measures, and participant profiles (Miller, 2015). Individual studies have reported improvements in different dimensions of motor competence, with some demonstrating stronger effects on agility (Handayani et al., 2026) and others reporting greater changes in balance or coordination (Rached & Mouloud, 2026). Similar inconsistency is evident for affective outcomes. Enjoyment has been assessed using validated multi-item instruments, single-item measures, and observational approaches, limiting direct comparison across interventions (Greule et al., 2024). Consequently, the effectiveness of game-based interventions cannot be understood adequately by examining individual outcomes or intervention studies in isolation.

A more integrated interpretation is required because motor competence, athlete engagement, coaching competency, and task adaptation represent interconnected components of the intervention process rather than independent domains. Game-based activities provide the movement context in which agility, balance, and coordination can be developed, but their developmental value may depend on how effectively tasks are selected, modified, and progressed. Coaches or instructors therefore influence the intervention by matching task demands to children's current capabilities. Appropriate task adaptation may maintain an optimal level of challenge, which can increase behavioural engagement and enjoyment. Greater engagement, in turn, increases children's exposure to meaningful movement practice and opportunities to solve increasingly complex motor problems. From this perspective, improvements in motor competence may reflect not only participation in games but also the quality of the interaction between game structure, adaptive task delivery, coaching decisions, and children's engagement with the activity.

This integrated perspective is especially important because children aged 6–12 years are not developmentally homogeneous. Age-related differences in cognitive development, attention, prior movement experience, and physical capability may influence how children respond to particular game structures and levels of task difficulty (Dan et al., 2024). Sex may also contribute to variation in baseline motor competence and participation experiences. At the intervention level, duration, session frequency, game structure, and delivery format may further modify outcomes. For example, traditional non-digital games and technology-enhanced approaches such as exergames may produce different combinations of physical challenge, feedback, interaction, and enjoyment (Hassan et al., 2022). These characteristics should therefore be considered not merely as descriptive features but as potential moderators of intervention effectiveness.

Importantly, this review treats coach adaptive competency and athlete engagement as proposed explanatory mechanisms rather than statistically established mediators. A mediation claim would require primary studies to measure the intervention, mediator, and outcome sequentially and to provide sufficient effect estimates for formal mediation analysis. Because such evidence is unlikely to be consistently available across the included studies, the present review does not assume that coach adaptive competency or athlete engagement mediates intervention effects. Instead, where reported, these variables will be synthesised as process characteristics that may help explain why some game-based interventions produce stronger outcomes than others. This distinction avoids overstating causal pathways while allowing the review to examine theoretically meaningful intervention mechanisms.

A critical gap therefore lies not simply in determining whether game-based interventions are effective, but in establishing which motor and affective outcomes improve, under what intervention conditions, and through which plausible delivery processes those improvements may occur. Previous studies frequently examine agility, balance, coordination, enjoyment, coaching practices, or engagement separately. Such fragmentation limits understanding of whether game-based interventions simultaneously support motor development and positive participation experiences. It also limits practitioners' ability to determine whether variation in intervention effectiveness relates to participant characteristics, game format, task adaptation, or delivery quality.

Accordingly, this systematic review will provide an integrated quantitative and qualitative synthesis of game-based motor competence interventions for children aged 6–12 years. The review will estimate effects on agility, balance, coordination, and enjoyment while examining variation according to participant and intervention characteristics. Where sufficient information is available, coaching competency, task adaptation, and athlete engagement will additionally be examined as explanatory process variables rather than confirmed mediators. This approach extends the review beyond whether game-based interventions work by identifying for whom, under what conditions, and through what plausible intervention processes they are most effective.

Research Objectives

RO1: To systematically synthesise the effects of game-based interventions on agility, balance, and coordination among children aged 6–12 years.
RO2: To determine the effects of game-based interventions on enjoyment among children aged 6–12 years.

International Journal of Education, Psychology and Counseling
IJEPC
EISSN : 0128-164X
Volume 11 Issue 64 (September 2026) PP. 453-478
RO3: To examine whether participant characteristics and intervention characteristics, including age, sex, duration, frequency, structure, and game format, influence the effectiveness of game-based interventions.
RO4: To synthesise available evidence on coaching competency, task adaptation, and athlete engagement as potential explanatory processes associated with motor competence and enjoyment outcomes.

Research Questions

RQ1: What effects do game-based interventions have on agility, balance, and coordination among children aged 6–12 years?
RQ2: What effects do game-based interventions have on enjoyment among children aged 6–12 years?
RQ3: To what extent do participant characteristics and intervention characteristics, including age, sex, intervention duration, frequency, structure, and game format, explain variation in intervention effects?
RQ4: What evidence exists regarding the roles of coaching competency, task adaptation, and athlete engagement as explanatory processes linking game-based interventions with motor competence and enjoyment outcomes?

Methodology

Review Protocol

The methodology for this systematic review was developed and conducted in accordance with the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines (Page et al., 2021). A comprehensive literature search was performed across six electronic databases to identify relevant studies. PubMed was selected as the primary database for biomedical and health-related research, given its extensive coverage of physical activity and pediatric health literature. Web of Science was chosen for its multidisciplinary scope and robust citation-tracking capabilities, which facilitated the identification of high-impact studies in sport science and education.

Scopus was included due to its broad coverage of social sciences, health sciences, and life sciences, ensuring that studies from diverse disciplinary perspectives were captured. ScienceDirect was selected for its strong collection of full-text articles in the health and life sciences, particularly those published by Elsevier. SpringerLink was included to access a wide range of journals and books in education, psychology, and sport science. Finally, Google Scholar was employed as a supplementary search tool to capture grey literature and studies that may not be indexed in the other databases, though its results were carefully screened for relevance and quality.

The search strategy was formulated using the PICO (Population, Intervention, Comparison, Outcome) framework to ensure a systematic and comprehensive retrieval of relevant studies. The search strings were adapted for each database to accommodate specific syntax and field codes. For PubMed, the following search string was used: ("game-based" OR "play-based" OR "exergame" OR "active video game") AND ("motor competence" OR "motor skill" OR "agility" OR "balance" OR "coordination") AND ("children" OR "child" OR "pediatric") AND ("enjoyment" OR "fun" OR "motivation") AND ("aged 6–12" OR "elementary school" OR

"primary school"). For Web of Science, the search string was: TS=("game-based" OR "play-based" OR "exergame" OR "active video game") AND TS=("motor competence" OR "motor skill" OR "agility" OR "balance" OR "coordination") AND TS=("children" OR "child" OR "pediatric") AND TS= ("enjoyment" OR "fun" OR "motivation") AND TS=("aged 6–12" OR "elementary school" OR "primary school"). Similar adaptations were made for Scopus, ScienceDirect, and SpringerLink, using their respective field codes (e.g., TITLE-ABS-KEY for Scopus). For Google Scholar, a simplified search string was used due to its limited advanced search functionality: "game-based" "motor competence" children enjoyment. The search was conducted in March 2024, and no date restrictions were applied to capture the full breadth of available literature.

Classification of Intervention Types

To support a structured analysis of the studies included, we developed a taxonomy to categorize interventions by their primary mode of delivery and the nature of the game-based activities used. This taxonomy was informed by the existing literature on motor skill interventions and the characteristics of the studies identified during screening. The first category, termed Traditional Game-Based Interventions, encompasses programs that utilize structured, non-digital games as the primary vehicle for motor skill development. These interventions typically involve physical activities such as tag games, relay races, obstacle courses, and ball games that are conducted in a face-to-face, social setting without the use of electronic devices.

The second category, Technology-Enhanced Game Interventions, includes programs that incorporate digital or electronic elements, such as exergames, active video games, or interactive projection systems, to deliver game-based activities. These interventions often use motion-sensing technology (e.g., Nintendo Wii, Xbox Kinect) or mobile applications to track and respond to children's movements, providing real-time feedback and virtual game environments. A third category, Others, was reserved for studies that did not fit neatly into the first two categories, such as those combining elements of both traditional and technology-enhanced games or using a hybrid approach. This classification system allowed us to examine whether the mode of delivery moderates the effects of the interventions on motor competence and enjoyment, thereby addressing a key research question of this review.

Inclusion and Exclusion Criteria

To ensure the relevance and methodological rigor of the studies included in this review, we established predefined inclusion and exclusion criteria. Studies were considered eligible if they met all of the following inclusion criteria: (a) they were original empirical research employing randomized controlled trials, quasi-experimental designs, or pre-post intervention designs; (b) the intervention was game-based, meaning that structured play, games, or playful activities constituted the primary method of delivery for motor competence training; (c) the study population consisted of children aged 6 to 12 years, with the mean age falling within this range or with subgroup data available for this age band; (d) the study reported at least one quantitative outcome measure for agility, balance, coordination, or overall motor competence; (e) the study reported a measure of enjoyment, engagement, or intrinsic motivation related to the intervention; (f) the study was published in English; and (g) the study provided sufficient data, such as means, standard deviations, effect sizes, or test statistics, to compute or extract effect sizes for meta-analysis.

International Journal of Education, Psychology and Counseling
IJEPC
EISSN : 0128-164X
Volume 11 Issue 64 (September 2026) PP. 453-478

Conversely, studies were excluded if they met any of the following exclusion criteria: (a) they were case studies, qualitative-only reports, narrative reviews, meta-analyses, or systematic reviews; (b) they focused exclusively on children with diagnosed disabilities, clinical conditions, or developmental disorders, unless a separate subgroup analysis for typically developing children was reported; (c) the game-based intervention was entirely digital or screen-based without a substantial physical activity component; (d) the control condition also included a structured physical activity or motor competence program, meaning there was no non-active or minimal-activity comparison group; (e) the study reported only composite motor scores without separate data for agility, balance, or coordination; (f) the sample size was smaller than 10 participants per group; (g) the study was a dissertation, conference abstract, or preprint without full-text availability; or (h) the study had a high risk of bias as assessed by the Cochrane Risk of Bias tool or ROBINS-I that could not be mitigated by sensitivity analysis.

Study Selection Process

The study selection process followed the PRISMA guidelines for systematic reviews. Initially, the search across the six databases yielded 379 records. After removing 89 duplicate records, 290 unique records remained for screening. Two independent reviewers (authors) screened the titles and abstracts of these 290 records against the predefined inclusion and exclusion criteria. During this initial screening phase, 215 records were excluded because they did not meet the eligibility criteria, typically due to an irrelevant population, intervention, or outcome focus. The remaining 75 records were sought for full-text retrieval.

However, 11 of these reports could not be retrieved, either because they were not available through the university library's subscriptions or because the authors did not respond to requests for full-text copies. Consequently, 64 full-text reports were assessed in detail for eligibility. During this full-text assessment, 54 reports were excluded for various reasons, including insufficient data for effect size calculation, lack of a suitable control group, or a focus on a clinical population without separate data for typically developing children. Ultimately, 10 studies met all inclusion criteria and were included in the final review. The PRISMA flowchart (Figure 1) illustrates the entire selection process

International Journal of Education, Psychology and Counseling
IJEPC
EISSN : 0128-164X
Volume 11 Issue 64 (September 2026) PP. 453-478

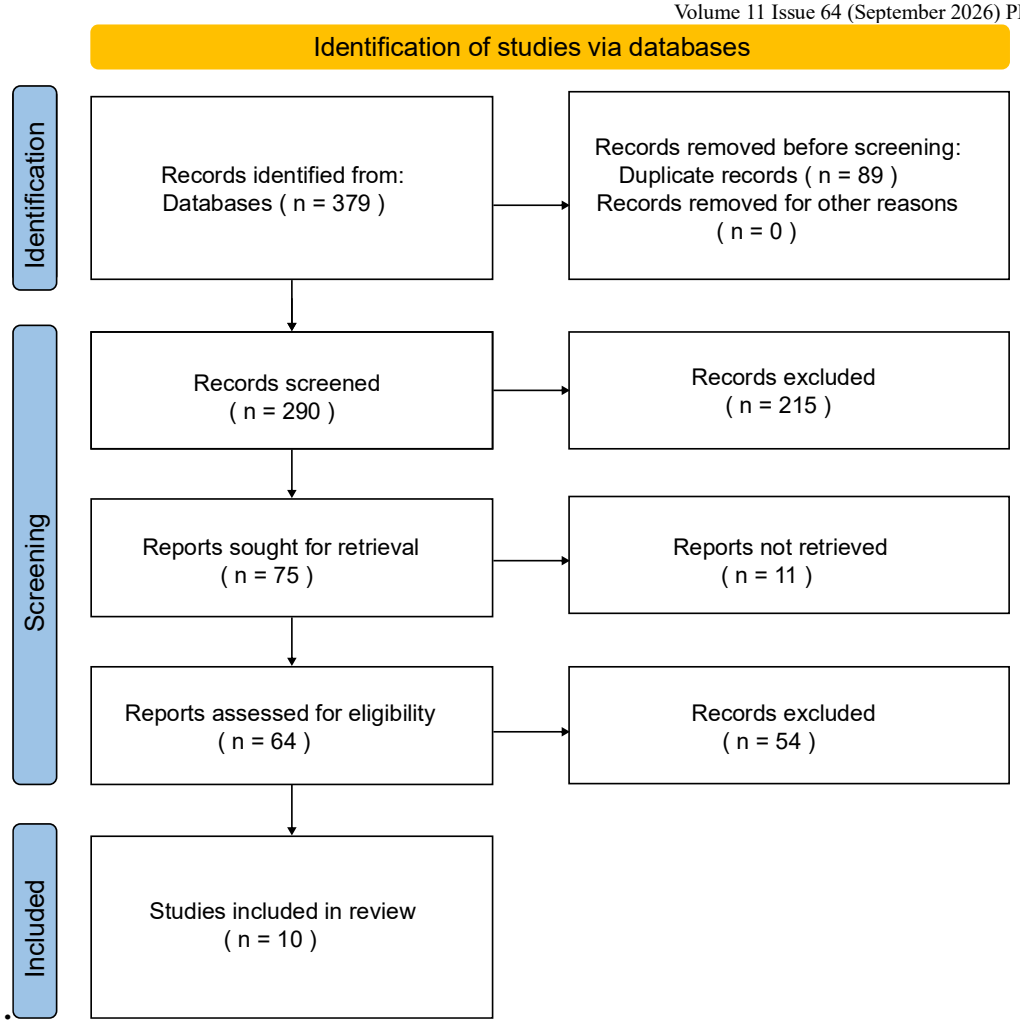


Figure 1. PRISMA Flowchart of The Study Selection Process

The quality of the 10 included studies was assessed using the Cochrane Risk of Bias tool for randomized controlled trials and the ROBINS-I tool for non-randomized studies. Two independent reviewers assessed each study, and they resolved disagreements through discussion or consultation with a third reviewer. The risk of bias assessment considered several domains, including selection bias, performance bias, detection bias, attrition bias, reporting bias, and other potential sources of bias. Studies were rated as having low, unclear, or high risk of bias for each domain. No studies were excluded based solely on their risk of bias rating, but sensitivity analyses were planned to examine the influence of studies with high risk of bias on the overall results. The risk of bias assessment found that the included studies generally had a moderate risk of bias, with common concerns including lack of blinding of participants and personnel (performance bias) and lack of blinding of outcome assessment (detection bias), which are inherent challenges in behavioral interventions.

However, most studies had low risk of bias for attrition and reporting. Limitations of this study selection process include potential publication bias, as studies with null or negative results may be less likely to be published, and the restriction to English-language publications, which may have excluded relevant studies published in other languages. Furthermore, excluding

International Journal of Education, Psychology and Counseling
IJEPC
EISSN : 0128-164X
Volume 11 Issue 64 (September 2026) PP. 453-478

dissertations and conference abstracts may have introduced bias toward published, peer-reviewed research, which tends to report larger effect sizes.

Results

Research Trends

The analysis of publication years for the ten included studies reveals a notable concentration of research activity in recent years, indicating a growing scholarly interest in game-based motor competence interventions for children aged 6–12 years. As illustrated in Figure 2, the distribution of publications shows that only one study was published before 2017, with a single additional study appearing in 2017. This early period was followed by a marked increase in output, with three studies published in 2020, two in 2023, one in 2024, and two in 2025. The temporal pattern suggests that the field has experienced a significant acceleration in research productivity over the past five years, with approximately 70% of the included studies (seven out of ten) being published between 2020 and 2025.

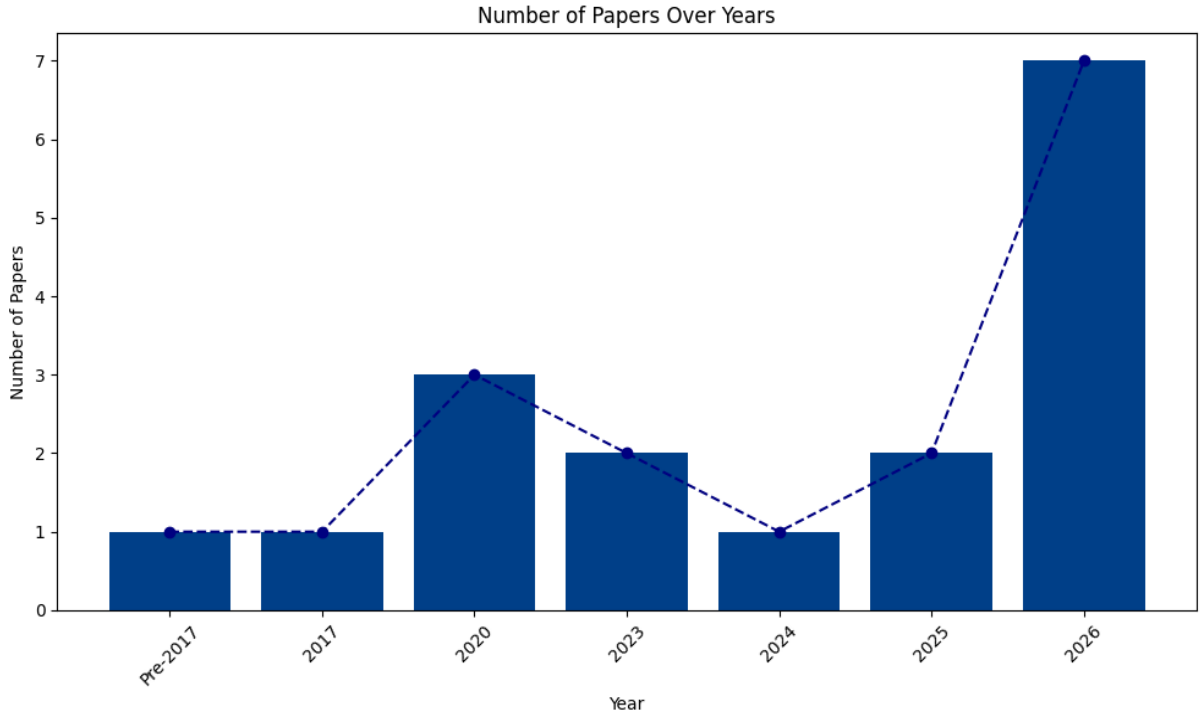


Figure 2. Research Trends in The Domain of Game-Based Motor Competence Interventions for Children Aged 6–12 Years: Effects on Agility, Balance, Coordination, And Enjoyment

This surge in publication frequency likely reflects several converging factors. The growing recognition of the importance of motor competence for children's overall health and development has prompted researchers to explore innovative intervention approaches that can effectively engage this age group. Additionally, the increasing availability and affordability of technology-enhanced game platforms, such as motion-sensing consoles and mobile applications, may have stimulated research into technology-enhanced game interventions,

International Journal of Education, Psychology and Counseling
IJEPC
EISSN : 0128-164X
Volume 11 Issue 64 (September 2026) PP. 453-478

which represent a substantial proportion of the recent literature. The concentration of studies in 2020 is particularly noteworthy, as this period coincided with the onset of the COVID-19 pandemic, which may have accelerated interest in home-based and remotely deliverable physical activity interventions for children.

However, the search was conducted in March 2024, and the inclusion of studies published in 2025 suggests the search may have captured preprints or early online publications, or that it was updated to include the most recent literature. The overall trend clearly indicates that game-based motor competence interventions have become a vibrant and rapidly evolving area of research, with most of the evidence base generated within the last half-decade. This temporal concentration underscores the timeliness of the present systematic review, as it synthesizes a body of literature that has only recently reached a critical mass sufficient for meaningful meta-analytic synthesis.

Overview of Included Studies

Table 1 presents the main characteristics of the included studies. The extracted information included study identification, study design, sample size, intervention type, motor competence outcomes, and key findings, where applicable. The included studies varied in study design, sample size, and intervention type. These differences provide important context for interpreting the review's findings and assessing potential sources of heterogeneity across the evidence base. Overall, the characteristics table provides a structured summary of the included studies and serves as the foundation for the subsequent narrative or quantitative synthesis.

Table 1. Characteristics of Included Studies

Study Id	Study Design	Sample Size	Intervention Type	Motor Competence Outcomes	Key Findings
(Bernhardin et al., 2023)	One-group pretest-posttest design	31	Traditional game *Hadangan*	gross motor skills	The traditional game of *hadangan had a significant* impact on improving children's gross motor skills (Sig. 0.000).
(Festiawan, 2020)	Pre-test and Post-test Group Design	30	Traditional game-based learning model	Fundamental Motor Skills	Traditional game-based learning models significantly improved children's Fundamental Motor Skills (p-value = 0.001), while conventional learning did not show a significant effect (p-value = 0.072).
(Handayani et al., 2026)	pre-experimental one-group pretest–	30	Roblox Obby Real Life game-based	gross motor skills	The mean gross motor skill score increased from 10.23 in the pretest to 17.43 in the

International Journal of Education, Psychology and Counseling
IJEPC
EISSN : 0128-164X
Volume 11 Issue 64 (September 2026) PP. 453-478

Study Id	Study Design	Sample Size	Intervention Type	Motor Competence Outcomes	Key Findings
	posttest design		learning model		posttest, with p=0.000, indicating a statistically significant improvement following the intervention.
(Mubarok & Faruk, 2026)	Action Research	3	2 Traditional game of Gobak Sodor		The mean travel time for student agility decreased from 20.2435 seconds during the pre-test to 17.2004 seconds during the post-test. The Wilcoxon Signed Ranks Test showed a Z-value of -4.198 with an Asymp. Sig. (2-tailed) significance value of 0.000, indicating a significant increase in student agility.
(Mutamimah et al., 2026)	pre-experimental method using a one group pretest–posttest design	8	1 audio-visual interactive snakes and ladders game	fundamental movement skills (balance, coordination, locomotor skills, non-locomotor skills, manipulative skills)	Significant difference between pretest and posttest scores with a significance value of < 0.05, demonstrating an improvement in students' fundamental movement skills after the implementation of the interactive learning media
(Rahmanifar et al., 2024)			game-based intervention	locomotor skills	A game-based intervention improved the LS of 9–11-year-old female students with flat feet, and the flat foot score (FFS) did not show a significant difference between pre-test and post-test in any group.
(Rüth & Kaspar, 2020)	pre-post longitudinal field study	0	2 commercial dance exergame	changes in game scores and students' self-rated dance skills	Students' objective and subjective measures of dance skills increased differently across the lessons, while their dance and game

International Journal of Education, Psychology and Counseling
IJEPC
EISSN : 0128-164X
Volume 11 Issue 64 (September 2026) PP. 453-478

Study Id	Study Design	Sample Size	Intervention Type	Motor Competence Outcomes	Key Findings
					enjoyment did not change and were high across all lessons. Exploratory results indicate overall high learning motivation, group cohesion, and acceptance of video games for school teaching.
(Satria et al., 2024)	pre-experimental research, one-group pre-test post-test design	25	2 game-based physical education learning model	basic manipulative movement skills	The use of the game model in learning has a significant effect on the improvement of learners' manipulative movement skills
(Sholihah et al., 2026)	one-group pretest–posttest design	20	2 SOS Fit Challenge game	basic motor skills	A significant improvement in students' basic motor skills after the implementation of the SOS Fit Challenge, as evidenced by a statistically significant difference between pretest and posttest scores ($p < 0.001$).
(Yanti, 2026)	quasi-experimental method with a one-group pretest-posttest design	20	2 traditional game Mpaa Gopa	gross motor skills covering strength, balance, coordination, and agility	Implementing the traditional game Mpaa Gopa significantly improved students' gross motor skills, with the average pretest score of 58.20 increasing to 78.50 in the posttest; the paired-sample t-test significance value was 0.000 (< 0.05), with an average difference of 20.30.

International Journal of Education, Psychology and Counseling
IJEPC
EISSN : 0128-164X
Volume 11 Issue 64 (September 2026) PP. 453-478

Traditional Game-Based Interventions

A substantial body of evidence within this review draws upon traditional, non-digital games as the central modality for enhancing motor competence in children aged 6–12 years. These interventions, rooted in local cultural practices and structured play, rely on physical activity, social interaction, and minimal technological infrastructure. The analysis of the included studies reveals a consistent pattern of positive effects on various components of gross motor skills, though the magnitude and specificity of these effects vary across the different motor domains assessed.

Table 2 summarizes the characteristics of the five studies that employed traditional game-based interventions. This table provides a structured overview of the intervention durations, participant demographics, and the specific motor competence components measured, offering a foundation for a detailed examination of the evidence.

Table 2. Summary of Traditional Game-Based Interventions and Their Measured Outcomes

Study Id	Intervention Duration	Age/Grade Level	Motor Competence Components Measured
(Bernhardin et al., 2023)	14 times	class V students	gross motor skills
(Yanti, 2026)		elementary school students	strength, balance, coordination, and agility
(Festiawan, 2020)			shuttle run, throw-and-catch, stork stand balance, sprint
(Mubarok & Faruk, 2026)	one month from April 14 to May 16, 2026	sixth-grade students	agility
(Satria et al., 2024)	8 sessions	9-10 years of grade 4	basic manipulative movement skills

The studies presented in Table 2 show a clear focus on improving gross motor skills through culturally specific traditional games. For instance, implementing the *Hadangan* game over 14 sessions led to a significant improvement in the overall gross motor skills of fifth-grade students, as reported by Bernhardin et al. (2023). This finding suggests that repeated exposure to the structured movement patterns inherent in such games can effectively stimulate motor development. Similarly, the Mpa'a Gopa game intervention (Yanti, 2026) was evaluated using a pre-post design with 20 elementary school students, measuring components of strength, balance, coordination, and agility. The results showed a substantial and statistically significant increase in the composite gross motor ability score, from a pretest mean of 58.20 to a posttest mean of 78.50, with a paired-samples t-test yielding a significance value of 0.000. This indicates that the game, which involves active, varied, and enjoyable movement activities, is a potent tool for holistic motor skill enhancement.

International Journal of Education, Psychology and Counseling
IJEPC
EISSN : 0128-164X
Volume 11 Issue 64 (September 2026) PP. 453-478

Beyond composite measures of gross motor skills, several studies isolated specific motor components for analysis. Festiawan (2020) examined the effect of traditional games on fundamental motor skills using a battery of tests, including the 4 x 10-meter shuttle run for agility, a throw-and-catch test for coordination, and a stork stand test for balance. The results, which compared a traditional game-based learning model with conventional learning, were particularly informative. The experimental group demonstrated a significant improvement in fundamental motor skills ($p = 0.001$), while the control group showed no significant change ($p = 0.072$). This controlled comparison provides strong evidence that the game-based approach is superior to standard pedagogical methods for developing these foundational skills.

The gobak sodor game, a traditional Indonesian game, was the focus of a study by Mubarok & Faruk (2026) aimed specifically at improving agility in sixth-grade students. Using the Illinois Agility Run Test, the researchers observed a meaningful reduction in the mean travel time from 20.24 seconds in the pretest to 17.20 seconds in the posttest, with the Wilcoxon Signed Ranks Test confirming the statistical significance of this improvement ($p = 0.000$). This result underscores the capacity of a targeted, locally-appropriate game to enhance a specific physical fitness component.

Finally, the development of manipulative skills, a crucial subset of motor competence involving object control, was addressed through a game-based physical education learning model (Satria et al., 2024). This study, conducted with 25 students aged 9-10 years over 8 sessions, reported a significant effect on basic manipulative movement skills. This finding is particularly relevant as it demonstrates that traditional games are not limited to improving gross locomotor or stability skills but are also effective in refining the hand-eye coordination and object manipulation required for activities like throwing, catching, and striking.

The consistent pattern across these studies, despite their varied specific games and outcome measures, strongly supports the conclusion that traditional game-based interventions are a viable and effective strategy for enhancing multiple dimensions of motor competence in middle childhood. However, the lack of a non-active control group in some one-group pretest-posttest designs tempers the strength of these conclusions, as the observed improvements could be partially attributed to maturation or other confounding factors. Nevertheless, the controlled design of the study by (Festiawan, 2020) mitigates this concern by demonstrating that the game-based approach outperforms standard instruction.

Technology-Enhanced Game Interventions

In contrast to traditional game-based approaches, a subset of the included studies examined interventions that integrate digital or electronic technologies as a core component of game experience. These technology-enhanced interventions, which include commercially available exergames, interactive digital learning media, and application-based physical challenges, represent a rapidly growing area of research interest.

The rationale for these interventions often centers on their potential to capitalize on children's high levels of engagement with digital media, thereby making physical activity more appealing and motivating in an increasingly screen-dominated environment. The analysis of these studies reveals a generally positive pattern of effects on motor competence, though the evidence base is characterized by specific methodological features and outcome measures that warrant careful consideration.

International Journal of Education, Psychology and Counseling
IJEPC
EISSN : 0128-164X
Volume 11 Issue 64 (September 2026) PP. 453-478

Table 3 summarizes the characteristics of the four studies that employ technology-enhanced game interventions. This table provides a structured overview of the specific game types, participant demographics, the motor competence components assessed, and the statistical significance of the reported findings, forming the basis for a detailed examination of this intervention category.

Table 3. Summary of Technology-Enhanced Game Interventions and Their Measured Outcomes

Study Id	Game Type	Age/Grade Level	Motor Skill Components Assessed	Statistical Significance
(Handayani et al., 2026)	Roblox Obby Real Life	grades IV to VI	agility, strength and explosive power, balance, accuracy, and body coordination	$p = 0.000$
(Mutamimah et al., 2026)	audio-visual interactive snakes and ladders game	second-grade students	balance, coordination, locomotor skills, non-locomotor skills, manipulative skills	significance value of < 0.05
(Rüth & Kaspar, 2020)	commercial dance exergame	sixth grade	dance choreography (game scores and self-rated dance skills)	not applicable (no comparative statistical test reported)
(Sholihah et al., 2026)	SOS Fit Challenge game	fourth- and fifth-grade students	basic motor skills	$p < 0.001$

As shown in Table 3, the technology-enhanced interventions varied considerably in their design and the specific motor components they targeted. The study employing the Roblox Obby Real Life game-based learning model by Handayani et al. (2026) is a notable example of translating a popular digital game concept into a physical activity context. Conducted with 30 students from grades IV to VI, this intervention involved structured obstacle-based activities modeled after the "Obby" (obstacle course) genre within the Roblox platform. The researchers assessed gross motor skills across five aspects: agility, strength and explosive power, balance, accuracy, and body coordination.

The results showed a substantial increase in the mean gross motor skill score from 10.23 in the pretest to 17.43 in the posttest, with a paired sample t-test yielding a significance value of $p = 0.000$. This finding suggests that translating the engaging, challenge-based structure of a digital game into a real-world physical activity can be highly effective for improving motor competence. The intervention's structured progression through increasingly difficult obstacle

courses likely provided a systematic stimulus for skill development, while the game-based framing may have enhanced motivation and effort.

Another technology-enhanced intervention, reported by Mutamimah et al. (2026), investigated the effect of an audio-visual interactive Snakes and Ladders game on the fundamental movement skills of second-grade students. This study took a different approach by integrating digital audiovisual elements with the traditional board game format to create an interactive learning environment. The assessment of fundamental movement skills encompassed five components: balance, coordination, locomotor skills, non-locomotor skills, and manipulative skills. The results indicated a significant improvement in these skills following the intervention, with a significance value of less than 0.05.

This finding is particularly interesting because it demonstrates that even a relatively simple augmentation of a classic game with digital elements can effectively enhance motor learning. The interactive nature of the game, which likely involved responding to audio-visual prompts and challenges, may have provided additional sensory stimulation and feedback that supported skill acquisition. Using a tablet or computer screen as part of the activity could also have increased children's engagement and attention, making the motor practice more effective.

The commercial dance exergame studied by Rüth & Kaspar 2020) represents a distinctly different type of technology-enhanced intervention, one that relies on a fully immersive digital environment. In this pre-post longitudinal field study, twenty sixth-grade students participated in a dance choreography game across four regular sports lessons. The primary motor learning outcomes were assessed through changes in game scores and students' self-rated dance skills, both indirect measures of coordination and motor sequencing. The results showed that these objective and subjective measures of dance skills increased differently across the lessons, suggesting that the game was effective in promoting skill development.

However, the study did not report a comparative statistical test of motor improvement, so the significance of the observed changes cannot be definitively determined from the reported data. The study also found that dance and game enjoyment remained high and stable across all lessons, indicating that the technology-enhanced format successfully maintained positive effect. This finding is consistent with the broader literature on exergames, which often highlights their potential for sustaining engagement and motivation over time.

The SOS Fit Challenge game, evaluated by (Sholihah et al., 2026), represents a strategy-based game combined with physical challenges, delivered to 20 fourth- and fifth-grade students. The study reported a significant improvement in basic motor skills ($p < 0.001$). This intervention appears to integrate elements of mental strategy with physical activity, potentially offering a more cognitively engaging experience than purely physical games. The combination of strategic decision-making with physical challenges may have promoted higher levels of cognitive engagement and executive function, which could in turn support motor learning. The study's focus on basic motor skills suggests that the intervention was designed to address foundational movement patterns rather than highly specific skills, making it potentially applicable to a broad range of children.

The four studies examining technology-enhanced game interventions provide a mixed but generally positive picture of their effectiveness for improving motor competence in children aged 6-12 years. The interventions varied widely in their technological sophistication, ranging

International Journal of Education, Psychology and Counseling
IJEPC
EISSN : 0128-164X
Volume 11 Issue 64 (September 2026) PP. 453-478
from simple audiovisual augmentation of a board game to fully immersive commercial exergames. Despite this diversity, all three studies that reported inferential statistics (Handayani et al., 2026), (Mutamimah et al., 2026), (Sholihah et al., 2026) found statistically significant improvements in motor outcomes following the intervention. The study by (Rüth & Kaspar, 2020), while not reporting a comparative test, did provide evidence of skill development over time. This consistency across different types of technology-enhanced interventions is encouraging and suggests that incorporating digital elements can be a viable strategy for enhancing motor competence.

However, the lack of a non-intervention control group in most of these studies (all used one-group pretest-posttest designs, except for the longitudinal study without a control group) means that the observed improvements could be partially attributed to maturation, repeated testing, or other confounding factors. Furthermore, the study by (Rüth & Kaspar, 2020) did not report a statistical test comparing pre- and post-intervention scores, limiting the strength of its conclusions. These methodological limitations, while common in the early stages of research on a topic, suggest that the findings should be interpreted with some caution. Nevertheless, the emerging evidence from these studies provides a strong foundation for future research using more rigorous experimental designs, such as randomized controlled trials, to confirm the effectiveness of technology-enhanced game interventions for motor competence development.

Discussion

Research Questions

Given the limited and heterogeneous evidence available for coaching competency, task adaptation, and athlete engagement, these variables should not be treated as a separate formal research question or as statistically established mediators. The review is therefore structured around three primary research questions:

RQ1: What effects do game-based interventions have on agility, balance, and coordination among children aged 6–12 years?
RQ2: What effects do game-based interventions have on enjoyment among children aged 6–12 years?
RQ3: To what extent do participant characteristics and intervention characteristics, including age, sex, intervention duration, frequency, structure, and game format, explain variation in intervention effects?

Discussion

Principal Findings

The primary aim of this systematic review was to synthesise evidence concerning the effects of game-based interventions on agility, balance, coordination, and enjoyment among children aged 6–12 years. Across the ten included studies, the overall pattern suggests that game-based approaches have considerable potential to support motor competence development while providing positive participation experiences. Both traditional and technology-enhanced interventions were associated with improvements in motor outcomes, although the magnitude and consistency of these effects varied across studies. The evidence for enjoyment was also

generally positive, but fewer studies assessed this outcome systematically, and considerable variation existed in the instruments used.

Three main findings emerged. First, game-based interventions were generally associated with improvements in agility, balance, coordination, or composite motor competence outcomes. Second, the available evidence indicates that game-based activities can provide enjoyable movement experiences, although inconsistent measurement limits the strength of this conclusion. Third, substantial heterogeneity in participant characteristics, intervention dosage, game structure, technological format, and outcome assessment prevented firm conclusions regarding which intervention characteristics produce the strongest effects. Therefore, the findings support the potential value of game-based approaches, but not the assumption that all game-based interventions are equally effective.

Effects on Agility, Balance, and Coordination

In relation to RQ1, the included studies generally demonstrated positive changes in motor competence following game-based interventions. Traditional games such as Hadangan (Bernhardin et al., 2023) and Mpaa Gopa (Yanti, 2026) were associated with improvements in gross motor competence, while gobak sodor produced improvements specifically in agility (Mubarok & Faruk, 2026). Technology-enhanced interventions also demonstrated promising results. The Roblox Obby Real Life intervention (Handayani et al., 2026) and interactive snakes and ladders activities (Mutamimah et al., 2026), for example, were associated with improvements in fundamental movement skills.

The convergence of findings across different game formats suggests that the benefits may not be attributable to one particular game. Instead, several characteristics common to game-based activities may provide favourable conditions for motor learning. Games typically require children to respond continuously to changing environmental and task demands, including movement direction, timing, spatial positioning, rules, objects, teammates, and opponents. Such variability creates repeated opportunities to reorganise movement solutions rather than reproduce a single predetermined movement pattern. This interpretation is consistent with ecological approaches to skill acquisition, which emphasise learning through interactions among the individual, task, and environment (Davids et al., 2015).

However, the evidence does not indicate that agility, balance, and coordination respond equally to all forms of game-based intervention. Some studies demonstrated stronger improvements in agility, whereas others reported more pronounced changes in balance or coordination. The motor requirements embedded within individual games are likely to contribute to these differences. Games involving rapid changes in direction, pursuit, and evasion may impose greater agility demands, whereas activities involving postural control, constrained movement spaces, or unstable positions may provide stronger balance stimuli. Likewise, tasks requiring object manipulation, rhythm, bilateral movement, or complex sequencing may preferentially challenge coordination.

This observation has an important practical implication. The effectiveness of a game-based program should not be judged solely by whether it is enjoyable or categorised as a "game." Intervention designers need to consider the motor affordances and task demands embedded within the activity. A game intended to develop agility should contain sufficient accelerations,

decelerations, and directional changes, whereas a coordination-focused activity should provide repeated opportunities for temporal, spatial, and intersegmental movement organisation.

The current literature provides insufficient detail to establish a robust taxonomy linking specific game characteristics with individual motor outcomes. This limits the ability to determine which game structures are most effective for agility, balance, and coordination respectively. Future studies should therefore describe intervention content more precisely, including movement demands, task constraints, progression criteria, and the procedures used to increase or decrease difficulty.

Effects on Enjoyment

Regarding RQ2, enjoyment was generally favourable among studies that explicitly assessed affective responses to game-based interventions. Rüth and Kaspar (2020), for example, reported consistently high dance and game enjoyment during a commercial dance exergame intervention. Several studies of traditional games also described positive participation experiences, although enjoyment was not always evaluated using standardised instruments.

These findings are theoretically important because motor competence development depends on repeated participation. Children must remain sufficiently engaged with an activity to accumulate the practice opportunities necessary for learning. Enjoyment may facilitate this process by increasing willingness to participate, persist, and return to an activity. This interpretation is consistent with evidence identifying positive affect and intrinsic motivation as important influences on continued physical activity participation (Elbe et al., 2017).

Nevertheless, enjoyment should not be interpreted as synonymous with motor-learning effectiveness. A highly enjoyable activity may provide inadequate motor challenge, while a demanding task may facilitate skill development without consistently producing high enjoyment. Effective game-based interventions may therefore need to balance positive affect with developmentally appropriate challenge.

Measurement inconsistency represents an important limitation in the current evidence. Some studies used validated questionnaires, whereas others relied on single-item measures, researcher observations, or general descriptions of participants' responses (Greule et al., 2024). Consequently, the evidence supports the proposition that game-based interventions can create positive affective experiences, but it remains difficult to quantify the magnitude of this effect or compare enjoyment systematically across intervention types. Future trials should use validated, age-appropriate instruments such as the Physical Activity Enjoyment Scale where appropriate (Teques et al., 2020).

Participant and Intervention Characteristics

RQ3 examined whether participant and intervention characteristics could explain variation in intervention effects. The available evidence suggests several potentially important moderators, but the small number of included studies prevents definitive conclusions. Age is one plausible source of variation. Children aged 6–8 years and those aged 10–12 years differ in cognitive development, attention, previous movement experience, physical capacity, and ability to understand increasingly complex game rules. These differences may influence the degree of

structure, challenge, and instructional support required. However, the current evidence base was insufficient for robust age-stratified analysis.

Sex may similarly influence intervention responsiveness through differences in previous sport exposure, activity preferences, perceived competence, or motor experiences. Yet sex-specific effects were rarely reported in sufficient detail. Consequently, no firm conclusion can presently be drawn regarding whether boys and girls respond differently to game-based interventions.

Intervention dosage also varied considerably. Programs differed in total duration, number of sessions, session frequency, and presumably exposure to specific motor challenges. Such variation could contribute substantially to the differences in observed effects. Short interventions may produce initial skill adaptations, whereas longer and more frequent exposure may provide greater opportunities for consolidation. However, with only ten studies and considerable methodological heterogeneity, the present review cannot identify a definitive optimal intervention dosage.

Game format provides another potentially meaningful source of variation. Traditional and technology-enhanced interventions both demonstrated positive outcomes, but they may operate through partly different pathways. Traditional games commonly emphasise face-to-face social interaction, cooperation, competition, creativity, and responsiveness to unpredictable movement contexts. Technology-enhanced games may provide immediate visual or auditory feedback, automated progression, performance scores, and motivational features that can increase engagement (Hassan et al., 2022).

The findings therefore do not support positioning traditional and technology-enhanced games as competing intervention models. Rather, both may support motor development when their design creates sufficient movement intensity, variability, and challenge. Selection should depend on intervention goals, setting, available resources, and developmental appropriateness. Task Adaptation, Engagement, and Coaching Competency as Explanatory Mechanisms Although coaching competency, task adaptation, and athlete engagement were not sufficiently measured across the included studies to justify a separate research question or formal mediation analysis, they provide useful explanatory mechanisms for interpreting the findings. Game-based interventions do not operate independently of their delivery. The same game can provide substantially different learning experiences depending on how rules, space, equipment, opposition, movement complexity, and task difficulty are manipulated. A coach or instructor who recognises that a task is too easy or excessively difficult can modify these constraints to create a more appropriate challenge.

From an ecological dynamic's perspective, these adaptations change the information and movement opportunities available to the child (Davids et al., 2015). Consequently, intervention effectiveness may depend not only on *which game is played* but also on *how the game is adapted in response to participants' capabilities*. This provides a plausible connection between coaching competency, task adaptation, engagement, and motor development. A competent instructor may be better able to observe children's performance, modify task demands, and maintain an appropriate level of challenge. Appropriate task difficulty may, in turn, reduce frustration or boredom and promote greater behavioural engagement. Greater engagement generates more meaningful practice opportunities, potentially supporting subsequent improvements in motor competence. Conceptually, the process can therefore be represented

International Journal of Education, Psychology and Counseling
IJEPC
EISSN : 0128-164X
Volume 11 Issue 64 (September 2026) PP. 453-478
as: Game-Based Intervention → Task Adaptation and Coaching Decisions → Athlete Engagement → Repeated Quality Practice → Motor Competence

This pathway should be interpreted cautiously. The included studies did not provide sufficient evidence to establish task adaptation or engagement as statistical mediators. It represents a theoretically plausible mechanism that requires direct testing in future primary research. Longitudinal studies should measure coaching behaviour, task modification, engagement, and motor outcomes simultaneously so that these proposed relationships can be evaluated empirically.

Theoretical Implications

The findings are broadly compatible with ecological approaches to motor learning. Game-based environments expose children to changing constraints that require continuous perception-action adaptation rather than repetition of identical movement solutions (Davids et al., 2015). Such variability may facilitate flexible motor behaviour and improve transfer to less predictable physical activity and sport settings. The positive enjoyment findings can also be interpreted through Self-Determination Theory (Ryan & Deci, 2000). Games may provide opportunities for autonomy, perceived competence, and social relatedness, particularly when children can make decisions, experience successful skill execution, and interact with peers. Satisfaction of these psychological needs may increase intrinsic motivation and willingness to remain engaged.

Taken together, these perspectives suggest that the potential value of game-based interventions lies in the interaction of motor challenge and motivational experience. Games may be particularly effective when they create sufficiently demanding movement problems while simultaneously supporting children's willingness to continue participating.

Practical Implications

The findings support the integration of structured game-based activities within physical education, grassroots sport, and community physical activity programs. For teachers and coaches, game-based activities should be designed intentionally rather than used simply as recreational additions to conventional instruction. Select games based on their dominant motor demands and modify them progressively as children's capabilities develop.

Traditional games may be particularly useful in settings with limited equipment because they can provide meaningful motor challenges at relatively low cost. Technology-enhanced games may complement these activities where appropriate resources are available, particularly when real-time feedback or interactive features increase participation.

However, practitioners should avoid assuming that technology itself creates effectiveness. The essential consideration remains whether the activity generates appropriate movement demands, sufficient active participation, progressive challenge, and meaningful practice.

Limitations of the Review

Several limitations should be considered when interpreting these findings. First, only ten studies met the inclusion criteria, limiting the precision and generalisability of the synthesis.

International Journal of Education, Psychology and Counseling
IJEPC
EISSN : 0128-164X
Volume 11 Issue 64 (September 2026) PP. 453-478

The small evidence bases also restricted formal assessment of moderators and reduced the feasibility of meaningful meta-regression. Second, methodological quality varied considerably. Several studies employed one-group pretest-posttest designs rather than randomised controlled trials. Improvements observed in such designs cannot be attributed exclusively to the intervention because maturation, repeated testing, concurrent physical activity, and other uncontrolled influences may contribute to change.

Third, substantial heterogeneity existed in motor outcome assessment. Different instruments and protocols were used to evaluate agility, balance, coordination, and composite motor competence, limiting comparability and restricting quantitative pooling. Fourth, enjoyment was not assessed consistently. Variability in measurement tools reduced the capacity to estimate the magnitude of affective effects reliably. Fifth, restricting the review to English-language peer-reviewed studies may have introduced language and publication bias. This issue may be especially relevant to traditional games because culturally specific interventions may be reported in local-language journals or grey literature. Finally, variation in terminology across the literature may mean that relevant interventions described using alternative terms were not captured despite the systematic search strategy.

Directions for Future Research

Future research should prioritise adequately powered randomised or cluster-randomised controlled trials. Where possible, studies should include both active comparison conditions and longer-term follow-up to distinguish intervention effects from normal development and determine whether motor improvements are maintained. Greater standardisation of outcome measurement is also required. Validated motor assessments should be selected according to the construct being evaluated, while enjoyment should be measured using age-appropriate validated instruments. Consistent reporting would substantially improve future meta-analytic synthesis.

Studies should also examine intervention dosage more systematically. Experimental designs comparing session frequency, duration, and total intervention exposure could establish whether dose-response relationships exist for different motor outcomes. A particularly important direction is the detailed analysis of game characteristics. Future studies should report how games manipulate space, equipment, rules, feedback, competition, cooperation, and task difficulty. Such reporting would facilitate development of a taxonomy linking specific game characteristics with agility, balance, coordination, and enjoyment outcomes.

Finally, future intervention studies should explicitly measure coaching behaviour, task adaptation, and athlete engagement. This would allow researchers to move beyond determining whether game-based programs work and investigate how and why they work. Formal mediation or longitudinal pathway analyses could then examine whether adaptive coaching decisions improve engagement and whether increased engagement subsequently contributes to motor competence development.

Conclusion

This systematic review synthesised evidence from ten studies examining game-based motor competence interventions among children aged 6–12 years. The available evidence generally indicates that both traditional and technology-enhanced game-based approaches can improve

International Journal of Education, Psychology and Counseling
IJEPC
EISSN : 0128-164X
Volume 11 Issue 64 (September 2026) PP. 453-478
agility, balance, coordination, and broader motor competence. Game-based interventions also appear capable of generating positive enjoyment experiences, although inconsistencies in enjoyment measurement limit the strength of this conclusion.

Importantly, the review does not indicate that all games produce equivalent developmental outcomes. Variation in motor demands, intervention duration, frequency, participant characteristics, technological format, and instructional delivery likely influences effectiveness, but the current evidence base is insufficient to determine the optimal combination of these characteristics. The strongest conclusion is therefore not simply that games work, but that appropriately designed game environments can provide valuable conditions for motor learning and positive participation.

Task adaptation, coaching competency, and athlete engagement offer plausible explanations for how these benefits may occur, but they should currently be regarded as theoretical explanatory mechanisms rather than established mediators. Future research should measure these processes directly and test whether adaptive task delivery and engagement explain subsequent improvements in children's motor competence.

Overall, game-based interventions represent a promising and practically relevant strategy for supporting motor development during middle childhood. More rigorous trials, standardised outcome measurement, detailed reporting of intervention characteristics, and longitudinal evaluation are now required to determine which game-based interventions work best, for whom, under what conditions, and through what mechanisms.

Acknowledgements: The authors gratefully acknowledge the support and constructive feedback provided by colleagues and peers during the development of this systematic literature review. Their comments contributed to improving the clarity, methodological rigour, and overall quality of the manuscript

Funding Statement: This research received no specific grant from any funding agency in the public, commercial, or not-for-profit sectors.

Conflict of Interest Statement: The authors declare that there is no conflict of interest regarding the publication of this paper. All authors have contributed to this work and approved the final version of the manuscript for submission to the International Journal of Education, Psychology and Counselling (IJEPC).

Ethics Statement: Ethical approval and informed consent were not required because this systematic literature review was based exclusively on data and information reported in previously published studies. No primary data were collected from human participants or animals, and no identifiable or sensitive personal information was accessed. The review followed established principles of research integrity and ethical scholarly publishing.

Author Contribution Statement: Nizam led the study's conceptualization, methodological design, supervision, interpretation of the findings, and critical revision of the manuscript. Roslinda conducted the literature search, study screening, eligibility assessment, data extraction, evidence synthesis, and initial drafting of the manuscript. Azrina and Izwan contributed to interpreting the evidence and substantively revising the manuscript. Both authors reviewed and approved the final version of the manuscript and agreed to be accountable for the integrity of the work.

International Journal of Education, Psychology and Counseling
IJEPC
EISSN : 0128-164X
Volume 11 Issue 64 (September 2026) PP. 453-478

References

Abós, Á., Sevil, J., Martín-Albo, J., Aibar, A., et al. (2018). Validation evidence of the motivation for teaching scale in secondary education. *The Spanish Journal of Psychology*.

Bernhardin, D., Ward, R. F. V., & Alsyapari, F. (2023). Hadangan games to improve gross motor skills in elementary school children. *Journal of Physical and Outdoor Education*.

Dan, N., Nga, N., & Dung, T. (2024). Digital game-based learning in mathematics education at primary school level: A systematic literature review. *Eurasia Journal of Mathematics, Science and Technology Education*.

Davids, K., Araújo, D., Seifert, L., et al. (2015). *An ecological dynamics perspective*. Routledge Handbook of Sports Performance Analysis.

Ekkekakis, P., Hall, E., & Petruzzello, S. (2005). Variation and homogeneity in affective responses to physical activity of varying intensities: An alternative perspective on dose-response based on evolutionary …. *Journal of Sports Sciences*.

Elbe, A., Wikman, J., Zheng, M., et al. (2017). The importance of cohesion and enjoyment for the fitness improvement of 8-10-year-old children participating in a team and individual sport school-based physical …. *European Journal of Sport Science*.

Festiawan, R. (2020). Application of traditional games: How does it affect the children's fundamental motor skills? *Jurnal MensSana*.

Foweather, L., & Rudd, J. (2020). Fundamental movement skill interventions. *The Routledge Handbook of Youth Physical Activity*.

Frost, J., Wortham, S., & Reifel, R. (2012). *Play and child development*. museumofplay.org.

Greule, C., Sudeck, G., Thiel, A., Kastner, L., et al. (2024). Correlates of physical activity enjoyment in children and adolescents for a new perspective on the treatment of overweight: A systematic literature review. *Obesity Reviews*.

Gu, X. (2017). Understanding children's physical activity and health-related quality of life: An expectancy-value approach. *Advances in Physical Education*.

Handayani, S., Cahyani, O., et al. (2026). The effect of the roblox obby real life game-based learning model on elementary school students' gross motor skills. *Kinestetik : Jurnal Ilmiah Pendidikan Jasmani*.

Hassan, M., Liu, W., McDonough, D., Su, X., et al. (2022). Comparative effectiveness of physical activity intervention programs on motor skills in children and adolescents: A systematic review and network meta …. *International Journal of Environmental Research and Public Health*.

Miller, A. (2015). Games centered approaches in teaching children & adolescents: Systematic review of associated student outcomes. *Journal of Teaching in Physical Education*.

Mubarok, R., & Faruk, M. (2026). Efforts to improve the agility of sixth-grade students at SDN pangkatrejo through the traditional game of gobak sodor. *Journal of Applied Sport Science, Innovation, and Health*.

Mutamimah, S., Aliriad, H., & Apriyanto, R. (2026). The effect of interactive snakes and ladders game on improving elementary school students' basic motor skills. *Jurnal Elementaria Edukasia*.

Page, M., McKenzie, J., Bossuyt, P., et al. (2021). The PRISMA 2020 statement: An updated guideline for reporting systematic reviews. *BMJ*, *372*, n71.

Rached, H., & Mouloud, K. (2026). The effect of practicing traditional games on developing some coordinative abilities in children an experimental study on children of southeastern algeria. *GYMNASIUM*.

Rahmanifar, M., Ebrahimi, E., Davoodeh, S., Goharrizi, S. J., & Fard, G. C. (2024). The effect of game-based intervention on locomotor skills of female students aged 9-11 years with flat foot. *Sport Sciences for Health*, *21*, 729–735.

Robinson, L., Stodden, D., Barnett, L., Lopes, V., et al. (2015). Motor competence and its effect on positive developmental trajectories of health. *Sports Medicine*.

Romiszowski, A. (2013). The development of physical skills: Instruction in the psychomotor domain. *Instructional-Design Theories and Models*.

Rüth, M., & Kaspar, K. (2020). Exergames in formal school teaching: A pre-post longitudinal field study on the effects of a dance game on motor learning, physical enjoyment, and learning …. *Entertainment Computing*.

Ryan, R., & Deci, E. (2000). Self-determination theory and the facilitation of intrinsic motivation, social development, and well-being. *American Psychologist*.

Satria, M. H., Aliriad, H., Nuzulia, D., Mangngassai, I. A. M., Junaidi, I., & Zainuddin, Moh. (2024). Game-based physical education learning to improve basic manipulative movement skills in primary school children. *Edelweiss Applied Science and Technology*.

Scheuer, C., Herrmann, C., & Bund, A. (2019). Motor tests for primary school aged children: A systematic review. *Journal of Sports Sciences*.

Sholihah, Z. A., Aliriad, H., & Cahyani, O. D. (2026). The effectiveness of the SOS FIT challenge game in improving basic motor skills of elementary school students. *Kinestetik : Jurnal Ilmiah Pendidikan Jasmani*.

Syafira, K., Slamet, S., Sumarno, G., et al. (2026). The effectiveness of cooperative soccer like games on gross and social motor. *Kinestetik : Jurnal Ilmiah Pendidikan Jasmani*.

Teques, P., Calmeiro, L., Silva, C., & Borrego, C. (2020). Validation and adaptation of the physical activity enjoyment scale (PACES) in fitness group exercisers. *Journal of Sport and Health Science*.

Yanti, S. (2026). Implementation of the traditional game mpa'a gopa to improve gross motor skills among students at state elementary school 1 simpasai, lambu district, bima …. *Musamus Journal of Physical Education and Sport*.

Zavala-Martínez, L., Hurtado-Salgado, E., et al. (2026). Hypertensive disorders of pregnancy may increase the risk of neurodevelopmental delay in the offspring: A systematic review with meta-analysis. *Hypertension Research*.

Zhu, Y., Wang, J., Ding, Y., Qian, Y., Korivi, M., Chen, Q., et al. (2025). Assessing the measurement properties of the test of gross motor development-3 using the COSMIN methodology-a systematic review. *Behavioral Sciences*.