



# Exploring the Relationship between Motor Competence with Physical Activity in Children: The Mediating Role of Motivation and Enjoyment

Amir Shams \*

Associate Professor, Sport Sciences Research Institute, Tehran, Iran

\*Corresponding Author: Amir Shams, Associate Professor, Sport Sciences Research Institute, Tehran, Iran. Email: a.shams@ssrc.ac.ir

Received: 27 September, 2025; Revised: 03 December, 2025; Accepted: 10 December, 2025; Published: 26 December, 2025.

## Abstract

**Introduction:** The connection between motor competence (MC) and participation in physical activity (PA) among children is well established; however, the underlying mechanisms of this relationship remain inadequately explored in existing research.

**Objective:** This study seeks to investigate the roles of motivation and enjoyment as potential mediators in the association between MC and engagement in PA among children.

**Methods:** This cross-sectional study utilized 183 male children who were selected through convenience sampling. TGMD-3, accelerometer, The Revised Scale of Sport Motivation and Enjoyment Scale were used to evaluate the research variables. Data analysis was conducted using Smart PLS.

**Results:** A significant positive structural relationship was observed between MC and PA ( $b=0.622$ ), motivation ( $b=0.571$ ), and enjoyment ( $b=0.711$ ). Additionally, the analysis highlights a significant positive correlation between motivation ( $b=0.475$ ) and enjoyment ( $b=0.512$ ) in relation to PA. Importantly, both motivation ( $b=0.271$ ) and enjoyment ( $b=0.364$ ) serve as significant mediating variables in the relationship between MC and PA.

**Conclusion:** Improved motor skills are linked to higher PA, with motivation and enjoyment being crucial factors in this relationship. Consequently, it is recommended that physical education teachers and coaches prioritize sports programs tailored to the motor abilities of children.

**Keywords:** Child, Exercise, Motor Skills, Motivation, Pleasure

**How to Cite:** Shams A. Exploring the Relationship between Motor Competence with Physical Activity in Children: The Mediating Role of Motivation and Enjoyment. Phys. Act. Child. 2025;2(2):22-27. doi:10.22034/pach.2025.549571.1070

## 1. Introduction

Physical activity (PA) plays a crucial role in maintaining health throughout the life (1). Insufficient PA significantly heightens the risk of various physical and mental health issues (2). Research indicates that a substantial portion of the global population is not engaging in adequate PA, prompting the World Health Organization to advocate for increased movement across all age groups (3,4). Specifically, studies reveal that only 39% of children aged 7 to 17 meet the international recommendations (5,6). Recognizing the various elements that affect children's engagement in physical activity is essential, particularly due to the substantial health advantages linked to consistent exercise. Identifying these determinants can help promote more active lifestyles among children, ultimately contributing to their overall well-being.

Fundamental motor skills play a crucial role in influencing children's engagement in PA (7). The foundational skills of PA include both ball-handling abilities and locomotor skills. These competencies are essential for executing more advanced movements that are necessary in various PA (8). Consequently, proficiency in these skills during childhood and adolescence can significantly predict PA patterns throughout the life (7). Motor competence (MC),

characterized by skilled performance and enhanced coordination, is vital for executing daily tasks and participating in various physical pursuits (9). Increased PA provides children with more opportunities to refine their fundamental motor skills, while a lack of engagement in PA can hinder their development of MC (10,11).

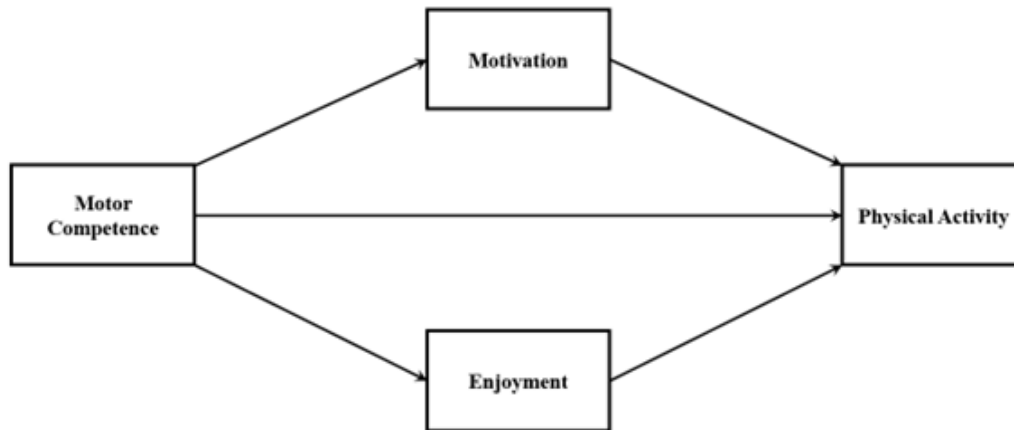
Research has identified a positive correlation between MC and participation in PA, a relationship that holds true across different ages and genders (12,13). It has been also found that as children age, their fundamental motor skills tend to mature, with no significant differences observed between genders (14,15). Despite these findings, research indicates that children often do not engage in regular PA (5,6). Stodden developed a model illustrating the interplay between MC, PA, perceived MC and physical fitness (16). The framework suggests a dynamic interaction where MC enhances PA during early childhood through diverse motor experiences. As children progress into middle and late childhood, the reciprocal relationship between these two factors intensifies. This model posits that the synergistic connection between MC and PA can lead to either beneficial outcomes, such as maintaining a healthy weight, or adverse ones, like obesity. Consequently, children who demonstrate superior MC tend to engage in higher PA and exhibit



lower obesity rates throughout childhood and adolescence. Longitudinal studies further corroborate that strong MC in childhood positively influences PA in subsequent years (17,18).

The association between MC and PA participation in youth is widely acknowledged; however, underlying mechanisms of this relationship remain underexplored in existing literature. According to the

Stodden model, perceived MC and physical fitness are significant factors that influence this association. Nevertheless, it is essential to explore other potential contributors. The primary objective is, therefore, to investigate the relationship between MC and PA while considering the influence of motivation and enjoyment as potential mediators. A conceptual model representing this relationship is depicted in Figure 1.



**Figure 1.** The Conceptual Model of the Study.

## 2. Methods

### 2.1. Design and Participants

This study utilized a descriptive-correlational design with structural equation modeling (SEM) and focused on a sample of 183 male children aged 9 to 12 years. Participants were recruited from primary schools and had to meet specific health criteria, being free from any physical or mental health issues and not currently on special medications. Those who did not meet these requirements or failed to complete the questionnaire were excluded from the analysis. A priori power analysis conducted with G\*Power 3.1 ( $f^2 = 0.15$ ,  $\alpha=0.05$ , power=0.80) with three predictors, indicated that a minimum of 77 participants was necessary. The final sample of 183 children surpassed this threshold, ensuring sufficient statistical power for the intended regression and mediation analyses.

### 2.2. Measurements

#### 2.2.1. Motor Competence

The Test of Gross Motor Development-Third Edition (TGMD-3) (19) was utilized for evaluating MC through two distinct subscales: locomotor skills and ball skills (object control). The locomotor skills subscale has a maximum score of 46 points and the ball skills subscale contribute 54 points towards a total possible score of 100 in the test. In this study, the Cronbach's alpha coefficient was 0.90.

#### 2.2.2. Physical Activity

PA was evaluated using an accelerometer. The accelerometer captures various intensities of PA, including light, moderate, and vigorous. This study concentrated on MVPA index as a means to evaluate overall PA.

#### 2.2.3. Motivation

The Revised Scale of Sport Motivation (20) was utilized to evaluate participants' motivation levels, encompassing 11 distinct items. Responses to the questionnaire were measured on a 7-point Likert scale. In this study, the Cronbach's alpha coefficient was 0.96.

#### 2.2.4. Enjoyment

To assess enjoyment, we employed a questionnaire comprising four items (21). Each item was rated from 1 (strongly disagree) to 5 (strongly agree). In this study, the Cronbach's alpha coefficient was 0.94.

### 2.3. Statistical Analysis

Means and standard deviations (SD) were utilized for descriptive statistics. Following this, Pearson correlation analyses were performed to investigate the relationships among MC, PA, motivation, and enjoyment. For the mediation analysis, SEM was conducted using SmartPLS version 4 ( $\alpha=0.05$ ). Prior to evaluating the structural model, the measurement model was examined for reliability and validity, focusing on indicator loadings, composite reliability, and average variance extracted (AVE). To mitigate potential multicollinearity among predictor variables, variance inflation factors (VIF) were calculated, ensuring that collinearity did not compromise the estimates. The model fit was evaluated using the standardized root mean square residual (SRMR) and other relevant PLS fit indices to confirm the validity of the proposed mediation model. Finally, bootstrapping with 5,000 resamples was utilized to assess the significance of both direct and indirect effects, providing a robust estimation of the mediating roles of motivation and enjoyment between MC and PA.

### 3. Results

The demographic analysis revealed that the average age of the children was 10.57 years, with a SD of 0.47 years. Additionally, the body mass index (BMI) was found to be within a normal and healthy range, averaging 18.42 with a SD of 1.46. Furthermore, [Table 1](#)

illustrates the means and SDs for MC, PA, motivation, and enjoyment. The skewness and kurtosis values for all measured variables were between -2 and +2, indicating that the data adheres to the assumptions of normal distribution.

**Table 1.** Description of Research Variables.

	Mean	SD	Skewness	Kurtosis
Motor competence	56.38	3.71	0.219	0.587
Physical activity	36.23	4.18	0.428	0.716
Motivation	3.66	0.43	0.158	0.293
Enjoyment	2.77	0.39	0.415	0.493

In addition, there was a significant positive correlation between MC and PA ( $p<0.001$ ), motivation ( $p<0.001$ ) and enjoyment ( $p<0.001$ ). Additionally, a significant positive relationship exists between motivation and enjoyment with PA ( $p<0.001$ ). Finally, motivation was significantly correlated with enjoyment ( $p<0.001$ ). These findings support the

validity of the assumption of a linear relationship among the variables. VIF values for the research variables were all below the critical threshold of 10, suggesting that multicollinearity is not a concern among them. Consequently, the research model was executed using Smart PLS statistical software, and the results were analyzed accordingly ([Table 2](#)).

**Table 2.** Pearson Correlation Matrix among the Research Variables.

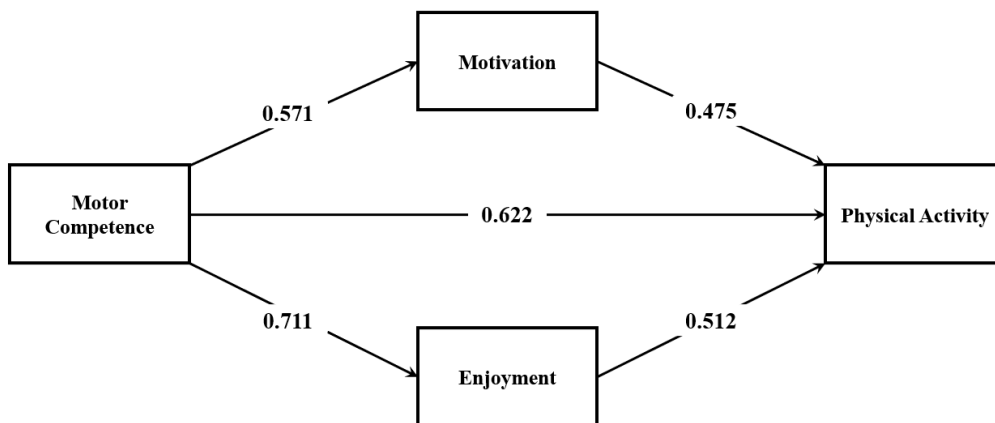
	1	2	3	4
1. Motor competence	-			
2. Physical activity	$r=0.638$ $p<0.001$	-		
3. Motivation	$r=0.583$ $p<0.001$	$r=0.439$ $p<0.001$	-	
4. Enjoyment	$r=0.715$ $p<0.001$	$r=0.507$ $p<0.001$	$r=0.472$	-

The path analysis results obtained through Smart PLS software, as depicted in [Table 3](#) and [Figure 2](#), indicate a significant positive structural relationship between MC and all research variables, including PA ( $b=0.622$ ), motivation ( $b=0.571$ ), and enjoyment ( $b=0.711$ ). Additionally, the analysis highlights a significant positive correlation between motivation and enjoyment in relation to PA ( $b=0.475$  and  $b=0.512$ ,

respectively). Importantly, both motivation and enjoyment serve as significant mediating variables in the relationship between MC and PA, evidenced by the results showing  $b=0.271$  for motivation and  $b=0.364$  for enjoyment. These findings underscore the intricate interplay between these variables, suggesting that enhancing MC may lead to increased PA through the channels of motivation and enjoyment.

**Table 3.** Structural Model Coefficients and Values for the Direct Path.

Direct Path	b	T-Value	p-Value
Motor Competence $\Rightarrow$ Physical Activity	0.622	6.547	0.000
Motor Competence $\Rightarrow$ Motivation	0.571	5.637	0.000
Motor Competence $\Rightarrow$ Enjoyment	0.711	7.139	0.000
Motivation $\Rightarrow$ Physical Activity	0.475	4.938	0.000
Enjoyment $\Rightarrow$ Physical Activity	0.512	5.074	0.000
Indirect Path			
Motor Competence $\Rightarrow$ Motivation $\Rightarrow$ Physical Activity	0.271	2.857	0.000
Motor Competence $\Rightarrow$ Enjoyment $\Rightarrow$ Physical Activity	0.364	3.726	0.000



**Figure 2.** Standardized Coefficients of Paths.

The Stone-Geisler Q2 index values were all found to be positive, which suggests that the structural model in question is of high quality. This model showcases strong predictive power concerning the endogenous latent variables, particularly evidenced by an  $R^2$  value of 0.35 and 0.39 for motivation and enjoyment, respectively. This figure indicates that the model accounts for 35 and 39 percent of the variance observed in motivation and enjoyment, respectively, highlighting their effectiveness. Additionally, SRMR value stands at 0.078, which is comfortably below the threshold of 0.08, further supporting the model's validity. Moreover, the goodness of fit index (GOF) for the overall model is recorded at 0.39, surpassing the minimum acceptable level of 0.36. Taken together, these metrics strongly suggest that the model demonstrates a robust fit, reinforcing its reliability and applicability in predictive analysis.

#### 4. Discussion

The current research aimed to explore the roles of motivation and enjoyment as potential mediators in the link between MC and PA engagement in young individuals. The results reveal a significant positive structural relationship between MC and PA. Notably, both motivation and enjoyment emerge as critical mediating factors in this relationship, highlighting the complex interactions among these variables. This suggests that improvements in MC could lead to greater participation in PA, facilitated by increased motivation and enjoyment. These findings are consistent with prior studies (16-18) that indicate that enhanced motor skills contribute to higher PA among children, with motivation and enjoyment playing essential roles in this process.

This relationship may be influenced by neurological or physiological factors (12,22,23). Effective coordination of movement relies on the integration of biomechanical and neuromuscular systems that govern muscle activation, sequencing, timing, and scaling (24). Consequently, children with higher MC are likely to engage in a wider range of PA, as they possess enhanced skills in activating and coordinating movement patterns (25). Additionally, more efficient movement may lead to reduced energy expenditure and lower fatigue levels, which can encourage increased frequency and intensity of PA (26). Further investigation is necessary to elucidate the psychosocial and neurophysiological mechanisms that underpin the relationship between MC and PA.

In addition, the theoretical framework underlying the observed positive structural relationships between MC, motivation, enjoyment and PA suggests that mastery of movement skills equips children with the necessary behavioral competencies to engage in a range of PA (27,28). This proficiency not only influences their perceptions of competence but also enhances their motivation, enjoyment and satisfaction in PA. In the absence of adequate movement skills, children may shy away from PA opportunities, gravitating instead towards more sedentary options (16,29). While participation in diverse PA is essential for motor development, the acquisition of MC lays the groundwork for more advanced movement skills, which in turn promote involvement in various forms of PA. As children grow and begin to assess their abilities against those of their peers, MC becomes

crucial factor influencing their participation in PA (17,18). Higher MC is linked to greater enjoyment and motivation for an active lifestyle, making it a vital element in encouraging PA. Conversely, low MC may lead to disengagement from PA, potentially hindering further motor development (28,29).

When children engage in PA that are both meaningful and appropriately challenging, they tend to experience heightened feelings of achievement, progress, and enjoyment (30). This study highlights motivation and enjoyment as key mediators in the relationship between MC and PA. These results align with self-determination theory, which posits that when children partake in PA where they feel a sense of mastery, their intrinsic motivation is bolstered, leading to increased satisfaction and enjoyment in sports (31). Consequently, it is crucial to design sports programs that present challenges suitable to children's physical abilities and skills. PA that are either too simplistic or excessively difficult can result in mental and physical fatigue, diminishing motivation and enjoyment (32). Thus, facilitating controlled experiences of success and failure is essential for enhancing self-efficacy and perception of capabilities. Ultimately, to foster motivation and enjoyment in PA, it is vital to create experiences that promote a sense of progress and mastery.

Motivation, particularly intrinsic motivation, is crucial for enhancing enjoyment of PA, as demonstrated in this study. When fundamental psychological needs are fulfilled, their intrinsic motivation is significantly bolstered (33). The findings indicate a strong positive correlation between motivation and enjoyment in PA, aligning with existing psychological and motivational research. Children are more likely to engage in PA when they have the freedom to choose and feel a sense of control over their participation (34). According to self-determination theory, enjoyment and satisfaction increase when children actively engage in PA without external pressure (35). Additionally, overcoming challenges fosters a sense of mastery and competence, which in turn boosts self-confidence, leading to a greater enjoyment of PA and an increased desire to participate (32,34).

#### 4.1. Conclusion

This research indicates that enhancing MC can significantly boost PA, driven by increased motivation and enjoyment. The results suggest that improved motor skills are linked to higher PA, with motivation and enjoyment being crucial factors in this relationship. Consequently, it is recommended that physical education teachers and coaches prioritize sports programs tailored to the motor abilities of children. By focusing on skill development that aligns with children's capabilities, these programs can better equip them to navigate challenges, thereby increasing their motivation and enjoyment. Furthermore, such initiatives can help children learn to manage disappointments and minor setbacks, transforming these experiences into valuable learning opportunities. Therefore, fostering adaptive skills should be a key component of children's sports programs to enhance physical health alongside mental and social development.

The findings of this study highlight the importance of fostering MC, motivation, and enjoyment to

promote children's PA. In practice, educators, coaches, and parents can support children's engagement in PA by providing diverse movement experiences that build fundamental motor skills while ensuring PA are enjoyable and intrinsically motivating. Schools and community programs could implement games, skill-based challenges, and playful PA that target motor development, rather than focusing solely on competitive performance. By emphasizing enjoyment and motivational support alongside skill development, interventions are more likely to encourage sustained participation in PA, ultimately contributing to better physical health, psychosocial well-being, and lifelong active habits in children.

## Acknowledgments

The author is grateful to all participants who took part in this research.

## Footnotes

**Authors' Contribution:** This study was carried out solely by the corresponding author.

## Conflicts of Interest

Non to declare.

**Data Availability:** The data that support the findings of this study are openly available upon request from the corresponding author.

**Ethical Approval:** This research was carried out in compliance with the ethical principles set forth in the Declaration of Helsinki and received approval from the University Ethics Committee (Code: IR.SSRC.REC.1404.058). Informed consent was obtained from both the participants and their parents.

## Funding Support

This study received no grant.

**Informed Consent:** Informed written consent was obtained from all participants

**Supplementary information** accompanies this paper at doi: 10.22034/pach.2025.549571.1070

## ORCID iD

Amir Shams  <https://orcid.org/0000-0001-9931-9158>

## References

- Sandri E, Capoferri M, Luciani G, Piredda M. The Link Between Physical Activity, Nutrition, and Health: A Cross-Sectional Study with Multivariate Analysis in a Young and Predominantly Female Spanish Sample. *Nutrients*. 2025;**17**(9):1486. [PubMed ID: 40362795]. <https://doi.org/10.3390/nu17091486>
- Białkowski A, Soszyński P, Stencel D, Religioni U. Consequences of Insufficient Physical Activity: A Comparative Analysis of Poland and Europe. *Med Sci Monit*. 2024;**30**:e942552. [PubMed ID: 38532539]. [PubMed Central ID: PMC10983816] <https://doi.org/10.12659/msm.942552>
- Strain T, Flaxman S, Guthold R, Semenov E, Cowan M, Riley LM, Bull FC, Stevens GA; Country Data Author Group. National, regional, and global trends in insufficient physical activity among adults from 2000 to 2022: a pooled analysis of 507 population-based surveys with 5.7 million participants. *Lancet Glob Health*. 2024;**12**(8):e1232-e1243. [PubMed ID: 38942042]. [PubMed Central ID: PMC11254784] [https://doi.org/10.1016/S2214-109X\(24\)00150-5](https://doi.org/10.1016/S2214-109X(24)00150-5)  
Erratum in: *Lancet Glob Health*. 2025;**13**(2):e202. [https://doi.org/10.1016/S2214-109X\(24\)00533-3](https://doi.org/10.1016/S2214-109X(24)00533-3).
- Dana A, Ranjbari S, Chaharbaghi Z, Ghorbani S. Association between Physical Activity and Motor Proficiency among Primary School Children. *Int J School Health*. 2023;**10**(3):128-135. <https://doi.org/10.30476/intjsh.2023.98237.1295>
- Hu D, Zhou S, Crowley-McHattan ZJ, Liu Z. A comparative study of the physical activity guidelines for children and adolescents from five countries and WHO. *Front Public Health*. 2024;**12**:1421843. [PubMed ID: 39071153]. [PubMed Central ID: PMC11272551] <https://doi.org/10.3389/fpubh.2024.1421843>
- Khanbeiki A. The Effects of Mindfulness Training in the Physical Education on Intention to Physical Activity, Mental Health and Academic Performance among High-School Students. *Phys Act Child*. 2024;**1**(1):68-73. <https://doi.org/10.61186/PACH.2024.470015.1022>
- Madu G, Kwong V, Calic D, Cleworth T, Belcastro A. The Role of Fundamental Movement Skills and Health-Related Fitness on Physical Activity During Guided Active Play for 8- to 10-Year-Old Children. *Children (Basel)*. 2025;**12**(6):805. [PubMed ID: 40564763]. [PubMed Central ID: PMC12192467] <https://doi.org/10.3390/children12060805>
- Rahimiderazi Z, Bagherzadeh R, Ravanipour M. Relationship between physical activity and sleep habits with motor proficiency among school aged children in Iran. *Sci Rep*. 2025;**15**(1):7837. [PubMed ID: 40050669]. [PubMed Central ID: PMC11885419] <https://doi.org/10.1038/s41598-025-92558-9>
- Gao J, Yang Y, Xu X, Huang D, Wu Y, Ren H, Zhang A, Ke X, Song W. Motor-Based Interventions in Children with Developmental Coordination Disorder: A Systematic Review and Meta-analysis of Randomised Controlled Trials. *Sports Med Open*. 2025;**11**(1):59. [PubMed ID: 40419841]. [PubMed Central ID: PMC12106291] <https://doi.org/10.1186/s40798-025-00833-w>
- Roscoe CMP, Taylor N, Weir N, Flynn RJ, Pringle A. Impact and Implementation of an Early Years Fundamental Motor Skills Intervention for Children 4-5 Years. *Children (Basel)*. 2024;**11**(4):416. [PubMed ID: 38671633]. [PubMed Central ID: PMC11048878] <https://doi.org/10.3390/children11040416>
- Guo X, Li C, Zhang Z, Silva AF, Clemente FM. Can motor competence be influenced by the type of training interventions preschool children are exposed to? A randomized experimental study comparing sports games and psychomotricity activities. *Front Psychol*. 2024;**15**:1476297. [PubMed ID: 39764074]. [PubMed Central ID: PMC11701235] <https://doi.org/10.3389/fpsyg.2024.1476297>
- Zi Y, de Geus EJC. Reviewing the association between motor competence and physical activity from a behavioral genetic perspective. *Front Psychol*. 2025;**16**:1480631. [PubMed ID: 40357490]. [PubMed Central ID: PMC12066450] <https://doi.org/10.3389/fpsyg.2025.1480631>
- Taylor SL, Downs SJ, Rudd JR, McGrane B, Melville CA, McGarty AM, Boddy LM, Fowweather L. Associations between motor competence and physical activity levels of children with intellectual disabilities and/or autism spectrum disorder: Movement matters. *J Intellect Disabil*. 2024;**28**(4):976-993. [PubMed ID: 37729890]. [PubMed Central ID: PMC11585179] <https://doi.org/10.1177/17446295231203764>
- Biino V, Pesce C, Martins C. Motor Skill Development at Preschool Age in Girls and Boys: The Role of Outdoor Free Play. *Children (Basel)*. 2025;**12**(5):594. [PubMed ID: 40426773]. [PubMed Central ID: PMC12109917] <https://doi.org/10.3390/children12050594>
- Hurtado-Almonacid J, Reyes-Amigo T, Yáñez-Sepúlveda R, Cortés-Roco G, Oñate-Navarrete C, Olivares-Arancibia J, Páez-Herrera J. Development of Basic Motor Skills from 3 to 10 Years of Age: Comparison by Sex and Age Range in Chilean Children. *Children (Basel)*. 2024;**11**(6):715. [PubMed ID: 38929294]. [PubMed Central ID: PMC11202137] <https://doi.org/10.3390/children11060715>
- Robinson LE, Stodden DF, Barnett LM, Lopes VP, Logan SW, Rodrigues LP, D'Hondt E. Motor Competence and its Effect on Positive Developmental Trajectories of Health. *Sports Med*. 2015;**45**(9):1273-1284. [PubMed ID: 26201678]. <https://doi.org/10.1007/s40279-015-0351-6>
- Pienaar AE, Gericke C, du Plessis W. Longitudinal pathways of associations between motor proficiency and physical fitness during earlier and later childhood: The NW-CHILD study. *Sci Prog*. 2024;**107**(1):368504241232515. [PubMed ID: 38490224]. [PubMed Central ID: PMC10943737] <https://doi.org/10.1177/00368504241232515>
- Schmutz EA, Leeger-Aschmann CS, Kakebeeke TH, Zysset AE, Messerli-Bürge N, Stülz K, Arhab A, Meyer AH, Munsch S, Puder JJ, Jenni OG, Kriemler S. Motor Competence and Physical Activity in Early Childhood: Stability and Relationship. *Front Public Health*. 2020;**8**:339. [PubMed ID: 32154207]. [PubMed Central ID: PMC7047434] <https://doi.org/10.3389/fpubh.2020.00039>
- Valentini NC, Duarte MG, Zanella LW, Nobre GC. Test of Gross Motor Development-3: Item Difficulty and Item Differential Functioning by Gender and Age with Rasch Analysis. *Int J Environ Res Public Health*. 2022;**19**(14):8667. [PubMed ID: 35886518]. [PubMed Central ID: PMC9322710] <https://doi.org/10.3390/ijerph19148667>
- Baaziz M, Aloui A, Tayech A, Stults-Kolehmainen M, Mejri MA, Ben Abderrahman A. Transcultural validation of the "revised sport motivation scale" (SMS-II) in Arabic language: Exploratory study on motivation in sport for a sample of Tunisian Athletes. *PLoS One*. 2023;**18**(11):e0295262. [PubMed ID: 38033105]. [PubMed Central ID: PMC10688960] <https://doi.org/10.1371/journal.pone.0295262>

- Retraction in: PLoS One. 2025;**20**(1):e0318595. <https://doi.org/10.1371/journal.pone.0318595>.
21. Chen C, Weyland S, Fritsch J, Woll A, Niessner C, Burchartz A, Schmidt SCE, Jekauc D. A Short Version of the Physical Activity Enjoyment Scale: Development and Psychometric Properties. *Int J Environ Res Public Health*. 2021;**18**(21):11035. [PubMed ID: 34769552]. [PubMed Central ID: PMC8582913] <https://doi.org/10.3390/ijerph182111035>
  22. Burton AM, Cowburn I, Thompson F, Eisenmann JC, Nicholson B, Till K. Associations Between Motor Competence and Physical Activity, Physical Fitness and Psychosocial Characteristics in Adolescents: A Systematic Review and Meta-analysis. *Sports Med*. 2023;**53**(11):2191-2256. [PubMed ID: 37542607]. [PubMed Central ID: PMC10587315] <https://doi.org/10.1007/s40279-023-01886-1>
  23. Ghorbanzadeh B, Orangi BM, Sahin T. The relationship between motor competence and executive function as influenced by age, sex, and family socio-economic status. *Front Psychol*. 2025;**16**:1544168. [PubMed ID: 40083765]. [PubMed Central ID: PMC11903737] <https://doi.org/10.3389/fpsyg.2025.1544168>
  24. Hill PJ, Mcnarry MA, Mackintosh KA, Murray MA, Pesce C, Valentini NC, Getchell N, Tomporowski PD, Robinson LE, Barnett LM. The Influence of Motor Competence on Broader Aspects of Health: A Systematic Review of the Longitudinal Associations Between Motor Competence and Cognitive and Social-Emotional Outcomes. *Sports Med*. 2024;**54**(2):375-427. [PubMed ID: 37989831]. [PubMed Central ID: PMC10933160] <https://doi.org/10.1007/s40279-023-01939-5>
  25. Utesch T, Bardid F, Büsch D, Strauss B. The Relationship Between Motor Competence and Physical Fitness from Early Childhood to Early Adulthood: A Meta-Analysis. *Sports Med*. 2019;**49**(4):541-551. [PubMed ID: 30747376]. <https://doi.org/10.1007/s40279-019-01068-y>
  26. Ensrud-Skraastad OK, Haga M. Associations between Motor Competence, Physical Self-Perception and Autonomous Motivation for Physical Activity in Children. *Sports (Basel)*. 2020;**8**(9):120. [PubMed ID: 32882897]. [PubMed Central ID: PMC7552734] <https://doi.org/10.3390/sports8090120>
  27. Bryant ES, Duncan MJ, Birch SL, James RS. Can Fundamental Movement Skill Mastery Be Increased via a Six Week Physical Activity Intervention to Have Positive Effects on Physical Activity and Physical Self-Perception? *Sports (Basel)*. 2016;**4**(1):10. [PubMed ID: 29910259]. [PubMed Central ID: PMC5968941] <https://doi.org/10.3390/sports4010010>
  28. Lubans DR, Morgan PJ, Cliff DP, Barnett LM, Okely AD. Fundamental movement skills in children and adolescents: review of associated health benefits. *Sports Med*. 2010;**40**(12):1019-35. [PubMed ID: 21058749]. <https://doi.org/10.2165/11536850-000000000-00000>
  29. Cohen KE, Morgan PJ, Plotnikoff RC, Callister R, Lubans DR. Fundamental movement skills and physical activity among children living in low-income communities: a cross-sectional study. *Int J Behav Nutr Phys Act*. 2014;**11**(1):49. [PubMed ID: 24708604]. [PubMed Central ID: PMC4234279] <https://doi.org/10.1186/1479-5868-11-49>
  30. Rodríguez Macías M, Abad Robles MT, Giménez Fuentes-Guerra FJ. Effects of Sport Teaching on Students' Enjoyment and Fun: A Systematic Review and Meta-Analysis. *Front Psychol*. 2021;**12**:708155. [PubMed ID: 34421757]. [PubMed Central ID: PMC8371314] <https://doi.org/10.3389/fpsyg.2021.708155>
  31. Sánchez-Oliva D, Mouratidis A, Leo FM, Chamorro JL, Pulido-González JJ, García-Calvo T. Understanding Physical Activity Intentions in Physical Education Context: A multi-level Analysis from the Self-Determination Theory. *Int J Environ Res Public Health*. 2020;**17**(3):799. [PubMed ID: 32012824]. [PubMed Central ID: PMC7036780] <https://doi.org/10.3390/ijerph17030799>
  32. Filanowski PM, Steeves JA, Slade E. Step by Step: Investigating Children's Physical Activity and Enjoyment in Outdoor Walking with Their Parents. *Healthcare (Basel)*. 2025;**13**(14):1721. [PubMed ID: 40724746]. [PubMed Central ID: PMC12294517] <https://doi.org/10.3390/healthcare13141721>
  33. Joy A, Hartstone-Rose A, Knox J, Mathews CJ, Cerda-Smith J, Mulvey KL. STEM ability perceptions, basic needs satisfaction, and intrinsic motivation in adolescents: The role of inclusive perceptions in self-determination. *PLoS One*. 2025;**20**(3):e0318266. [PubMed ID: 40067837]. [PubMed Central ID: PMC11896037] <https://doi.org/10.1371/journal.pone.0318266>
  34. Olsen RK. Key factors for child participation - an empowerment model for active inclusion in participatory processes. *Front Psychol*. 2023;**14**:1247483. [PubMed ID: 37868609]. [PubMed Central ID: PMC10588002] <https://doi.org/10.3389/fpsyg.2023.1247483>
  35. Macila E, Dogan E, Sancar N. Investigating Correlation between Exercise Participation Motivation and Social Physique Anxiety and Their Differences across Exercise Stages of Change. *Sports (Basel)*. 2024;**12**(9):239. [PubMed ID: 39330716]. [PubMed Central ID: PMC11436123] <https://doi.org/10.3390/sports12090239>