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ORIGINAL RESEARCH

The Relationship Between Actual Motor Competence and Physical Activity in Children: Mediating Roles of Perceived Motor Competence and Physical Activity Enjoyment

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This study's objective was to examine whether the relationship between actual motor competence and physical activity (PA) in children is mediated by perceived motor competence (PMC) and physical activity enjoyment. The participants consisted of a total of 167 students (male = 92, female = 75) in 10 different schools in the fourth grade of primary schools in the central district of Isparta Province, Turkey, during the 2020–2021 academic year. Multiple parallel mediation analysis was used to examine the mediation role in the analysis of the data, and regression analysis based on the bootstrapping method was performed. As a result of the research, it was seen that PMC had a full mediating role between actual motor competence and PA ($b = 0.003$, 95% confidence interval [0.002, 0.094]). On the other hand, it was determined that PA enjoyment did not have a mediating role in this relationship ($b = 0.001$, 95% confidence interval [–0.002, 0.005]). The total indirect effect was not significant ($b = 0.005$, 95% confidence interval [–0.000, 0.012]). The multiple mediation analysis showed that PMC accounted for 23.2% of the total effect of actual motor competence on PA. In conclusion, the findings show that PMC is an important variable in participation in PA. Therefore, PMC should be considered a key outcome in physical education.

Keywords: motor skills, perception, motor development, physical education, primary school children

The World Health Organization recommends that children and adolescents between the ages of 5 and 17 participate in an average of 60 min of moderate- to high-intensity physical activity daily across the week for a healthy life (Bull et al.,

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2020). Adequate amounts of physical activity improves health-related physical fitness parameters, prevents the risks of various chronic diseases (cardiovascular diseases, obesity, Type II diabetes, cancer, etc.), increases academic success, and reduces stress and anxiety (Janssen & LeBlanc, 2010; Poitras et al., 2016; Strong et al., 2005). Despite the positive effects of physical activity on human health, it has been reported that participation in regular and sufficient amounts of physical activity is at very low levels among children and adolescents. Globally, 80% of the population is physically inactive (Hallal et al., 2012; World Health Organization, 2014). Physical activity habits are acquired in childhood, and these low-level habits may tend to continue similarly in adulthood (Telama et al., 2005; Telama et al., 2014). When children participate in insufficient physical activity, overweight, obesity, and many related chronic diseases can be seen in older age. Therefore, it is important to determine the factors that affect participation in physical activity during childhood.

Participation in physical activity can be affected by many factors, such as biological, demographic, psychological, behavioral, and sociocultural (Brunet et al., 2014; Fisher et al., 2011; Sallis et al., 2000; Trost & Loprinzi, 2011). In recent years, the concept of actual motor competence has become prominent because it emphasizes the basic mechanisms underlying participation in physical activity. Actual motor competence is an individual's proficiency in fundamental movement skills, such as locomotor, object control, and balancing skills (Luz et al., 2016; Stodden et al., 2008). Fundamental movement skills are the basic building blocks for performing more complex movement skills and specialized sports skills, and they are necessary for engaging in various physical activities, games, and sports. Children need to apply these skills proficiently as they participate in these activities as skills that are not developed at a competent level hinder the acquisition of more complex movement skills and specialized sports skills, thereby limiting participation in these activities (Clark & Metcalfe, 2002; Haywood & Getchell, 2014; Hulteen et al., 2018; Robinson, Stodden, et al., 2015; Seefeldt, 1980; Stodden et al., 2008; Welk, 1999). For this reason, Stodden et al. (2008) stated that the conceptual model of motor development emphasizes the positive relationship between actual motor competence and physical activity to prevent childhood overweight and obesity risk. It also suggests that these positive relationships are reciprocal and synergistic and would strengthen with age. For example, participation in physical activity in the preschool years may improve actual motor competence, and in the later primary and secondary school years, high actual motor competence can enable children to participate in physical activity. However, although the authors state that the actual motor competence–physical activity relationship may not be significant and will be low in the preschool years, they also state that as children grow up, this relationship will be significant and may be at moderate and high levels. These relationships suggested by the authors are supported by systematic reviews and meta-analysis studies (Barnett et al., 2022; Holfelder & Schott, 2014; Logan et al., 2015; Lopes et al., 2021; Lubans et al., 2010).

Perceived motor competence is also an important variable in participation in physical activity (Barnett et al., 2022). Stodden et al. (2008) stated that this positive relationship may be mediated by perceived motor competence and health-related physical fitness. Perceived motor competence refers to an awareness, belief, or perception of an individual's own ability to perform basic movement skills

(Estevan & Barnett, 2018). Children's engagement in physical activities, sports, or games may vary based on their perceived motor competence. Those with lower actual motor competence during childhood might also perceive themselves as less capable. As they develop cognitively into adolescence, they may compare themselves with peers and may avoid participation if they feel less competent. This may negatively impact their engagement in these activities. Conversely, higher perceived motor competence levels are associated with more positive outcomes (Harter, 1999; Stodden et al., 2008). In systematic review and meta-analysis studies conducted by Barnett et al. (2022) and De Meester et al. (2020), positive relationships within this model were identified across studies involving preschool, primary school, and secondary school students from diverse countries. However, some studies investigating these relationships have been limited by focusing only on perceptions of physical competence and its subdimensions (perceived sports/athletic competence), which measure more general judgments without a direct alignment with actual motor competence (fundamental movement skills) rather than perceived motor competence (Barnett et al., 2015; De Meester et al., 2020; Estevan & Barnett, 2018; Robinson, Stodden, et al., 2015). It is recommended to use scales aligned with fundamental movement skills to better understand the relationships between actual motor competence and perceived motor competence (Barnett et al., 2015; Estevan & Barnett, 2018). That is because although perceived sports/athletic competence evaluates general competence perceptions in various sports and games, perceived motor competence specifically evaluates perceptions and awareness of fundamental movement skills. Therefore, it is essential for young children to develop these skills for enjoyment, skill development, and establishing physical activity habits, prioritizing them over performance and competition (Estevan & Barnett, 2018). Recent studies examining the mediating role of perceived motor competence, aligned with fundamental movement skills, are increasing. Whereas some studies suggest no mediating role (Chan et al., 2019; Hall et al., 2019; He et al., 2021), others report this mediating role (Feitoza et al., 2022; Menescardi et al., 2022, 2023; Utesch et al., 2021). However, the study conducted by Barnett et al. (2022) suggested that there is insufficient evidence regarding the relationships between perceived motor competence, actual motor competence, and physical activity.

Another important variable in participation in physical activity during childhood is physical activity enjoyment (Adank et al. 2021; Carcamo-Oyarzun et al., 2023; Gao et al., 2013, 2014; Hagberg et al., 2009; Motl et al., 2001; Zhang et al, 2021). Physical activity enjoyment is the positive emotional state arising from activities and movement experiences, encompassing excitement, pleasure, fun, joy, and enthusiasm (Raedeke, 2007; Scanlan & Simons, 1992; Wankel, 1993). It fosters a cyclical relationship with participation: Individuals tend to select and engage in activities they find enjoyable, leading to repeated participation (Biddle & Vergeer, 2020; Chan et al., 2019; Kruk et al., 2018; Michael et al., 2016). Moreover, it may play a crucial role in motivating children to participate in physical activity (Cairney et al., 2012; Gao et al., 2013; Prochaska et al., 2003; Scanlan et al., 1993) and may contribute significantly to the development of intrinsic motivation (Bajamal et al., 2024; Deci & Ryan, 2000). Physical activity enjoyment is not only an emotional state but also a perceptual process experienced during activity (Ntoumanis, 2001). It may be influenced by various factors such as perceived difficulty, competence levels,

emotional state, social support, perceived success, and proficiency in fundamental movement skills (Baron & Downey, 2007; Shen et al., 2018; Smith & St. Pierre, 2009). Children may perceive activities as enjoyable, successful, and easy based on their actual motor competence, thereby positively influencing enjoyment and increasing participation (Loprinzi et al., 2015; Stodden et al., 2008; Welk, 1999). In this context, physical activity enjoyment may play a mediating role (Loprinzi et al., 2015; Stodden et al., 2008; Welk, 1999). However, this variable is not included in the conceptual model of motor development (Stodden et al., 2008), and there is limited research on this subject (Adank et al. 2021; Chan et al., 2019; Fu & Burns, 2018; Zhang et al., 2021). In the study by Adank et al. (2021), actual motor competence was not a predictor of physical activity enjoyment in Dutch 10- to 12-year-old children. In the studies conducted by Zhang et al. (2021) and Fu and Burns (2018), it was reported that there was no significant relationship between motor competence and physical activity enjoyment and that physical activity enjoyment did not have a mediating role between actual motor competence and physical activity. On the other hand, in the study conducted by Chan et al. (2019), it was observed that there was a positive significant relationship between actual motor competence and physical activity enjoyment. However, it is stated that physical activity enjoyment is a mediating variable between locomotor skills and self-reported physical activity. Therefore, considering the small number of studies and the different results, it is considered important to conduct more research.

In the Turkish education system, fourth-grade students, typically aged 10, represent the final year of primary school and are expected to have developed high motor proficiency. This stage may offer an optimal opportunity to explore the mediating role of aligned perceived motor competence and physical activity enjoyment in the relationship between actual motor competence and physical activity. In addition, it is stated in the literature that there is a decrease in physical activity with age and that this decrease occurs in the transition from primary school to secondary school (Chong et al., 2020; De Meester et al., 2014; Jago et al., 2012). Therefore, it may be important to examine these relationships at this age. To the knowledge of the researchers, no study has been found examining these relationships in a Turkish sample. Therefore, in this study, we aimed to examine the various relationships outlined in the conceptual model in the Turkish sample as well as the mediating roles by adding physical activity enjoyment to the conceptual model. The following research questions guided this research:

Research Question 1: Does perceived motor competence mediate the relationship between actual motor competence and physical activity in Turkish children?

Research Question 2: Does physical activity enjoyment mediate the relationship between actual motor competence and physical activity in Turkish children?

Conceptual Framework

The conceptual framework employed in this study (see Figure 1) was grounded in these prior empirical and theoretical associations between actual motor competence, perceived motor competence, physical activity enjoyment, and physical activity. Perceived motor competence and physical activity enjoyment are

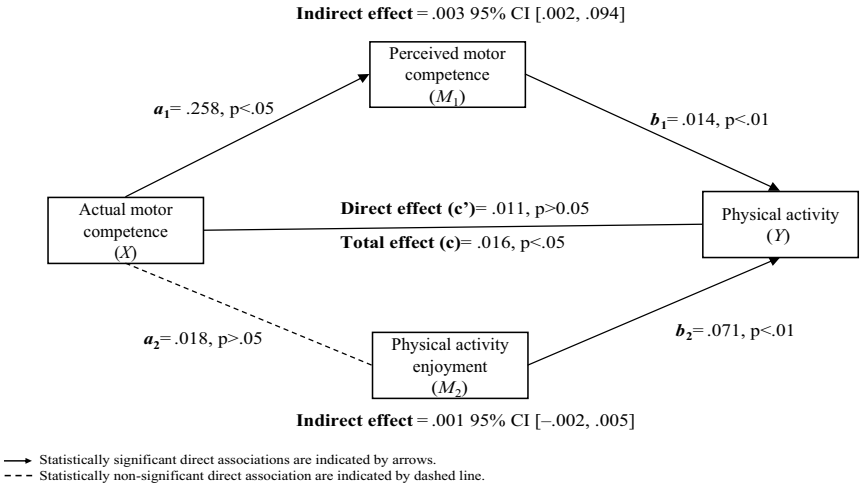


Figure 1 — The mediating role of perceived motor competence and physical activity enjoyment in the relationship between actual motor competence and physical activity.

perceptual and motivational variables. Therefore, they may be affected by individuals' actual motor competence (Barnett et al., 2022; Carcamo-Oyarzun et al., 2023; Chan et al., 2019; De Meester et al., 2020; Robinson, Stodden, et al., 2015; Stodden et al., 2008; Welk, 1999; Zhang et al., 2021). Based on the available literature, we propose that the effect of actual motor competence on physical activity may occur indirectly through perceived motor competence and physical activity enjoyment in Turkish fourth grade primary school students (see Figure 1).

Method

Participants

The research was conducted in the spring semester of the 2020–2021 academic year. A total of 51 primary schools in the Central District of Isparta, Turkey were invited to participate in the research. Ten primary schools agreed to participate in the research. The schools had one or two fourth-grade classes and there were between 10 and 15 students in these classes. In total, the sample consisted of 167 students, 75 girls (44.9%) and 92 boys (55.1%). The students consisted of 10-year-old children attending the fourth grade of primary school. The participants were recruited by a convenience sampling method.

Data Collection Tools

Actual Motor Competence

To evaluate children's actual motor competence, the Test of Gross Motor Development-2, developed by Ulrich (2000) and adapted into Turkish by Boz

and Aytar (2012), was used. This test evaluated a total of 12 fundamental movement skills in two subdimensions. They were divided into locomotor skills (run, gallop, hop, leap, horizontal jump, and slide) and object control skills (striking a stationary ball, stationary dribble, catch, kick, overhead throw, and underhand roll). However, striking a stationary ball was removed from the test during the adaptation phase because its relationship with the object control skill subdimension was insufficient. Each fundamental movement skill had three to five evaluation criteria. Although fundamental movement skills were evaluated, children were given one familiarization trial and two performance trials. The results of these two performance trials were recorded by considering the criteria for each fundamental movement skill of the child and by giving 1 point if the criterion was observed and 0 points if it was not observed (Ulrich, 2000). The sum of the criterion scores given for each fundamental movement skill constituted the score of that fundamental movement skill. The highest score that could be obtained from the test was 48 for locomotor skills and 38 for object control skills. The total score was 86. Increasing scores from the test indicated that the level of motor proficiency had increased. The Cronbach's alpha internal consistency coefficients of the test were stated as .94 for locomotor skills, .95 for object control skills, and .96 for total motor competence for girls; and .95 for locomotor skills, .97 for object control skills, and .96 for total motor competence for boys. The results of the confirmatory factor analysis indicated that the goodness-of-fit values were as follows: ($\chi^2 = 538.43$, $df = 224$, $\chi^2/df = 2.40$, Goodness-of-Fit Index = .93, comparative-fit index [CFI] = .99, root mean square error of approximation [RMSEA] = .08, Normed Fit Index = .99, root mean square residual = .04). Therefore, it was a valid and reliable test for children aged 5–10 (Boz & Aytar, 2012). For the current study, the Cronbach Alpha internal consistency coefficients of the test were calculated as .69 for locomotor skills, .71 for object control skills, and .74 for total test. As a result of the confirmatory factor analysis performed for the current study, it was seen that the goodness-of-fit values were a good fit and within the acceptable fit range ($\chi^2/df = 1.18$, RMSEA = .03, CFI = .931, GFI = .95, standardized root mean square residual [SRMR] = .05). Therefore, our data may be considered valid and reliable.

Before actual motor competence measurements began, the measurement environment was prepared in the school garden and the school gym. Measurements were made independently in the students' physical education and sports classes without the supervision of the classroom teacher. Necessary explanations about the test were given to the children just before the measurements. Then, the skills were demonstrated via a standard video, tablet, and smartphone to avoid causing different understandings regarding the execution of each fundamental movement skill included in the test (Robinson, Palme, et al., 2015). Additional explanations were made through this video, and skills were demonstrated by the researcher when necessary. Then, the children were given one trial. Then, they were given the right to two performance attempts, and these performance attempts were recorded on video using a camera. The camera was positioned sideways and diagonally to show the full-body movements of the children while they performed the skills (Lopes et al., 2018). While measurements were being taken, children were frequently encouraged to keep their interest aroused and perform at their best with phrases such as "go faster, stronger, or jump farther." However, while doing

this, no feedback was given for part or all of the skill (Ulrich, 2000). Each child took 10–15 min to complete the measurements. The captured videos were then watched in their entirety by the first researcher, who coded them, and scores were calculated. Intrarater reliability and interrater reliability analyses were performed to determine the reliability of the measurements made. For intrarater reliability analysis, 30 of the videos ($n = 50$) were rewatched and evaluated by the primary researcher 10 days later. Before the interrater reliability analyses were conducted by two independent observers (the primary researcher and the physical education and sports teacher), information was given about the scoring and procedure of the test, and training was provided until the agreement percentage (>90%) was reached between the researcher and the second evaluator regarding the skill criteria. Then, 30% of the videos ($n = 50$) were coded independently by the researcher and the second evaluator. Scoring results were evaluated according to (agreements/[agreements+ disagreements]) × 100 (Bolger et al., 2019; Thomas et al., 2015; Van Der Mars, 1989). As a result of the evaluation, the interrater agreement percentage was calculated to be between 84% and 98%, and the average agreement percentage was 93.02%. The intrarater reliability agreement percentage was calculated to be between 86% and 98%, and the average agreement percentage was 93.91%.

Perceived Motor Competence

To evaluate children's perceived motor competence, The Perceived Motor Competence Questionnaire in Childhood, developed by Dreiskaemper et al. (2018) and adapted into Turkish by Ballı and Altunsöz (2019), was used. This scale evaluated a total of eight fundamental movement skills in two subdimensions. The first of these subdimensions consisted of locomotor skills (running, hopping, leaping, and jumping), and the second consisted of object control skills (throwing, catching, bouncing, and kicking). Although each skill had its own three items, the scale consisted of 24 items in total. The scale was a 4-point Likert type, consisting of facial expressions ranging from "1" strongly disagree (a very sad face) to "4" strongly agree (a very happy face). The lowest score that could be obtained from the scale was 24, and the highest score was 96. Increasing scores from the scale indicated an increase in the level of perceived motor competence. The Cronbach alpha internal consistency coefficient of the scale was calculated to be .90 for locomotor skills and .87 for object control skills. The results of the confirmatory factor analysis indicated that the goodness-of-fit values were as follows: $\chi^2 = 538.43$, $df = 224$, $\chi^2/df = 2.40$, GFI = .88, CFI = .92, RMSEA = .06, Tucker–Lewis index = .90. For this reason, it was a valid and reliable scale for children and adolescents between the ages of 10 and 15 (Ballı and Altunsöz, 2019). For the current study, the Cronbach alpha internal consistency coefficients of the scale were calculated as .87 for locomotor skills, .90 for perceived object control skills, and .92 for the entire scale. As a result of the confirmatory factor analysis performed for the current study, it was seen that the goodness-of-fit values were a good fit and within the acceptable fit range ($\chi^2/df = 1.88$, GFI = .83, CFI = .89, RMSEA = .07, SRMR = .05). On the other hand, GFI and CFI values were found to be very close to the acceptable fit range. At this point, it has been stated that there is no full agreement among researchers on which fit index criteria will be considered

standard (Munro, 2005; Şimşek, 2007). In addition, as stated by Harrington (2009), it may be sufficient to have values close to acceptable fit value ranges. Therefore, our data may be considered valid and reliable.

Physical Activity Enjoyment

To evaluate children's physical activity enjoyment, the test was developed by Kendzierski and DeCarlo (1991), then modified, and a short form was created by Graves et al. (2010) and finally adapted to a Turkish version by Mirzeoğlu and Çoknaz (2014); the Turkish Version of the Physical Activity Enjoyment Scale-Short Form was used. This scale consisted of five items and a 7-point Likert-type scale. The scale was developed in a two-sided structure that simultaneously showed liking and disliking of physical activity. The items in the scale (Items 1 and 4) were reverse coded. The lowest score that could be obtained from the scale was 7, and the highest score was 35. Increasing scores from the scale indicated that physical activity enjoyment increased. Cronbach alpha internal consistency coefficient of the scale is .71. The results of the confirmatory factor analysis indicated that the goodness-of-fit values were as follows: $\chi^2 = .04$, $df = 43$, $p < .01$, CFI = .98, SRMR = .03, RMSEA = .05, Tucker–Lewis index = .96. Therefore, it was a valid and reliable scale for children and adolescents between the ages of 9–14. The Cronbach alpha internal consistency coefficient for the current study was calculated as .60. As a result of the confirmatory factor analysis performed for the current study, it was seen that the goodness-of-fit values were a good fit and within the acceptable fit range ($\chi^2/df = 2.10$, RMSEA = .08, CFI = .95, GFI = .97, SRMR = .04). Therefore, our data may be considered valid and reliable.

Physical Activity

To determine the physical activity participation levels of secondary school students, the "Physical Activity Questionnaire for Older Children," developed by Kowalski et al. (2004) and later adapted into Turkish by Erdim et al. (2019), was used. This measurement tool was a self-report questionnaire answered by the child to recall the last 7 days to determine children's physical activity participation levels. It evaluated children's physical activity level in a total of 10 questions and two subdimensions (in school and out of school). The average physical activity score was calculated by taking the average of the scores of the first nine questions, omitting the 10th question, which asked whether there was a disease or a condition that prevented physical activity. The survey was scored between 1 and 5, with the lowest physical activity level being "1" and the highest physical activity level being "5." The Cronbach alpha internal consistency coefficient of the measurement tool was stated as .77 for the general sample (girls $\alpha = .76$, boys $\alpha = .77$). The results of the confirmatory factor analysis indicated that the goodness-of-fit values were as follows: $\chi^2/df = 2.174$; CFI = .97; SRMR = .03; RMSEA = .05; GFI = .97; Non-Normed Fit Index = .95; Adjusted Goodness of Fit Index = .95. Therefore, it was a valid and reliable scale for children between the ages of 9 and 14 (Erdim et al., 2019). In the current study, the Cronbach alpha internal consistency coefficient was calculated as .75 for the entire scale. As a result of the confirmatory factor analysis performed for the current study, it was seen that the goodness-of-fit values were a good fit and within the acceptable fit range ($\chi^2/df = 1.619$; RMSEA =

.06; CFI = .94; GFI = .94; SRMR = .06). Therefore, our data may be considered valid and reliable.

Procedure

Before starting the research, ethics committee approval was obtained from the Ankara University Ethics Committee Presidency (56786525-050.04.04/32139). Necessary permissions were obtained from the Isparta Provincial Directorate of National Education to conduct the research in schools affiliated with the Ministry of National Education. Then, school principals were contacted, and consent forms were sent to the parents through the children, and the necessary permissions were obtained. Before starting the study, children were asked whether they wanted to participate in the study, and consent forms were obtained. Information about the purpose and importance of the research and how the research would be conducted was explained in detail to all stakeholders (school principals, parents, and children). In addition, parents and students were given the right to withdraw from the research at any time. Within the scope of the research, the families of 20 students did not allow their children to participate in the study. The research was conducted in the spring semester of the 2020–2021 academic year.

Questionnaires were taken in children's physical education and sports classes. Questionnaires were taken in two sessions, 1 week apart. The order of the questionnaires was chosen to ensure the necessary temporal proximity of the questionnaires and to prevent the participants' experiences and the results of the actual motor competence assessments from influencing the current assessment of perceived motor competence and physical activity. Before each questionnaire, detailed explanations were provided on how to answer the questions. The questionnaires were administered as the Turkish Version of the Physical Activity Enjoyment Scale-Short Form, Physical Activity Questionnaire, and The Perceived Motor Competence Questionnaire in Childhood, respectively. While collecting data on perceived motor competence, the researcher provided a standard visual for each item (fundamental motor skill). The questionnaires were collected by two researchers in a quiet classroom environment without the supervision of the classroom teacher. One of the researchers read the questions aloud, and the other checked the children's answers. Children were encouraged to take their time, think about the answers, raise their hands to ask questions they did not understand, and be as honest as possible. It took approximately 40–50 min for the children to respond to all questions. A week later, actual motor competence measurements were taken on the same day during the lesson, following the procedure described earlier.

Analysis of Data

Statistical Package for Social Sciences (SPSS; version 22.0) and Process Macro v3.3 plug-in were used to analyze the research data statistically. Before data analysis, the data were checked for any missing or incorrect answers. Subsequently, during the analysis phase, the Kolmogorov–Smirnov test was performed to assess the normality distribution of the data, and it was found that the data did not

follow a normal distribution ($p < .05$). Therefore, nonparametric analyses were used. Descriptive statistics were used to determine the mean scores and *SD*s of the variables. Spearman correlation analysis was used for relationships between research variables. For mediation analyses, regression analysis based on the bootstrapping method was performed, and indirect effects were reported in line with confidence interval (CI) values (Gürbüz, 2019; Hayes, 2018; MacKinnon et al., 2004). Bootstrapping analyses were performed using the Process Macro v3.3 plug-in developed by Hayes (2018) and multiple parallel mediation analysis with Model 4. The analysis was carried out with 5,000 resampling methods with a 95% CI. In this context, the significance of the mediation role was evaluated according to the criterion that the bootstrapping results did not include the (0) value of the lower (BootLLCI) and upper (BootULCI) CI. Fritz and Mackinnon (2007) suggested that a sample size of 71 would be required to achieve a power of .80 for detecting a medium effect size of the indirect effect in mediation analysis using a bootstrapping approach. Therefore, the current sample size was considered sufficiently powered. In mediation analysis, three terms are commonly used: direct effect, indirect effect, and total effect. The direct effect (c') represents the effect of actual motor competence (X) on physical activity (Y) after controlling for the proposed mediators perceived motor competence (M_1) and physical activity enjoyment (M_2) in the model. Indirect effects represent the effect of actual motor competence (X) on physical activity (Y) through perceived motor competence (M_1) and physical activity enjoyment (M_2) in the model. Finally, the total effect (c) represents the sum of the direct and indirect effects in the model. Unstandardized regression coefficients are reported. The effect size for mediation analysis was measured with percent mediation interpreted as the percent of the total effect (c) accounted for by the indirect effects (Preacher & Kelley, 2011). For all analyses, the alpha level $p < .05$ was taken into account.

Results

Actual motor competence was not significantly associated with perceived motor competence ($\rho = .127$ $p > .05$), physical activity enjoyment ($\rho = .059$, $p > .05$), and physical activity ($\rho = .139$, $p > .05$) (Table 1). Physical activity was significantly associated with physical activity enjoyment ($\rho = .337$, $p < .05$) and perceived motor competence ($\rho = .274$, $p < .05$).

When examining the multiple parallel mediation analysis presented in Figure 1, it was noted that there was a direct association between actual motor competence and perceived motor competence ($a_1 = 0.258$, $t = 2.462$, $p < .05$). However, there was not

Table 1 Correlations, Means, and *SD*s of Variables

Variables	Mean	*SD*	1	2	3	4
1. Actual motor competence (0–86)	61.568	8.939	1			
2. Perceived motor competence (24–96)	77.437	12.261	.127	1		
3. Physical activity enjoyment (7–35)	32.946	2.958	.059	.337**	1	
4. Physical activity (1–5)	3.207	.753	.139	.274**	.329**	1

**$p < .01$.

a direct association with physical activity enjoyment ($a_2 = 0.018$, $t = .733$, $p > .05$). It was observed that there was a direct association between perceived motor competence and physical activity ($b_1 = 0.014$, $t = 3.211$ $p < .01$). Similarly, direct association was also observed between physical activity enjoyment and physical activity ($b_2 = 0.071$, $t = 3.828$ $p < .01$). In this model, the total effect was significant ($c = 0.016$, $t = 2.537$, $p < .05$), whereas the direct effect was not significant ($c' = 0.011$, $t = 1.874$, $p > .05$). With all these findings, when the mediating roles of perceived motor competence and physical activity enjoyment were evaluated according to the fact that the binary CI values did not include the value 0, it was observed that perceived motor competence had a full mediating role ($b = 0.003$, 95% CI [0.002, 0.094]). The multiple mediation analysis showed that perceived motor competence accounted for 23.2% (percent mediation = .232) of the total effect of actual motor competence on physical activity. This result shows that perceived motor competence had a full mediating role and that actual motor competence increased physical activity through perceived motor competence. On the other hand, it was observed that physical activity enjoyment did not have a mediating role ($b = 0.001$, 95% CI [–0.002, 0.005]).

Discussion

The aim of the study was to examine whether perceived motor competence and physical activity enjoyment have a mediating role in the relationship between motor competence and physical activity in Turkish children. As a result of the research, it was found that perceived motor competence had a full mediating role in the relationship between actual motor competence and physical activity. This result indicates that there is a positive indirect relationship between actual motor competence and physical activity mediated by perceived motor competence. A small number of studies in the literature have examined the mediating role of perceived motor competence using scales aligned with actual motor competence (Chan et al., 2019; Hall et al., 2019; He et al., 2021; Menescardi et al., 2023, 2022; Utesch et al., 2021). Studies examining preschool children have found that perceived motor competence does not mediate the relationship between actual motor competence and physical activity (Hall et al., 2019; He et al., 2021). When studies conducted with a sample similar to that of the current study were examined, Chan et al. (2019) found that perceived motor competence did not mediate between actual motor competence and physical activity. However, an increasing number of studies indicate that perceived motor competence has a mediating role between actual motor competence and physical activity (Menescardi et al., 2023, 2022; Utesch et al., 2021). Stodden et al. (2008) supported the hypothesis that perceived motor competence has a mediation role between actual motor competence and physical activity. It may be posited that the disparity in findings between our study and others is attributed to the developmental nature of perceived motor competence over time. In this context, this may be due to children under the age of 8 perceiving themselves as higher or lower than their actual motor competence level as they may not make accurate distinctions about their actual motor competence level, depending on their cognitive development level. In this case, it is stated that the relationships between the variables may be weak or nonexistent because preschool

children may not make the right decisions about themselves. However, it is stated that when children move from early childhood to middle childhood, they may perceive their actual motor competence levels more accurately due to the increase in their cognitive capacity, and the relationships may be stronger (Estevan & Barnett, 2018; Harter, 1999; Stodden et al., 2008). Similarly, De Meester et al. (2020) reported that most of the studies using aligned instruments focused on preschool children, and the lack of sufficient research in middle and late childhood may have an effect on the mediating role of perceived motor competence. At this point, as our sample group is in their middle childhood and they are senior primary school students, it shows that they have acquired actual motor competence and perceived these skills correctly. This result may be caused by the alignment of the instruments used. Perceived motor competence may be an important factor in participation in physical activity. For this reason, perceived motor competence should be considered a key outcome in physical education. In addition, it is recommended that future research be conducted on which factors are related to perceived motor competence.

The relationships between actual motor competence, perceived motor competence, and physical activity in our results may be bidirectional. For example, participation in physical activity may have a positive association with perceived motor competence, and perceived motor competence may have a positive association with actual motor competence (Burns & Fu, 2018). Therefore, it may be important to examine the bidirectional relationships between variables, taking into account the theoretical explanations in the literature. In addition, gender may have a moderating effect in these relationships. It is observed that boys tend to have higher perceived motor competence and higher actual motor competence than girls (He et al., 2021; De Meester et al., 2018; Duncan et al., 2018; van Veen et al., 2020). Segura-Berges et al. (2024) showed that gender may have a moderating effect on these relationships. Therefore, it is recommended that future studies include variables that may play a moderating role (age, gender, etc.) when examining these relationships.

Another research finding of the study was that physical activity enjoyment did not have a mediating role in the relationship between actual motor competence and physical activity. There are limited studies on the mediating role of physical activity enjoyment in these relationships (Chan et al., 2019; Fu & Burns, 2018; Zhang et al, 2021). In studies conducted by Zhang et al. (2021) and Fu and Burns (2018), it was found that physical activity enjoyment did not have a mediating role between actual motor competence and physical activity. In contrast, Chan et al. (2019) observed a mediating effect of physical activity enjoyment between locomotor skills and self-reported physical activity in a study conducted on Chinese children. At this point, although the literature supported our research findings, our expectation was that physical activity enjoyment might have had a mediating role (Loprinzi et al., 2015). The reason for this is that physical activity enjoyment is a psychological, perceptual, and motivational variable characterized by fun and pleasure as well as the perceived difficulty of the activities performed by people, how competent the person perceives themselves, the intensity level of physical activity, and the factors that affect people's perception of the activity before participating in physical activity. It is thought that this may be due to being affected by various factors, such as emotional state (Baron & Downey, 2007; Barnett et al., 2017; Gao et al., 2013; Smith & St. Pierre, 2009; Stodden et al., 2008;

Wankel, 1993). Another reason is that given that physical activity enjoyment is a perceptual and motivational variable, it may be related to perceived motor competence rather than actual motor competence, because perceived motor competence may be more important than actual motor competence in participating in physical activity (De Meester et al., 2016; den Uil et al., 2023). Our research findings showed that there was a positive relationship between perceived motor competence and physical activity enjoyment. Hence, it is possible that children's physical activity enjoyment is influenced more by their perceived motor competence rather than their actual motor competence. In other words, as children feel more competent about their abilities, they may perceive tasks as less difficult and find the activity more enjoyable. Therefore, the mediating role of physical activity enjoyment may be sequential. Actual motor competence may increase perceived motor competence, and perceived motor competence may increase participation in physical activity by affecting physical activity enjoyment. The study by Zhang et al. (2021) supports this idea. However, there are limited studies on this subject. Future studies conducting further research from this perspective may help to understand the relationships better.

This research has some limitations. The first limitation is that the research was designed in a cross-sectional research model, and the data were collected over a certain period of time, so it did not examine causal relationships. The second limitation is that the participants in the study were determined by a convenience sample method. This method limits the generalization of research results. The last limitation is that physical activity was obtained through a self-report questionnaire. This method does not determine the frequency, duration, and intensity of physical activity. However, participants are likely to remember the approximate amount of physical activity in which they have engaged. Longitudinal and experimental designs are recommended to establish causality. It is recommended that new research should obtain physical activity data with objective measurement methods (e.g., pedometer, accelerometer). It is recommended that future research be conducted in different provinces, in different classes, and with more participants to generalize the research results. Analyses were not stratified by gender. Therefore, in larger sample groups, analyses could have been stratified by gender.

Conclusions

In conclusion, it was observed that perceived motor competence serves as a mediating factor in the relationship between actual motor competence and physical activity among Turkish children. This study offers evidence supporting the mechanisms proposed by Stodden et al. (2008) for the relationship between motor competence and physical activity. Moreover, findings indicate that perceived motor competence is important for physical activity promotion during childhood.

Note

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References

Adank, A.M., Van Kann, D.H., Remmers, T., Kremers, S.P., & Vos, S.B. (2021). Longitudinal perspectives on children's physical activity patterns: "Do physical education–related factors matter?" *Journal of Physical Activity and Health, 18*(10), 1199–1206. https://doi.org/10.1123/jpah.2020-0859

Bajamal, E., Abou Hashish, E.A., & Robbins, L.B. (2024). Enjoyment of physical activity among children and adolescents: A concept analysis. *The Journal of School Nursing, 40*(1), 97–107. https://doi.org/10.1177/10598405221137718

Ballı, M.Ö., & Altunsöz, H.I. (2019). *Adaptation study of the perceived motor competence questionnaire in childhood into Turkish*. VIth International Eurasian Educational Research Congress (pp. 2619–2619). Ankara University.

Barnett, L., Salmon, J., Timperio, A., Lubans, D., & Ridgers, N. (2017). What is the contribution of motor skill, fitness, and physical activity to children's self-perceptions of motor competence*? Journal of Science and Medicine in Sport, 20*, Article e76. https://doi.org/10.1016/j.jsams.2017.01.025

Barnett, L.M., Robinson, L.E., Webster, E.K., & Ridgers, N.D. (2015). Reliability of the pictorial scale of perceived movement skill competence in 2 diverse samples of young children. *Journal of Physical Activity and Health, 12*(8), 1045–1051. https://doi.org/10.1016/j.jsams.2014.03.001

Barnett, L.M., Webster, E.K., Hulteen, R.M., De Meester, A., Valentini, N.C., Lenoir, M., Pesce, C., Getchell, N., Lopes, V.P., Robinson, L.E., Brian, A., Rodrigues, L.P.& Rodrigues, L.P. (2022). Through the looking glass: A systematic review of longitudinal evidence, providing new insight for motor competence and health. *Sports Medicine, 52*(4), 875–920. https://doi.org/10.1007/s40279-021-01516-8

Baron, L.J., & Downey, P.J. (2007). Perceived success and enjoyment in elementary physical education. *Journal of Applied Research on Learning, 1*(2), Article 1.

Biddle, S.J., & Vergeer, I. (2020). Mental health benefits of physical activity for young people. T.A. Brusseau, S.J. Fairclough, & D.R. Lubans (Eds.) *The routledge handbook of youth physical activity*. The Routledge Handbooks.

Bolger, L.E., Bolger, L.A., O'Neill, C., Coughlan, E., O'Brien, W., Lacey, S., & Burns, C. (2019). Accuracy of children's perceived skill competence and its association with physical activity. *Journal of Physical Activity and Health, 16*(1), 29–36. https://doi.org/10.1123/jpah.2017-0371

Boz, M.& Aytar, A.G. (2012). The adaptation study of test of gross motor development-2 to Turkish children. *Mediterranean Journal of Educational Research, 12*, 17–24.

Brunet, J., Sabiston, C.M., O'Loughlin, J., Mathieu, M.E., Tremblay, A., Barnett, T.A., & Lambert, M. (2014). Perceived parental social support and moderate-to-vigorous physical activity in children at risk of obesity. *Research Quarterly for Exercise and Sport, 85*(2), 198–207. https://doi.org/10.1136/bjsports-2020-102955

Bull, F.C., Al-Ansari, S.S., Biddle, S., Borodulin, K., Buman, M.P., Cardon, G., Carty, C., Chaput, J.P., Chastin, S., Chou, R., Dempsey, P.C., DiPietro, L., Ekelund, U., Firth, J., Friedenreich, C.M., Garcia, L., Gichu, M., Jago, R., Katzmarzyk, PT., … &

Willumsen, J.F. (2020). World Health Organization 2020 guidelines on physical activity and sedentary behavior. *British Journal of Sports Medicine, 54*(24), 1451–1462. https://doi.org/10.1136/bjsports-2020-102955

Burns, R.D., & Fu, Y. (2018). Testing the motor competence and health-related variable conceptual model: A path analysis. *Journal of Functional Morphology and Kinesiology, 3*(4), Article 61. https://doi.org/10.3390/jfmk3040061

Cairney, J., Kwan, M.Y., Velduizen, S., Hay, J., Bray, S.R., & Faught, B.E. (2012). Gender, perceived competence and the enjoyment of physical education in children: A longitudinal examination. *International Journal of Behavioral Nutrition and Physical Activity, 9*(1), Article 26. https://doi.org/10.1186/1479-5868-9-26

Carcamo-Oyarzun, J., Herrmann, C., Gerlach, E., Salvo-Garrido, S., & Estevan, I. (2023). Motor competence, motivation and enjoyment in physical education to profile children in relation to physical activity behaviors. *Physical Education and Sport Pedagogy,* Advance online publication, 1–16. https://doi.org/10.1080/17408989.2023.2265399

Chan, C.H., Ha, A.S., Ng, J.Y., & Lubans, D.R. (2019). Associations between fundamental movement skill competence, physical activity and psycho-social determinants in Hong Kong Chinese children. *Journal of Sports Sciences, 37*(2), 229–236. https://doi.org/10.1080/02640414.2018.1490055.

Chong, K.H., Parrish, A.M., Cliff, D.P., Kemp, B.J., Zhang, Z., & Okely, A.D. (2020). Changes in physical activity, sedentary behaviour and sleep across the transition from primary to secondary school: A systematic review. *Journal of Science and Medicine in Sport, 23*(5), 498–505. https://doi.org/10.1016/j.jsams.2019.12.002

Clark, J.E., & Metcalfe, J.S. (2002). The mountain of motor development: A metaphor. In J.E. Clark& J.H. Humphrey (Eds.), *Motor development: research and reviews* (Vol. 2, pp. 163–190). National Association of Sport and Physical Education.

Deci, E.L., & Ryan, R.M. (2000). The "what" and "why" of goal pursuits: Human needs and the self-determination of behavior. *Psychological Inquiry, 11*(4), 227–268. https://doi.org/10.1207/S15327965PLI1104_01

De Meester, A., Barnett, L.M., Brian, A., Bowe, S.J., Jiménez-Díaz, J., Van Duyse, F., & Haerens, L. (2020). The relationship between actual and perceived motor competence in children, adolescents, and young adults: A systematic review and meta-analysis. *Sports Medicine, 50*(11), 2001–2049. https://doi.org/10.1007/s40279-020-01336-2

De Meester, A., Maes, J., Stodden, D., Cardon, G., Goodway, J., Lenoir, M., & Haerens, L. (2016). Identifying profiles of actual and perceived motor competence among adolescents: Associations with motivation, physical activity, and sports participation. *Journal of Sports Sciences, 34*(21), 2027–2037.

De Meester, A., Stodden, D., Goodway, J., True, L., Brian, A., Ferkel, R., & Haerens, L. (2018). Identifying a motor proficiency barrier for meeting physical activity guidelines in children. *Journal of Science and Medicine in Sport, 21*(1), 58–62. https://doi.org/10.1016/j.jsams.2017.05.007

De Meester, F., Van Dyck, D., De Bourdeaudhuij, I., Deforche, B., & Cardon, G. (2014). Changes in physical activity during the transition from primary to secondary school in Belgian children: What is the role of the school environment? *BMC Public Health, 14*(1), Article 261. https://doi.org/10.1186/1471-2458-14-261

den Uil, A.R., Janssen, M., Busch, V., Kat, I.T., & Scholte, R.H. (2023). The relationships between children's motor competence, physical activity, perceived motor competence, physical fitness and weight status in relation to age. *PLoS One, 18*(4), Article e0278438. https://doi.org/10.1371/journal.pone.0278438

Dreiskaemper, D., Utesch, T., & Tietjens, M. (2018). The perceived motor competence questionnaire in childhood (PMC-C). *Journal of Motor Learning and Development, 6*(2), 264–280. https://doi.org/10.1123/jmld.2016-0080

Duncan, M.J., Jones, V., O'Brien, W., Barnett, L.M., & Eyre, E.L. (2018). Self-perceived and actual motor competence in young British children. *Perceptual & Motor Skills, 125*(2), 251–264. https://doi.org/10.1177/0031512517752833

Erdim, L., Ergün, A.& Kuğuoğlu, S. (2019). Reliability and validity of the Turkish version of the physical activity questionnaire for older children (PAQ-C). *Turkish Journal of Medical Sciences, 49*(1), 162–169. https://doi.org/10.3906/sag-1806-212

Estevan, I., & Barnett, L.M. (2018). Considerations related to the definition, measurement and analysis of perceived motor competence. *Sports Medicine, 48*(12), 2685–2694. https://doi.org/10.1007/s40279-018-0940-2

Feitoza, A.H.P., Santos, A.B.D., Barnett, L.M., & Cattuzzo, M.T. (2022). Motor competence, physical activity, and perceived motor competence: A relational systems approach. *Journal of Sports Sciences, 40*(21), 2371–2383. https://doi.org/10.1080/02640414.2022.2158268

Fisher, A., Saxton, J., Hill, C., Webber, L., Purslow, L., & Wardle, J. (2011). Psychosocial correlates of objectively measured physical activity in children. *European Journal of Public Health, 21*(2), 145–150. https://doi.org/10.1093/eurpub/ckq034

Fritz, M.S., & MacKinnon, D.P. (2007). Required sample size to detect the mediated effect. *Psychological Science, 18*(3), 233–239. https://doi.org/10.1111/j.1467-9280.2007.01882.x

Fu, Y., & Burns, R.D. (2018). Gross motor skills and school day physical activity: Mediating effect of perceived competence. *Journal of Motor Learning and Development, 6*(2), 287–300. https://doi.org/10.1123/jmld.2017-0043

Gao, Z., Podlog, L., & Huang, C. (2013). Associations among children's situational motivation, physical activity participation, and enjoyment in an active dance video game. *Journal of Sport and Health Science, 2*(2), 122–128. https://doi.org/10.1016/j.jshs.2013.01.005

Gao, Z., Zhang, P., & Podlog, L.W. (2014). Examining elementary school children's level of enjoyment of traditional tag games vs. interactive dance games. *Psychology, Health & Medicine, 19*(5), 605–613. https://doi.org/10.1080/13548506.2013.845304

Graves, L.E., Ridgers, N.D., Williams, K., Stratton, G., Atkinson, G., & Cable, N.T. (2010). The physiological cost and enjoyment of Wii Fit in adolescents, young adults, and older adults. *Journal of Physical Activity & Health, 7*(3), 393–401. https://doi.org/10.1123/jpah.7.3.393

Gürbüz, S. (2019). *Mediator, moderator and situational effect analyzes in social sciences*. Seçkin Publishing.

Hagberg, L.A., Lindahl, B., Nyberg, L., & Hellénius, M.L. (2009). Importance of enjoyment when promoting physical exercise. *Scandinavian Journal of Medicine & Science in Sports, 19*(5), 740–747. https://doi.org/10.1111/j.1600-0838.2008.00844.x

Hall, C.J., Eyre, E.L., Oxford, S.W., & Duncan, M.J. (2019). Does perception of motor competence mediate associations between motor competence and physical activity in early years children?. *Sports, 7*(4), Article 77. https://doi.org/10.3390/sports7040077

Hallal, P.C., Andersen, L.B., Bull, F.C., Guthold, R., Haskell, W., & Ekelund, U. (2012). Global physical activity levels: Surveillance progress, pitfalls, and prospects. *The lancet, 380*(9838), 247–257. https://doi.org/10.1016/S0140-6736(12)60646-1

Harrington, D. (2009). *Confirmatory factor analysis*. Oxford University Press.

Harter, S. (1999). *The construction of the self: A developmental perspective*. Guilford Press.

Hayes, A.F. (2018). *Introduction to mediation, moderation, and conditional process analysis: A regression-based approach* (2nd ed.). Guilford publications.

Haywood, K., & Getchell, N. (2014). *Life span motor development* (6th ed.). Human Kinetics.

He, Q., Ng, J.Y., Cairney, J., Bedard, C., & Ha, A.S. (2021). Association between physical activity and fundamental movement skills in preschool-aged children: Does perceived

movement skill competence mediate this relationship? *International Journal of Environmental Research and Public Health, 18*(3), Article 1289. https://doi.org/10.3390/ijerph18031289

Holfelder, B., & Schott, N. (2014). Relationship of fundamental movement skills and physical activity in children and adolescents: A systematic review. *Psychology Of Sport and Exercise, 15*(4), 382–391. https://doi.org/10.1016/j.psychsport.2014.03.005

Hulteen, R.M., Morgan, P.J., Barnett, L.M., Stodden, D.F., & Lubans, D.R. (2018). Development of foundational movement skills: A conceptual model for physical activity across the lifespan. *Sports Medicine, 48*(7), 1533–1540. https://doi.org/10.1007/s40279-018-0892-6

Jago, R., Page, A.S., & Cooper, A.R. (2012). Friends and physical activity during the transition from primary to secondary school. *Medicine and Science in Sports and Exercise, 44*(1), 111–117. https://doi.org/10.1249/mss.0b013e318229df6e

Janssen, I., & LeBlanc, A.G. (2010). Systematic review of the health benefits of physical activity and fitness in school-aged children and youth. *International Journal of Behavioral Nutrition and Physical Activity, 7*(1), Article 40. https://doi.org/10.1186/1479-5868-7-40

Kendzierski, D., & DeCarlo, K.J. (1991). Physical activity enjoyment scale: Two validation studies. *Journal of Sport & Exercise Psychology, 13*(1), 50–64. https://doi.org/10.1123/jsep.13.1.50

Kowalski, K.C., Crocker, P.R., & Donen, R.M. (2004). The physical activity questionnaire for older children (PAQ-C) and adolescents (PAQ-A) manual. *College of Kinesiology, University of Saskatchewan, 87*(1), 1–38.

Kruk, M., Zarychta, K., Horodyska, K., Boberska, M., Scholz, U., Radtke, T., & Luszczynska, A. (2018). From enjoyment to physical activity or from physical activity to enjoyment? Longitudinal associations in parent–child dyads. *Psychology & Health, 33*(10), 1269–1283. https://doi.org/10.1080/08870446.2018.1489049

Logan, S.W., Webster, E.K., Getchell, N., Pfeiffer, K.A., & Robinson, L.E. (2015). Relationship between fundamental motor skill competence and physical activity during childhood and adolescence: A systematic review. *Kinesiology Review, 4*(4), 416–426. https://doi.org/10.1123/kr.2013-0012

Lopes, L., Santos, R., Coelho-e-Silva, M., Draper, C., Mota, J., Jidovtseff, B., Clark, C., Schmidt, M., Morgan, P., Duncan, M., O'Brien, W., Bentsen, P., D'Hondt, E., Houwen, S., Stratton, G., Martelaer, K., Scheuer, C., Herrmann, C., García-Hermoso, A., … & Agostinis-Sobrinho, C. (2021). A narrative review of motor competence in children and adolescents: What we know and what we need to find out. *International Journal of Environmental Research and Public Health, 18*(1), Article 18. https://doi.org/10.3390/ijerph18010018

Lopes, V.P., Saraiva, L., & Rodrigues, L.P. (2018). Reliability and construct validity of the test of gross motor development-2 in Portuguese children. *International Journal of Sport and Exercise Psychology, 16*(3), 250–260. https://doi.org/10.1080/1612197X.2016.1226923

Loprinzi, P.D., Davis, R.E., & Fu, Y.C. (2015). Early motor skill competence as a mediator of child and adult physical activity. *Preventive Medicine Reports, 2*, 833–838. https://doi.org/10.1016/j.pmedr.2015.09.015

Lubans, D.R., Morgan, P.J., Cliff, D.P., Barnett, L.M., & Okely, A.D. (2010). Fundamental movement skills in children and adolescents. *Sports Medicine, 40*(12), 1019–1035, https://doi.org/10.2165/11536850-000000000-00000

Luz, C., Rodrigues, L.P., Almeida, G., & Cordovil, R. (2016). Development and validation of a model of motor competence in children and adolescents. *Journal of Science and Medicine In Sport, 19*(7), 568–572. https://doi.org/10.1016/j.jsams.2015.07.005

MacKinnon, D.P., Lockwood, C.M., & Williams, J. (2004). Confidence limits for the indirect effect: Distribution of the product and resampling methods. *Multivariate Behavioral Research, 39*(1), 99–128. https://doi.org/10.1207/s15327906mbr3901_4

Menescardi, C., De Meester, A., Álvarez, O., Castillo, I., Haerens, L., & Estevan, I. (2023). The mediational role of motivation in the model of motor development in childhood: A longitudinal study. *Psychology of Sport and Exercise, 66*, Article 102398. https://doi.org/10.1016/j.psychsport.2023.102398

Menescardi, C., Meester, A.D., Morbée, S., Haerens, L., & Estevan, I. (2022). The role of motivation into the conceptual model of motor development in childhood. *Psychology of Sport and Exercise, 61*, Article 102188. https://doi.org/10.1016/j.psychsport.2022.102188

Michael, S.L., Coffield, E., Lee, S.M., & Fulton, J.E. (2016). Variety, enjoyment, and physical activity participation among high school students. *Journal of Physical Activity and Health, 13*(2), 223–230. https://doi.org/10.1123/jpah.2014-0551

Mirzeoğlu, A.D.& Çoknaz, D. (2014). A validity and reliability study of physical activity enjoyment scale-short form for Turkish children and youth. *International Journal of Human Sciences, 11*(1), 672–687.

Motl, R.W., Dishman, R.K., Saunders, R., Dowda, M., Felton, G., & Pate, R.R. (2001). Measuring enjoyment of physical activity in adolescent girls. *American Journal of Preventive Medicine, 21*(2), 110–117. https://doi.org/10.1016/S0749-3797(01)00326-9

Munro, B.H. (2005). *Statistical methods for health care research*. (1st ed.). Lippincott Williams & Wilkins Company.

Ntoumanis, N. (2001). A self-determination approach to the understanding of motivation in physical education. *British Journal of Educational Psychology, 71*(2), 225–242. https://doi.org/10.1348/000709901158497

Poitras, V.J., Gray, C.E., Borghese, M.M., Carson, V., Chaput, J.P., Janssen, I., & Sampson, M. (2016). Systematic review of the relationships between objectively measured physical activity and health indicators in school-aged children and youth. *Applied Physiology, Nutrition, and Metabolism, 41*(6), 197–239. https://doi.org/10.1139/apnm-2015-066

Preacher, K.J., & Kelley, K. (2011). Effect size measures for mediation models: Quantitative strategies for communicating indirect effects. *Psychological Methods, 16*(2), 93–115. https://doi.org/10.1037/a0022658

Prochaska, J.J., Sallis, J.F., Slymen, D.J., & McKenzie, T.L. (2003). A longitudinal study of children's enjoyment of physical education. *Pediatric Exercise Science, 15*(2), 170–178. https://doi.org/10.1123/pes.15.2.170

Raedeke, T.D. (2007). The relationship between enjoyment and affective responses to exercise. *Journal of Applied Sport Psychology, 19*(1), 105–115. https://doi.org/10.1080/10413200601113638

Robinson, L.E., Palmer, K.K., Irwin, J.M., Webster, E.K., Dennis, A.L., Brock, S.J., & Rudisill, M.E. (2015). The use of multimedia demonstration on the test of gross motor development–second edition: Performance and participant preference. *Journal of Motor Learning and Development, 3*(2), 110–122. https://doi.org/10.1123/jmld.2014-0064

Robinson, L.E., Stodden, D.F., Barnett, L.M., Lopes, V.P., Logan, S.W., Rodrigues, L.P., & D'Hondt, E. (2015). 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

Sallis, J.F., Prochaska, J.J., & Taylor, W.C. (2000). A review of correlates of physical activity of children and adolescents. *Medicine and Science in Sports and Exercise, 32*(5), 963–975. https://doi.org/10.1097/00005768-200005000-00014

Scanlan, T.K., Carpenter, P.J., Lobel, M., & Simons, J.P. (1993). Sources of enjoyment for youth sport athletes. *Pediatric Exercise Science, 5*(3), 275–285. https://doi.org/10.1123/pes.5.3.275

Scanlan, T.K.& Simons, J.P. (1992). The construct of sport enjoyment. In G.C. Roberts (Ed.) *Motivation in sport and exercise* (pp. 199–215). Human Kinetics.

Seefeldt, V. (1980). Developmental motor patterns: Implications for elementary school physical education. *Psychology of Motor Behavior and Sport, 36*(6), 314–323.

Segura-Berges, M., Peñarrubia-Lozano, C., & Bustamante, J.C. (2024). (Re) defining motor competence: Empirical exploration based on a moderated mediation approach. *Research Quarterly for Exercise and Sport,* Advance online publication, 1–9. https://doi.org/10.1080/02701367.2024.2319589

Shen, B., Centeio, E., Garn, A., Martin, J., Kulik, N., Somers, C., & McCaughtry, N. (2018). Parental social support, perceived competence and enjoyment in school physical activity. *Journal of Sport and Health Science, 7*(3), 346–352. https://doi.org/10.1016/j.jshs.2016.01.003

Şimşek, O.F. (2007). *Introduction to structural equation modeling: Basic principles and LISREL applications*. Ekinoks

Smith, M.A., & St. Pierre, P.E. (2009). Secondary students' perceptions of enjoyment in physical education: An American and English perspective. *Physical Educator, 66*(4), 209–221.

Stodden, D.F., Goodway, J.D., Langendorfer, S.J., Roberton, M.A., Rudisill, M.E., Garcia, C., & Garcia, L.E. (2008). A developmental perspective on the role of motor skill competence in physical activity: An emergent relationship. *Quest, 60*(2), 290–306. https://doi.org/10.1080/00336297.2008.10483582

Strong, W.B., Malina, R.M., Blimkie, C.J., Daniels, S.R., Dishman, R.K., Gutin, B., Hergenroeder, A.C., Must, A., Nixon, P.A., Pivarnik, J.M., Rowland, T., Trost, S., & Rowland, T. (2005). Evidence based physical activity for school-age youth. *The Journal of Pediatrics, 146*(6), 732–737. https://doi.org/10.1016/j.jpeds.2005.01.055

Telama, R., Yang, X., Leskinen, E., Kankaanpää, A., Hirvensalo, M., Tammelin, T., Viikari, J.S. A., & Raitakari, O.T. (2014). Tracking of physical activity from early childhood through youth into adulthood. *Medicine and Science in Sports and Exercise, 46*(5), 955–962. https://doi.org/10.1249/mss.0000000000000181

Telama, R., Yang, X., Viikari, J., Välimäki, I., Wanne, O., & Raitakari, O. (2005). Physical activity from childhood to adulthood: A 21-year tracking study. *American Journal of Preventive Medicine, 28*(3), 267–273. https://doi.org/10.1016/j.amepre.2004.12.003

Thomas, J.R., Nelson, J.K., & Silverman, S.J. (2015). *Research methods in physical activity*. Human kinetics.

Trost, S.G., & Loprinzi, P.D. (2011). Parental influences on physical activity behavior in children and adolescents: A brief review. *American Journal of Lifestyle Medicine, 5*(2), 171–181. https://doi.org/10.1177/1559827610387236

Ulrich, D.A. (2000). *Test of gross motor development, examiner's manual*. Pro-ED. Inc..

Utesch, T., Eggelbusch, M., Dreiskaemper, D., Estevan, I., Tietjens, M., & Bardid, F. (2021). The mediating role of perceived motor competence in the relationship between actual motor competence and physical activity in children. *Journal of Sport and Exercise Psychology, 43*(S1), 21–22. https://doi.org/10.1123/jsep.2021-0103

Van Der Mars, H. (1989). Observer reliability: Issues and procedures. In P.W. Darst, D. Zakrajsek, & V.H. Mancini (Ed.), *Analyzing physical education and sport instruction* (pp. 53–80). Human Kinetics.

van Veen, C., Schott, N., Lander, N., Tietjens, M., Hinkley, T., Dreiskämper, D., Holfelder, B., Utesch, T., & Barnett, L.M. (2020). The stability of perceived motor competence of primary school children from two countries over one year. *Measurement in Physical Education and Exercise Science, 24*(1), 74–80. https://doi.org/10.1080/1091367X.2019.1675665

Wankel, L.M. (1993). The importance of enjoyment to adherence and psychological benefits from physical activity. *International Journal of Sport Psychology, 24*(2), 151–169.

Welk, G.J. (1999). The youth physical activity promotion model: A conceptual bridge between theory and practice. *Quest, 51*(1), 5–23. https://doi.org/10.1080/00336297.1999.10484297

World Health Organization. (2014). *Global status report on noncommunicable diseases*.
Zhang, T., Lee, J., Barnett, L.M., & Gu, X. (2021). Does perceived competence mediate between ball skills and children's physical activity and enjoyment? *Children, 8*(7), Article 575. https://doi.org/10.3390/children8070575