



Construction of Physical Movement Games to Improve Motor Movement Ability for Preschool Children

Xu Shenjing¹ and Chanchai Siripan²

^{1,2}Faculty of Sports Science and Technology, Bangkokthonburi University, Thailand

¹E-mail: 393650866@qq.com, ORCID ID: <https://orcid.org/0009-0006-9688-9634>

²E-mail: siriphan.cs@gmail.com, ORCID ID: <https://orcid.org/0009-0000-9981-655X>

Received 10/09/2025

Revised 24/09/2025

Accepted 31/10/2025

Abstract

Background and Aims: The main objective of this research was to develop physical movement games to improve motor ability in preschool children.

Methodology: This study employed a mixed-methods approach combining quantitative and qualitative research. The participants consisted of 225 kindergarten children in Sichuan Province, who were assessed using the TGMD-3 test, and 5 physical education teachers, who were interviewed. Validity checks were conducted with three experts for teachers and expert interview questionnaires (IOC = 0.86 and 0.83). Seven experts identified factors related to preschool game teaching, and ten experts refined the draft of physical movement games through a focus group. Finally, nine experts verified the developed games using connoisseurship methods, with TGMD-3 data analyzed using mean and standard deviation, and qualitative data analyzed through content analysis.

Results: The research results found that the physical movement games to improve motor movement ability for preschool children for a total of 17 games, including 4 locomotor games, 9 object control games, and 4 integrated skills games.

Conclusion: All nine experts are unanimous that physical movement games for preschool children should be developmentally appropriate, inclusive, and engaging.

Keywords: Physical Movement Games; Motor Movement Ability; Preschool Children

Introduction

Gross motor skills play a crucial role in the overall development of preschool children. The early years, particularly ages 3–6, are considered the golden period for cultivating physical abilities, which form the foundation for lifelong health and fitness (Gallahue & Ozmun, 2019). Developing fundamental movement skills enhances balance, coordination, flexibility, and strength. These abilities not only improve athleticism but also support cognitive growth, social interaction, and self-confidence (Haywood & Getchell, 2020). Research shows that children who participate in regular physical activities perform better academically, adapt more easily in social contexts, and





develop positive psychological traits (Lubans et al., 2016). The Test of Gross Motor Development–Third Edition (TGMD-3) is widely used to assess and monitor children’s skills, ensuring that they are progressing appropriately (Ulrich, 2017). Structured motor development programs have also been shown to improve coordination and movement efficiency, encouraging active and engaged lifestyles (Brian et al., 2019).

Despite the well-recognized benefits of gross motor development, many preschool children face challenges in their physical growth. The Chinese Health Association (2022) reported a significant decline in children’s fitness levels, with common problems including obesity, poor posture, reduced flexibility, and limited fundamental movement skills. These challenges are often linked to increased screen time, reduced outdoor play, and insufficient structured physical education programs (Timmons et al., 2012). The Long-Term Athlete Development (LTAD) model highlights that early childhood is a critical period for developing fundamental movement skills, which are essential for lifelong participation in sport and activity (Balyi et al., 2013). Without timely intervention, children may miss these opportunities, leading to sedentary behaviors and long-term health risks (Côté & Hancock, 2016).

Another challenge lies in the lack of well-prepared preschool educators. Many kindergarten teachers do not have adequate training in physical education, limiting their ability to design and implement effective programs (Hardy et al., 2010). As a result, children miss crucial opportunities to develop foundational movement skills. According to the LTAD framework, early programs should emphasize enjoyable, age-appropriate activities so that children build skills through play (Balyi et al., 2013). If early interventions are absent, deficits in coordination, fitness, and motivation to participate in physical activities may persist into later childhood (Logan et al., 2018).

One strategy to address these issues is to integrate physical movement games into preschool education. Such games enhance gross motor skills while keeping children engaged (Goodway & Robinson, 2015). By incorporating fun activities such as running, jumping, climbing, and balancing, educators can create enjoyable environments that foster physical development. Standardized tools like TGMD-3 help teachers track progress and identify specific areas for improvement (Ulrich, 2017). Evidence-based programs have been shown to close gaps in children’s motor development, ensuring they achieve appropriate physical milestones (Barnett et al., 2016). Parental involvement is also vital. Families can reinforce movement habits at home through active play, outdoor activities, or organized sports (Hnatiuk et al., 2019).

This study focuses on designing and structuring a sequence of movement games that align with preschool children’s developmental needs. The aim is to establish a structured, progressive program that systematically develops motor skills. Age-appropriate activities are integrated to create a comprehensive model for improving physical abilities (Logan et al., 2018). TGMD-3 will





be used as the main assessment tool to evaluate progress during the intervention (Ulrich, 2017). By measuring the effectiveness of these games, this study seeks to provide a framework for preschool physical education that can be adapted on a larger scale (Goodway & Robinson, 2015).

The findings of this study will help guide early childhood physical education policies to better support children's motor development, fitness, and overall well-being (Timmons et al., 2012). By applying principles from the LTAD model, it emphasizes the importance of early, structured experiences that foster lifelong participation in physical activity and sport (Balyi et al., 2013). Supporting motor skills development at this stage not only promotes immediate physical and cognitive growth but also lays the foundation for active, healthy lifestyles in the long term (Côté & Hancock, 2016). Importantly, the activities chosen are fun, age-appropriate, and scientifically informed, avoiding strenuous exercise while targeting developmental gaps identified through TGMD-3.

Childhood obesity has become a major concern in China. A 2019 Harvard report revealed that one in five Chinese children is overweight or obese, often due to sedentary behavior and poor diet. Within preschools, physical activities are often reduced to unstructured play that emphasizes enjoyment and safety, rather than targeted skill development. Since many teachers lack formal training in physical education, they struggle to design appropriate content for children's developmental needs. As a result, children's activities may fail to achieve the intended benefits of exercise.

In China's early education context, policies explicitly encourage the use of games to promote children's basic movement skills and enthusiasm for physical activity. However, in practice, gaps remain in program design and teacher expertise. Against this backdrop, this study was conducted under the title Sports Game Activity Curriculum Design for Kindergartens under Chuan Nan Preschool College, Neijiang City, Sichuan Province, China. The study was carried out to contribute to the improvement of preschool physical education through a structured and evidence-based approach.

Objectives

Main Objective

To develop physical movement games to improve motor ability in preschool children.

Subsidiary Objectives

- 1) To explore the current problems affecting preschool children's motor ability.
- 2) To modify physical movement games to improve the motor ability of preschool children.
- 3) To confirm physical movement games to improve the ability of preschool children.



Literature Review

(1) Trends in Children's Physical Fitness in China

Chinese children's physical fitness has shown a noticeable decline in recent years. Common issues include obesity, reduced flexibility, poor posture, and insufficient fundamental movement skills. Reports indicate that only about one-third of children meet the recommended physical activity guidelines, while sedentary lifestyles are on the rise. Longitudinal studies highlight worsening flexibility, strength, and coordination, alongside increased BMI and body composition problems. Research also shows strong links between fundamental movement skills and overall health-related fitness, suggesting that deficits in these skills contribute to poor outcomes. These findings emphasize the urgent need for targeted interventions in schools and communities to reverse the decline and promote lifelong physical activity (Chinese Health Association, 2022).

(2) Theoretical Perspectives on Motor Development

Gallahue and Ozmun (2019) propose a dynamic systems perspective, emphasizing the interaction between biological maturation, cognitive processes, and environmental factors. Similarly, Haywood and Getchell (2020) support this view, noting that motor learning is not limited to childhood but continues across the lifespan. Lubans et al. (2010) also found strong evidence of a positive correlation between motor skill competence and physical activity in children and adolescents, with a negative correlation between motor skills and weight status.

(3) Effects of Structured Interventions and Games

Brian et al. (2018) implemented targeted games such as *Kick and Score Adventure*, *Hit 4 and Go*, and *Catch the Rainbow*. These games incorporated repetitive, play-based approaches that significantly improved children's coordination and confidence. Locomotor skills, including running, galloping, hopping, and skipping, showed moderate proficiency and improvement after such game-based interventions. These findings align with TGMD-3 international norms, which indicate that locomotor development is often more advanced due to natural exposure through unstructured play (Ulrich, 2019). Similarly, Logan et al. (2018) emphasized that preschoolers with higher motor competence are more likely to engage in structured physical activities.

(4) Environmental and Contextual Challenges

Despite these benefits, limitations remain in the development of object control skills. Teachers report that activities such as striking or accurate kicking are rarely included in daily routines due to space limitations or fear of injury. Moreover, games requiring equipment like soft foam bats or large targets are often constrained by resource availability. These challenges echo Hardy et al. (2010), who emphasized the critical role of facilities and equipment in skill acquisition. Goodway and Robinson (2015) also noted that many preschoolers demonstrate delayed object manipulation skills due to limited structured practice opportunities.



(5) Frameworks and Policy Implications

Research in motor development categorizes gross motor skills into mobility (e.g., walking, running, jumping, sliding), manipulative (e.g., grasping, throwing, catching, striking), and stabilizing skills (e.g., rotating, landing, bending) (Barnett et al., 2016). Evidence supports the use of multicomponent interventions to promote these skills. For example, Hnatiuk et al. (2019) reviewed physical activity interventions and found that school-based programs combined with family and community engagement were the most effective. However, sustaining long-term behavioral change remains a challenge.

Timmons et al. (2012) further emphasized that structured and unstructured physical activity in early childhood is strongly linked to health and well-being, reducing the risks of obesity and chronic disease. The Long-Term Athlete Development (LTAD) framework stresses the importance of fun, age-appropriate play to foster fundamental motor skills in early years (Balyi et al., 2013). Similarly, Côté and Hancock (2016) advocate for evidence-based youth sports policies that balance skill acquisition with psychological well-being. Collectively, these studies underscore the importance of structured interventions, supportive environments, and policy frameworks in promoting lifelong physical activity.



Conceptual Framework

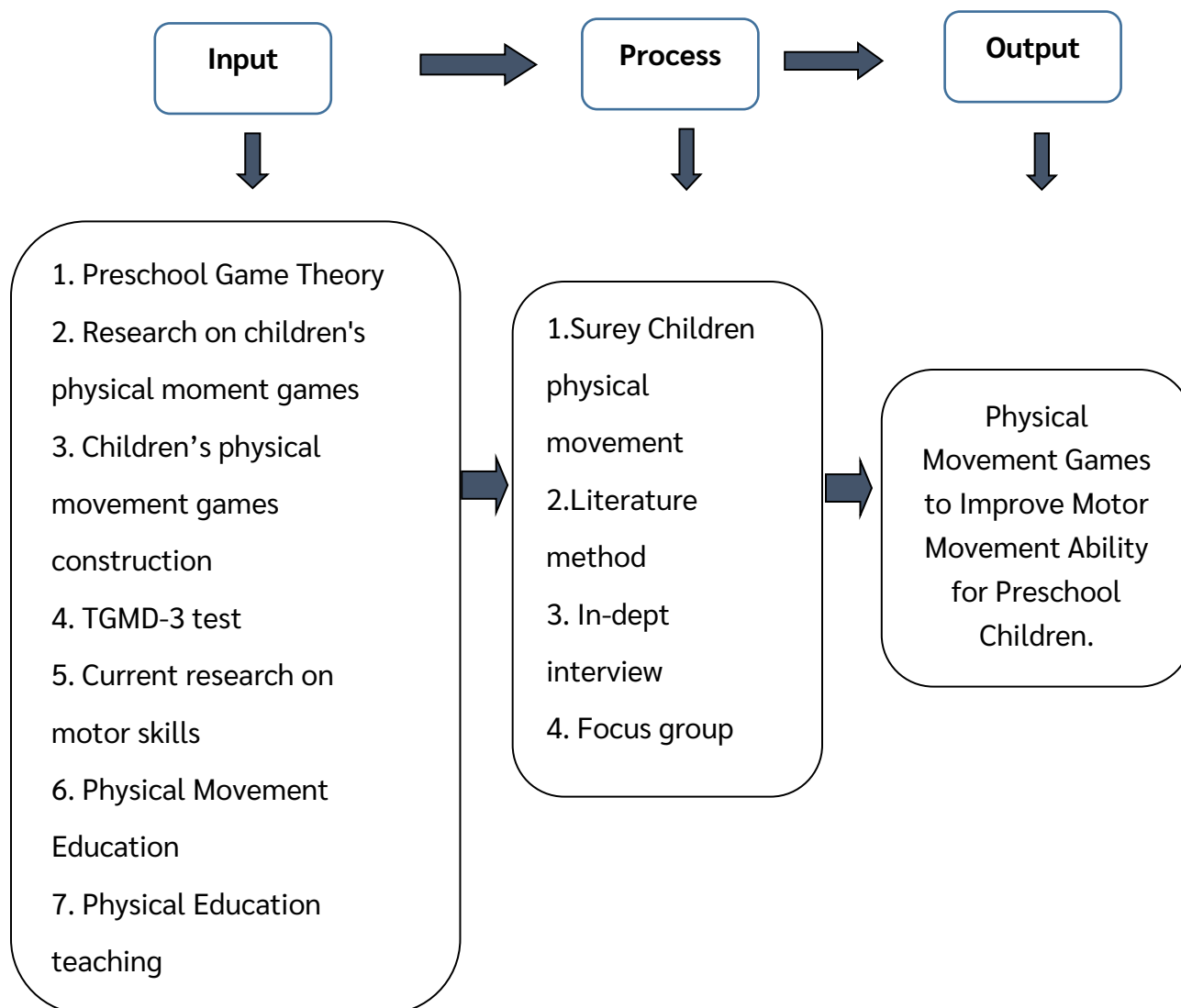


Figure 1 Conceptual Framework

Methodology

This study was conducted in five preschools in Sichuan Province with 160 children aged 3–6 and 15 teachers. Experts were purposively sampled: 3 for IOC validation, 7 for identifying teaching factors, 10 for game development, and 7 for connoisseurship verification. Research instruments included expert interview outlines, focus group outlines, connoisseurship assessments, and the TGMD-3 test. Data collection involved literature review, TGMD-3 testing, teacher interviews, expert interviews, focus group discussions, and connoisseurship analysis. Data were analyzed using Excel and statistical software, with TGMD-3 results reported as mean and SD, and qualitative data analyzed through content analysis. The research process included identifying

current problems, modifying physical movement games, confirming the final game design, and producing the research report.

Results

Part 1 Exploration of Current Issues in Preschool Children's Physical Development

Motor skill ability is crucial for preschool children's overall development, yet many face delays due to systemic and instructional issues. This study explored the problem through a literature review and TGMD-3 assessment of 225 children. Findings highlight the need for structured interventions and improved practices in early motor education.

Table 1 TGMD-3 Mean (M) and Standard Deviation (SD) Statistics for the 225 Children (n = 225)

No.	Skills	Mean (M)	Standard Deviation (SD)	Performance Level
1	Run	4.07	2.43	Moderate
2	Gallop	4.43	2.71	Moderate
3	Hop	3.77	2.81	Moderate
4	Skip	3.95	2.75	Moderate
5	Horizontal Jump	3.38	2.50	Moderate
6	Slide	4.05	2.59	Moderate
7	Two-Hand Strike	3.33	2.43	Low
8	One-Hand Strike	4.18	2.66	Moderate
9	Dribble	4.07	2.55	Moderate
10	Catch	3.73	2.61	Moderate
11	Kick	3.40	2.55	Low
12	Overhand Throw	4.12	2.73	Low
13	Underhand Throw	4.03	2.44	Moderate

From Table 1, TGMD-3 Score Interpretation Based on Mean and Standard Deviation

Dribble had the highest mean score ($M = 4.07$, $SD = 2.55$), but the wide variability suggests performance differences among children. Several skills demonstrated moderate performance, including Run ($M = 4.07$, $SD = 2.43$), Hop ($M = 3.77$, $SD = 2.81$), Skip ($M = 3.95$, $SD = 2.75$), Horizontal Jump ($M = 3.38$, $SD = 2.50$), Slide ($M = 4.05$, $SD = 2.59$), One-Hand Strike ($M = 4.18$, $SD = 2.66$), Catch ($M = 3.73$, $SD = 2.61$), and Underhand Throw ($M = 4.03$, $SD = 2.44$).

In contrast, children demonstrated low performance in Two-Hand Strike ($M = 3.33$, $SD = 2.43$), Kick ($M = 3.40$, $SD = 2.55$), and Overhand Throw ($M = 4.12$, $SD = 2.73$). Two-Hand Strike was the lowest-performing skill.



The highest variability ($SD \geq 2.70$) was observed in Gallop (2.71), Hop (2.81), Skip (2.75), and Overhand Throw (2.73). This indicates substantial differences in ability levels, highlighting the need for individualized instruction.

In summary, the mean scores across all 13 TGMD-3 skills ranged from 3.33 to 4.43, reflecting moderate to low proficiency overall. The considerable variability emphasizes the importance of designing diverse and inclusive physical activity programs that address individual differences in motor development.

Part 2 Modification of Physical Movement Games to Improve Preschool Children's Physical Health

Table 2 Final Draft of 17 Modified Physical Movement Games Developed Based on Focus Group Experts' Suggestions

No.	Game Name	Target Motor Skills	Category
1	Animal Obstacle Adventure	Walk, Run, Hop, Skip, Jump, Walk Backward	Locomotor Games
2	Run the Circle	Run, Skip, Gallop, Slide	Locomotor Games
3	Frogs and Lily Pads	Hop, Horizontal Jump, Balance, Body Coordination	Locomotor Games
4	Balance Tag Games	Run, Balance	Locomotor Games
5	Rhythm and Strike Parade	One-Hand Strike, Two-Hand Strike	Object Control Games
6	Kick and Score Adventure	Kick	Object Control Games
7	Dribble and Dash Maze	Dribble	Object Control Games
8	Catch the Rainbow	Catch	Object Control Games
9	Socctopus	Overhand Throw, Underhand Throw, Balance	Object Control Games
10	Target Relay	Overhand Throw, Underhand Throw, Run, Skip	Object Control Games





No.	Game Name	Target Motor Skills	Category
11	Hit Four and Go	Two-Hand Strike, Run, Overhand Throw	Object Control Games
12	Catching Challenge	Catch, Underhand Throw	Object Control Games
13	Long Pass	Kick, Run, Dribble	Object Control Games
14	Motor Skill Circuit Stations	Run, Gallop, Hop, Skip, Horizontal Jump, Slide, Striking, Dribble, Catch, Kick, Throw	Integrated Skills Games
15	Rob the Nest	Run, Carry, and Control, Underhand Throw	Integrated Skills Games
16	Balance Energizers	Balance, Core Stability	Integrated Skills Games
17	Team Alphabet	Run, Gallop, Skip, Slide	Integrated Skills Games

Part 3 Confirmation of Physical Movement Games to Improve Preschool Children's Physical Health.

Through the connoisseurship method, all nine experts unanimously agreed that physical movement games for preschool children should be developmentally appropriate, inclusive, and engaging. They recommended adjusting difficulty levels to accommodate diverse abilities, using flexible and sensory-friendly materials, and integrating both visual and auditory cues to enhance learning. The games should also combine locomotor and object control skills, often embedded within storytelling and imaginative themes to capture children's interest and maintain motivation. In addition, experts emphasized the importance of promoting peer interaction, ensuring cultural relevance, and incorporating academic elements such as literacy and numeracy within the activities. They further highlighted the necessity of structured progression, regular assessment, and strong teacher support to sustain the effectiveness of the games. Overall, the experts concluded that a clear structure, inclusive design, and progressive skill development are essential to maximize the benefits of physical movement games for improving preschool children's physical health.

Discussion

1. Effectiveness of the Games in Enhancing Locomotor and Object Control Skills



The study demonstrated that modified movement games effectively improved locomotor and object control skills in preschoolers. TGMD-3 results revealed weaker performance in striking, kicking, and throwing, which is consistent with prior research on delayed object skill development (Kim et al., 2020; Goodway & Robinson, 2015). Targeted games such as Kick and Score Adventure and Catch the Rainbow enhanced these abilities through play-based repetition (Brian et al., 2018). Locomotor skills such as running and galloping improved moderately, while hopping and skipping showed greater variability due to developmental maturity and environmental factors (Ulrich, 2019; Robinson et al., 2017). The use of inclusive materials and structured designs helped overcome resource barriers and ensured alignment with TGMD-3 criteria, thereby validating the effectiveness of the modified games (Hardy et al., 2010).

2. Developmentally Appropriate Game Design

The modified movement games were found to be developmentally appropriate for preschoolers aged 3–6, aligning with NAEYC (2020) guidelines. Games such as Animal Obstacle Adventure and Balance Tag incorporated imaginative play and age-appropriate movements, thereby supporting children's natural motor development (Pica, 2013). The play-based design integrated storytelling, music, and role-play, thereby fostering motor skills as well as language, executive function, and social cooperation (Ginsburg, 2007; Pellegrini & Smith, 2005). Integrated games such as Team Alphabet and Target Relay linked physical activity with literacy and numeracy, reflecting UNESCO's (2016) recommendations. Overall, scaffolded difficulty, inclusive tools, and thematic content ensured accessibility, joyful learning, and holistic growth (Tomlinson, 2014).

Recommendation

Research Application Results:

1. Preschools should form collaborative planning teams including teachers, administrators, parents, and early childhood specialists to co-design, implement, and monitor the use of physical movement games. This inclusive approach ensures that game activities address diverse developmental needs and remain aligned with educational goals.
2. To ensure successful implementation, preschools should invest in structured teacher training workshops that focus on movement skill development, inclusive practices, and game facilitation. The development of teacher manuals, assessment rubrics, and instructional videos can enhance consistency and confidence in game delivery.
3. School leaders should actively endorse the use of physical movement games by participating in play sessions, sharing success stories through school newsletters or parent channels, and empowering teachers and students as advocates for movement-based learning.



4. Schools should integrate systematic evaluation tools such as observational checklists, skill progression charts, and child-friendly reflection methods to monitor motor development. Regular feedback from teachers, parents, as well as children can help adapt games to evolving developmental needs.

5. Administrators must provide appropriate space, time, and materials such as soft balls, cones, and visual aids for physical movement games. Where facilities are limited, flexible setups using classrooms or outdoor zones can be optimized for movement-based activities.

Future Study Recommendations:

1. Future research should track the long-term effects of using modified movement games on preschool children's gross motor skills, social interaction, and school readiness to evaluate long-term developmental outcomes.

2. Future research should conduct comparative studies across urban, rural, and diverse socio-economic preschool settings to identify contextual influences and develop adaptable, equitable movement game strategies.

3. Future research should evaluate the effectiveness of different professional development formats, including workshops, peer coaching, and online modules, in enhancing teacher capacity for implementing motor skill games.

4. Future research could examine the impact of child-led game formats and peer modeling on children's participation, engagement, and leadership development in early childhood motor education.

5. Future research should investigate the integration of technology such as interactive apps, video modeling, or gamification to boost children's motivation, facilitate home practice, and support differentiated learning in physical movement games.

References

- Balyi, I., Way, R., & Higgs, C. (2013). *Long-term athlete development*. Human Kinetics.
- Barnett, L. M., Salmon, J., & Hesketh, K. D. (2016). More active preschool children have better motor competence at school starting age: An observational cohort study. *BMC Public Health*, 16, Article 1068. <https://doi.org/10.1186/s12889-016-3742-1>
- Brian, A., True, L., & Goodway, J. D. (2018). Effectiveness of motor skill intervention in young children: A systematic review. *Research Quarterly for Exercise and Sport*, 89(3), 267–277. <https://doi.org/10.1080/02701367.2018.1481366>
- Brian, A., True, L., & Goodway, J. D. (2019). Motor competence levels and developmental delay in early childhood: A multicenter cross-sectional study conducted in the USA. *Research Quarterly for Exercise and Sport*, 90(3), 333–341.





- Chinese Health Association. (2022). *Report on the physical fitness of Chinese children*. Chinese Health Association
- Côté, J., & Hancock, D. J. (2016). Evidence-based policies for youth sport programs. *International Journal of Sport Policy and Politics*, 8(1), 51–65.
<https://doi.org/10.1080/19406940.2014.919338>
- Gallahue, D. L., & Ozmun, J. C. (2019). *Understanding motor development: Infants, children, adolescents, adults* (8th ed.). McGraw-Hill Education.
- Ginsburg, K. R. (2007). The importance of play in promoting healthy child development and maintaining strong parent–child bonds. *Pediatrics*, 119(1), 182–191.
<https://doi.org/10.1542/peds.2006-2697>
- Goodway, J. D., & Robinson, L. E. (2015a). Developmental trajectories in early sport specialization: A case for early sampling from a motor skill competence perspective. *Quest*, 67(4), 371–383. <https://doi.org/10.1080/00336297.2015.1082856>
- Goodway, J. D., & Robinson, L. E. (2015b). Developmental trajectories in early sport specialization: Early motor skills and lifelong physical activity. *Quest*, 67(2), 173–187.
<https://doi.org/10.1080/00336297.2015.1041967>
- Hardy, L. L., King, L., Farrell, L., Macniven, R., & Howlett, S. (2010). Fundamental movement skills among Australian preschool children. *Journal of Science and Medicine in Sport*, 13(5), 503–508. <https://doi.org/10.1016/j.jsams.2009.05.010>
- Haywood, K. M., & Getchell, N. (2020). *Life span motor development* (7th ed.). Human Kinetics.
- Hnatiuk, J. A., Brown, H. E., Downing, K. L., Hinkley, T., Salmon, J., & Hesketh, K. D. (2019). Interventions to increase physical activity in children 0–5 years old: A systematic review, meta-analysis and realist synthesis. *Obesity Reviews*, 20(12), 75–87.
<https://doi.org/10.1111/obr.12853>
- Kim, H., Park, I., & Lee, Y. (2020). Fundamental motor skills and physical activity in young children: A systematic review and meta-analysis. *International Journal of Behavioral Nutrition and Physical Activity*, 17(1), 1–20. <https://doi.org/10.1186/s12966-020-00938-y>
- Logan, S. W., Ross, S. M., Chee, K., Stodden, D. F., & Robinson, L. E. (2018). Fundamental motor skills: A systematic review of terminology. *Journal of Sports Sciences*, 36(7), 781–796.
<https://doi.org/10.1080/02640414.2017.1340660>
- Lubans, D. R., Morgan, P. J., Cliff, D. P., Barnett, L. M., & Okely, A. D. (2016). Fundamental movement skills in children and adolescents: Review of associated health benefits. *Sports Medicine*, 40(12), 1019–1035. <https://doi.org/10.2165/11536850-000000000-00000>





- National Association for the Education of Young Children (NAEYC). (2020). *Developmentally appropriate practice in early childhood programs serving children from birth through age 8* (4th ed.). National Association for the Education of Young Children.
- Pellegrini, A. D., & Smith, P. K. (2005). *The nature of play: Great apes and humans*. Guilford Press.
- Pica, R. (2013). *Moving and learning across the curriculum: More than 300 activities and games to make learning fun*. Cengage Learning.
- Robinson, L. E., Stodden, D. F., Barnett, L. M., Lopes, V. P., Logan, S. W., Rodrigues, L. P., & D'Hondt, E. (2017). Motor competence and its effect on positive developmental trajectories of health. *Sports Medicine*, 45(9), 1273–1284. <https://doi.org/10.1007/s40279-015-0351-6>
- Timmons, B. W., Leblanc, A. G., Carson, V., Connor Gorber, S., Dillman, C., Janssen, I., Kho, M. E., Spence, J. C., Stearns, J. A., & Tremblay, M. S. (2012). Systematic review of physical activity and health in the early years (aged 0–4 years). *Applied Physiology, Nutrition, and Metabolism*, 37(4), 773–792. <https://doi.org/10.1139/h2012-070>
- Tomlinson, C. A. (2014). *The differentiated classroom: Responding to the needs of all learners* (2nd ed.). ASCD.
- Ulrich, D. A. (2017). *Test of Gross Motor Development* (3rd ed.). Pro-Ed.
- Ulrich, D. A. (2019). *Test of Gross Motor Development, Third Edition (TGMD-3)*. Pro-Ed.
- UNESCO. (2016). *Quality physical education (QPE): Guidelines for policy-makers*. United Nations Educational, Scientific, and Cultural Organization.
<https://unesdoc.unesco.org/ark:/48223/pf0000242425>

