Psychology of Sport & Exercise 63 (2022) 102256

Contents lists available at ScienceDirect

Psychology of Sport & Exercise

journal homepage: www.elsevier.com/locate/psychsport

Motor competence predicts self-esteem during childhood in typical development children

Vítor P. Lopes [a,b,*], Susana Rafaela Martins [c], Celina Gonçalves [a,b], Marco Antonio Cossio-Bolaños [d], Rossana Gómez-Campos [d], Luis P. Rodrigues [c,b]

[a] Instituto Politécnico de Bragança, Campus de Santa Apolónia, 5300-223, Bragança, Portugal
[b] Research Centre in Sports Sciences, Health Sciences and Human Development (CIDESD), Vila Real, Portugal
[c] Instituto Politécnico de Viana do Castelo, Escola Superior Desporto e Lazer de Melgaço, Viana do Castelo, Portugal
[d] Departamento de ciencias de la actividad física, Universidad Católica del Maule, Talca, Chile

ARTICLE INFO

Keywords:
Self-worth
Physical activity
Child development
Children behaviour. psychological well-being

ABSTRACT

Purpose: The purpose of this study was to study the relationship between motor competence (MC) and self-esteem in children between 7 and 13 years of age.
Methods: This is five years mixed longitudinal study, although only the last two years were included in the analysis. Participants were N = 144 of both sexes (69 girls) divided in 6 cohorts. At baseline the youngest and the oldest cohorts had 4 and 9 years of age respectively. MC was assessed with KTK. Self-esteem and self-worth were assessed with the Portuguese version of Physical Self-Perception Profile for Children and Youth (PSPP-CY). Cross-lagged models were used to find out whether MC predicts self-esteem and self-worth, or the reverse. Linear mixed models were applied.
Results: Overall, only self-esteem was predicted by MC across age. Results show that self-esteem had a significant decrease between 7 and 13 years of age (−0.56) and that MC is positively associated with self-esteem (b = 0.006).
Conclusions: MC had a mitigating effect on the decrease of self-esteem. Promoting MC during childhood and adolescence might have a positive effect on children's well-being and mental health and prevent them to dropout from physical activities.

1. Introduction

The relationship between motor competence (MC) and health-related behaviours and attributes, such as physical activity and body mass index, has received great attention from research in the last decade (Barnett et al., 2021; Robinson et al., 2015), especially after the publication of the conceptual model by Stodden et al. (2008) on the relationship among physical activity, MC, perceived MC, health-related physical fitness, and obesity. MC is considered a crucial element to promote physical activity (Utesch et al., 2018). MC, defined as a person's proficiency to execute motor skills and the underlying mechanisms such as motor control and coordination (Logan et al., 2018; Lopes & Rodrigues, 2021; Robinson et al., 2015; Rodrigues et al., 2021), is also related with other areas of child development, like cognitive function and academic achievement (Lopes et al., 2013; Pesce et al., 2016; van der Fels et al., 2015). In fact, the development of MC is recognized as an important part of general development, with an impact on many other areas (Bond et al., 2011), including children's psychosocial attributes. Several investigations have shown that a poor MC has extensive repercussions on social and emotional function (e.g. Piek et al., 2006; Skinner & Piek, 2001), like low self-esteem (Henderson et al., 1989).

Self-esteem, individuals' subjective evaluation of their own worth (Harter, 1993; Leary & Baumeister, 2000), was acknowledged as a major determinant of behaviour, psychological well-being and mental health (Hattie, 1992; Rose et al., 2012).

The self-worth model (Harter (1987), developed to explain motivation for behaviour of children and adolescents (8–18 year), is based on a developmental perspective that considers social and emotional factors (Harter & Marold, 1991). Weiss and Ebbeck (1996) adapted the Harter's model to include the physical activity (PA) domain, proposing that

* Corresponding author. Instituto Politécnico de Bragança, Campus de Santa Apolónia, 5300-223, Bragança, Portugal.
E-mail addresses: vplopes@ipb.pt (V.P. Lopes), srgm@estg.ipvc.pt (S.R. Martins), mcossio1972@hotmail.com (M.A. Cossio-Bolaños), rossaunicamp@gmail.com (R. Gómez-Campos), lprodrigues@esdl.ipvc.pt (L.P. Rodrigues).

https://doi.org/10.1016/j.psychsport.2022.102256
Received 30 September 2021; Received in revised form 21 July 2022; Accepted 22 July 2022
Available online 2 August 2022

self-esteem is associated with PA levels. It was suggested (Harter, 1987; Weiss, 2000; Weiss, 2008) that PA and perceived competence for PA improve self-esteem. In addition, high self-esteem is expected to cause positive affect and to reduce negative affect, promoting PA enjoyment and engagement. Moreover, PA enjoyment and self-esteem are hypothesized to predict the amount of PA. In fact, it was found that self-esteem was associated with increased PA level (Davison et al., 2007; Inchley et al., 2011; Neumark-Sztainer et al., 2003). Children acquire self-confidence and self-esteem as a result of successful experiences, particularly in the motor domain (Bunker, 1991), which in turn are dependent on MC (Barnett et al., 2021; Robinson et al., 2015).

Using the Self-Perception Profile Scale for Children (Harter, 1985) and for Adolescents (Harter, 1988), several investigations found that MC was related to global self-worth as well to domain-specific self--evaluations such as the social acceptance, athletic competence, physical appearance and behavioural conduct (Piek et al., 2006; Rose et al., 2015; Skinner & Piek, 2001), promoting personal fulfilment. In a recent systematic review (Lodal & Bond, 2016), it was found that, although there seems to be a relationship between MC and self-esteem, the results were mixed in relation to the domain of self-esteem that is identified as affected by insufficient MC. In the context of the present investigation, self-esteem is interpreted as a general evaluation of one's worth as a person, in line with the definition presented by Harter (1993); and assessed with Physical Self-Perception Profile for Children and Youth (PSPP-CY) (Whitehead, 1995). Specifically, global self-esteem is at the apex of a hierarchy, followed by the physical self-worth which is super-ordinate to four subdomains (sports competence, physical condition, body attractiveness, physical strength). In this context, self-esteem can be discussed in relation to the assessment of self in a specific dimension or domain or it can be used to refer to the self-assessment of an individual (global self-esteem).

In the context of the relationship of MC and self-esteem, studies are mostly cross-sectional. In fact, as far as we know there are none longitudinal study focusing on the relationship of MC and self-esteem in children and youth. Therefore, the main purpose of the present study is to longitudinally analyse the relationship between MC and global self-esteem in children between 7 and 13 years of age, and test whether possible reciprocal effects exist. We postulate that MC predicts self-esteem, that is, children with higher levels of MC will demonstrate better self-esteem than children with low levels of MC.

2. Methods

2.1. Study design and participants

Mixed longitudinal study was carried out between 2009 and 2013.

Six cohorts were followed for five consecutive years. At the first evaluation children were 4, 5, 6, 7, 8 and 9 years of age (1st, 2nd, 3rd, 4th, 5th, and 6th cohort, respectively). MC was assessed annually on five occasions, while self-esteem was evaluated in the two last years. For that reason, the present study is limited to the last two years, between 7 and 13 years of age, that is waves 4th (baseline) and 5th.

Participants were 144 children of both sexes (68 girls), recruited as a convenience sample in four schools (two kindergarten and two primary schools) in the north region of Portugal. Table 1 shows the number of participants by age and wave. During the period considered in the analysis for the present investigation there was no drop-out. Permission was obtained from the school director, and the parents or guardians gave their informed consent and children assent. The ethics committee of the institution of the first author approved this study.

2.2. Measurements

The first author conducted all assessment procedures with the assistance of trained research assistants, undergraduate students in sports science, and of the class teacher. All assessments were carried out in the fall of each year (September and November).

Table 1
Mixed longitudinal study design with number of participants (girls) measures at each wave by age (only wave 4th and 5th were included in the present analysis).

Age (years)	Wave					
	1st	2nd	3rd	4th	5th	Cohort
4	11(6)					
5	12(5)	11(6)				
6	28(10)	12(5)	11(6)			
7	42(19)	28(10)	12(5)	11(6)		
8	36(10)	42(19)	28(10)	12(5)	11(6)	1
9	15(6)	36(10)	42(19)	28(10)	12(5)	2
10		15(6)	36(10)	42(19)	28(10)	3
11			15(6)	36(10)	42(19)	4
12				15(6)	36(10)	5
13					15(6)	6

2.3. Motor competence

Although a variety of tests are available to assess MC, the present study used the Körperkoordination Test für Kinder (KTK) or body coordination test (Kiphard & Schilling, 2007). The KTK is a product-oriented assessment tool, appropriate for children and youth 5 through 14 years. KTK battery includes four test items which assess gross body control, coordination, and dynamic balance: [1] Walking backwards – each child walks backwards three times on three balance beams 3 m in length with decreasing widths: 6 cm, 4.5 cm, 3 cm; the number of successful steps is recorded per trial with a maximum of 72 steps. [2] Jumping sideways - the child jumps consecutively from side to side over a small beam (60 cm × 4 cm x 2 cm) as fast as possible for 15 s. The number of correct jumps is recorded and summed across two trials. [3] Hopping for height – the child is instructed to hop on one foot at a time over a stack of foam squares (50 cm × 20 cm x 5 cm). The first, second or third trial of each height was awarded by three, two or one point(s), respectively. The maximum test score was 39 points for each leg, resulting in a maximum of 78 points with both legs. [4] Shifting platforms – The child had two identical wooden platforms (size 25 cm × 25 cm, height 5.7 cm) and after stepping to one, they had to transfer another one alongside the first to step on to it and then to retrieve the first platform, and to continue this sequence for 20 s. One point is assigned since child transfer the platform for the first time, a second point when step to this platform, a third point when transfer the other platform and fourth when step to this platform, etc. The result is the sum of two trials.

The performance score for each test item was converted into a standardized motor quotient, using normative data tables adjusted for age and sex (Schilling, 2014). The sum of the motor quotients for each item provided a global motor quotient which was used for this analysis.

The test-retest reliability coefficient for the raw score on the total test battery was 0.97, while corresponding coefficients for individual tests ranged from 0.80 to 0.96 (Kiphard & Schilling, 1974, 2007). The total score on the KTK has been shown to moderately correlate with the M-ABC (r = 0.62–0.65) (Smits-Engelsman et al., 1998) and the Bruininks-Oseretsky Test of Motor Proficiency (BOT-2) short form total score (r = 0.61–0.64) (Fransen et al., 2014). Factor analysis of the four individual tests resulted in a single factor labeled gross MC. The percentage of total variance in MC explained by the four tests varied from 81% at 6 years to 98% at 9 years (Kiphard & Schilling, 1974, 2007). Intercorrelations among the four tests varied from 0.60 to 0.81 for the reference sample of 1228 children. Both the factor analysis and intercorrelations indicated acceptable construct validity. In addition, the Cronbach's alphas for the four items showed a high internal consistency (0.95) (Camacho-Araya et al., 1990).

Reliability for the present study was estimated by the extrapolation to a zero-interval of a linear regression between the inter-age

correlations at different intervals, and the correspondent age interval, the result found was 0.82 for the total score and range from 0.60 to 0.84 for individual tests.

2.4. Self-esteem and physical self-worth

The Portuguese version of Physical Self-Perception Profile for Children and Youth (PSPP-CY) (Bernardo & Matos, 2003) was used to measure self-esteem. The PSPP-CY consists of 36 items and uses Harter's (1982) structured alternative format designed to minimize the tendency towards socially desirable responses. This instrument has six subscales: sport competence, physical condition, attractive body, physical strength, physical self-worth, and global self-esteem. Each subscale consists of 6 items in which participants are presented with two contrasting descriptions. When answering, the individual first decides which of the two statements best describes him, the one with which he identifies most (e.g., those with unattractive bodies and those with attractive bodies). Then they decide whether the description that they select is "sort of true" or "really true" for them. Item scores can range from 1 to 4. A value of 3 or 4 represents a positive perception and value of 2 or 1 a negative perception. The result of each subscale is obtained with the average of 6 items belonging to the scale.

The Portuguese version of the PSPP-CY validation was done replicating the analysis carried out by Whitehead (1995) after the translation of the instrument into Portuguese and with data collected in 625 boys and girls of ages between 11 and 19 years. Bernardo and Matos (2003) confirmed the internal validity of the Portuguese version of the PSPP-CY, as it reproduced the hierarchical structure of the model proposed by Fox and Corbin (1989) Fox (1990), a good fit of the data to the model, insofar as the loadings obtained are all significant and the values close to the original study (Whitehead, 1995). The reported internal consistency (alpha) for the different subscales were between 0.73 and 0.85, while test re-test reliability were between 0.71 and 0.77 (Bernardo & Matos, 2003).

When necessary, especially for younger children, a research assistants helped with the interpretation and responses to the questionnaire.

2.5. Data analysis

Descriptive statistics (mean and standard deviation) were calculated for all variables for boys and girls.

The primary analyses were conducted using a structural equation modelling (SEM) framework. Cross-lagged panel models using maximum likelihood estimation to assess the reciprocal relationships between the variables of the 4th and 5th year of evaluations were performed. Specifically, six cross-lagged panel models were used to test the relationships between MC with each of the 6 subscales of PSPP-CY. With cross-lagged models, reciprocal relationships between two or more observed variables measured at two or more distinct timepoints could be analysed. Cross-lagged models include autoregressive effects (the association of a variable on itself at a later point) and cross-lagged effects (an association of a variable with another variable at a later point) within the model (Selig & Little, 2012). In the present study, the cross-lagged models, like path models, have no latent variables, i.e., all variables were observed.

The absolute fit of the models (individual and multigroup analysis) were evaluated using the chi-square by degrees of freedom ratio ($\chi 2/df$), and the standardized root mean square residual (SRMR), while relative fit was assessed using the normed fit index (NFI), the Tucker–Lewis index (TLI) and the comparative fit index (CFI). For these indices, values over 0.95 are deemed indicative of a good fit, and values over 0.98 of a very good fit (Byrne, 2016; Kline, 2016). A value lower than 0.08 for SRMSR are considered acceptable (Hooper et al., 2008). The root mean square error of approximation (RMSEA) was used for evaluating how well the model reproduced the variance–covariance matrix of the data, keeping in mind that RMSEA values as low as 0.08 are deemed adequate, and below 0.06 represent a good fit to the model (Hooper et al., 2008).

A SEM multigroup analysis was done to test whether each cross-lagged models were invariant across sex as suggested by (Byrne, 2016). Therefore, the recommendations of Cheung and Rensvold (2002) and Byrne (2016) were followed: (1) the SEM model should provide acceptable fit in each group; (2) the subsequent invariance types: unconstrained model; structural weights; structural intercepts, structural means, structural covariances and structural residuals should be respected. Invariance standards were assessed via the differences in Comparative Fit Index ($\Delta CFI<0.01$), as suggested by Cheung and Rensvold (2002). The analysis was performed in AMOS 23.0.

The final analyses were done in the multilevel framework. Since repeated measures were nested within individual children, the longitudinal data set was treated as multilevel with two levels: level 2 for children, and level 1 for repeated measures within individual children. Therefore, after checking for the direction of effect and the invariance between sexes, linear mixed models were applied to find an explanatory model for each subscale of PSPP-CY where it was found significant effect. In the case of the multigroup analysis demonstrate invariance between sexes all participants were included. For the cases were multigroup analysis demonstrate no invariance the analysis was done separately for each sex. In any case, multilevel models were only tested in case the cross-lagged models showed a significant effect. To perform these models, time was centred at the initial state, and independent variables were centred around the mean. Model assumptions and residual diagnoses were tested. For each case, one model was run to test if the starting age of the participants interacted with each subscale change, that is, it was tested as a control variable for the cohort design. The final models only include the variables with significant effects. To choose the most appropriate model, the convergence factor, and the Bayesian Information Criterion (BIC) indicator were considered. The glmmPQL and hlme functions of R software version 4.0.3 (2020-10-10) was used.

Significance level was set to $p < 0.05$.

3. Results

Descriptive statistics results (mean and standard deviations) for MC and self-esteem, for boys and girls in each wave of evaluation (4th and 5th) by cohort are presented in Table 2.

3.1. Cross lagged models results

Results regarding multigroup analysis revealed that the SEM cross-lagged model was invariant between boys and girls only for global self-esteem, since invariance assumptions [all factor loadings, structural paths, factor covariances, factor residual variances, and measurement error variances operating equivalently between genders ($\Delta CFI<0.01$] were only met in this PSPP-CY' subscale (see Table 3)].

Figure 1 demonstrates the results of the reciprocal relationship between MC and each PSPP-CY′ subscale by cross-lagged models in boys and girls and in Table 4 are shown the respective goodness-of-fit results. All PSPP-CY′ subscales in both boys and girls cross-lagged models present reasonable up to very good fit indices. In all models the autoregressive path for MC is significant, which is not the case for PSPP-CY' subscales, that is not significant in most of the cases. For both boys and girls, MC significantly predicts global self-esteem one year later. Also, for both sexes, perceived physical condition, perceived attractive body, and physical self-worth had no longitudinal relationship with MC, but they are significantly related at year 4. Only in girls, perceived physical strength has no longitudinal relationship with MC, but they are significantly related at year 4. In boys, perceived physical strength predicts MC (negative), and perceived sport competence predicts MC (negative) and in girls is the other way around, MC positively predicts perceived sport competence.

Table 2
Means and standard deviations for MC and self-esteem, for boys and girls in each wave of evaluation by cohort.

Wave	Cohort											
	1		2		3		4		5		6	
	M	SD	M	SD	M	SD	M	SD	M	SD	M	SD
Girls												
4th												
MC	90.8	11.9	85.3	5.4	82.1	10.8	74.8	12.8	80.5	15.5	82.6	10.2
Self-esteem	3.6	0.6	3.9	0.2	3.7	0.4	3.6	0.6	3.9	0.2	4.0	0.1
Physical self-worth	3,4	0,7	3,8	0,3	3,7	0,4	3,4	0,5	3,7	0,3	3,8	0,5
Sport competence	3,3	0,4	3,2	0,7	3,0	0,7	2,4	0,6	2,5	0,9	3,1	0,5
Physical condition	3,1	0,4	3,7	0,3	3,1	0,7	2,7	0,7	3,1	0,7	3,1	0,5
Attractive body	3,4	0,5	3,7	0,4	3,3	0,3	2,6	0,5	2,9	0,4	3,0	0,5
Physical strength	2,9	0,8	3,2	1,0	3,0	0,7	2,6	0,6	2,6	1,0	2,6	0,6
5th												
MC	97.0	15.6	87.5	5.8	84.2	11.4	78.0	14.3	84.0	20.3	82.3	9.4
Self-esteem	3.6	0.6	2.7	1.0	3.3	0.7	3.2	0.6	3.0	0.7	3.1	0.7
Physical self-worth	3,4	0,8	2,8	1,0	3,3	0,6	2,9	0,7	2,9	0,5	2,8	0,9
Sport competence	2,9	0,4	2,5	0,6	2,7	0,7	2,5	0,6	2,6	0,6	2,4	0,2
Physical condition	2,5	0,7	3,0	0,6	3,0	0,5	2,5	0,6	2,6	0,7	2,4	0,5
Attractive body	3,0	0,8	2,5	0,7	2,8	0,5	2,5	0,5	2,6	0,5	2,4	1,0
Physical strength	2,3	0,7	2,4	0,9	2,5	0,5	2,2	0,5	2,2	0,6	2,1	0,3
Boys												
4th												
MC	94.3	9.9	90.5	7.4	85.0	14.1	86.3	16.5	78.8	17.6	91.7	15.7
Self-esteem	3.9	0.4	4.0	0.1	3.6	0.5	3.6	0.6	3.9	0.3	3.8	0.4
Physical self-worth	3,7	0,3	3,7	0,4	3,7	0,3	3,6	0,3	3,7	0,4	3,7	0,5
Sport competence	3,3	0,6	3,4	0,8	3,2	0,5	2,7	0,8	2,8	0,6	3,1	1,0
Physical condition	3,6	0,6	3,5	0,7	3,6	0,5	3,3	0,8	3,3	0,6	3,7	0,5
Attractive body	3,4	0,3	3,3	0,6	3,2	0,5	3,0	0,7	3,1	0,4	3,1	1,0
Physical strength	3,1	0,8	3,1	0,7	3,3	0,6	3,0	0,8	3,1	0,6	3,7	0,4
5th												
MC	100.0	3.6	97.3	11.6	88.3	10.0	92.4	20.1	83.7	19.6	99.2	9.1
Self-esteem	3.5	0.7	3.2	0.8	3.3	0.6	3.1	0.4	3.3	0.6	3.5	0.3
Physical self-worth	3,5	1,0	3,4	0,6	3,1	0,7	2,9	0,6	3,1	0,6	3,3	0,7
Sport competence	3,3	0,4	3,1	0,8	2,9	0,5	2,8	0,5	3,0	0,6	3,2	0,6
Physical condition	3,2	0,8	3,1	0,6	3,2	0,5	3,0	0,6	2,9	0,7	3,3	0,6
Attractive body	3,1	0,7	3,3	0,6	2,7	0,6	2,7	0,5	2,8	0,4	3,2	0,3
Physical strength	3,1	0,7	2,7	0,5	3,1	0,6	2,6	0,6	2,8	0,4	3,2	0,7
All participants												
4th												
MC	92,4	8,4	84,2	15,5	83,2	11,4	78,0	16,2	79,6	17,3	88,7	13,0
Self-esteem	3,7	0,5	3,9	0,2	3,7	0,5	3,5	0,6	3,9	0,2	3,9	0,3
Physical self-worth	3,6	0,5	3,7	0,3	3,7	0,3	3,5	0,5	3,7	0,3	3,7	0,5
Sport competence	3,3	0,5	3,3	0,7	3,1	0,6	2,5	0,7	2,7	0,7	3,1	0,7
Physical condition	3,4	0,5	3,6	0,5	3,4	0,6	2,9	0,8	3,2	0,6	3,4	0,5
Attractive body	3,4	0,4	3,5	0,6	3,2	0,4	2,8	0,6	3,0	0,4	3,0	0,7
Physical strength	3,0	0,7	3,2	0,8	3,1	0,6	2,7	0,7	2,9	0,8	3,1	0,7
5th												
MC	96,5	9,8	88,7	18,5	86,5	10,4	83,6	18,0	83,8	19,4	90,8	12,4
Self-esteem	3,6	0,6	2,9	0,9	3,3	0,6	3,2	0,5	3,2	0,6	3,3	0,6
Physical self-worth	3,4	0,9	3,1	0,8	3,2	0,6	2,9	0,7	3,0	0,6	3,0	0,8
Sport competence	3,1	0,4	2,8	0,8	2,8	0,6	2,6	0,6	2,9	0,6	2,8	0,6
Physical condition	2,9	0,8	3,1	0,6	3,1	0,5	2,7	0,6	2,8	0,7	2,9	0,7
Attractive body	3,1	0,8	2,9	0,7	2,7	0,6	2,5	0,5	2,7	0,5	2,8	0,8
Physical strength	2,8	0,8	2,6	0,7	2,8	0,6	2,3	0,6	2,6	0,6	2,7	0,7

Notes. MC = motor competence

Table 3
Goodness-of-fit indexes for the invariance of the structural model between sexes in global self-esteem.

Model	Global self-esteem		Physical self-worth		Sport competence		Physical condition		Attractive body		Physical strength	
	CFI	ΔCFI	CFI	ΔCFI	CFI	ΔCFI	CFI	ΔCFI	CFI	ΔCFI	CFI	ΔCFI
Male vs Female												
UM	1.00	–	1.00	–	1.00	–	1.00	–	1.00	–	0.995	–
SW	1.00	0	1.00	0	1.00	0	1.00	0	1.00	0	0.967	0.028
SI	1.00	0	1.00	0	0.955	0.045	0.973	0.027	0.998	0.002	0.853	0.142
SM	0.992	0,008	0.978	0.022	0.918	0.082	0.890	0.110	0.966	0.034	0.745	0.250
SC	1.00	0	0.932	0.068	0.929	0.071	0.892	0.108	0.978	0.022	0.754	0.241
SR	1.00	0	0.943	0.057	0.941	0.059	0.902	0.098	0.986	0.014	0.747	0.248

Note. CFI = comparative fit index; ΔCFI = differences in the value of the comparative fit index; UM: unconstrained model; SW: structural weights; SI: structural intercepts; SM: structural means; SC: structural covariance; structural residuals.

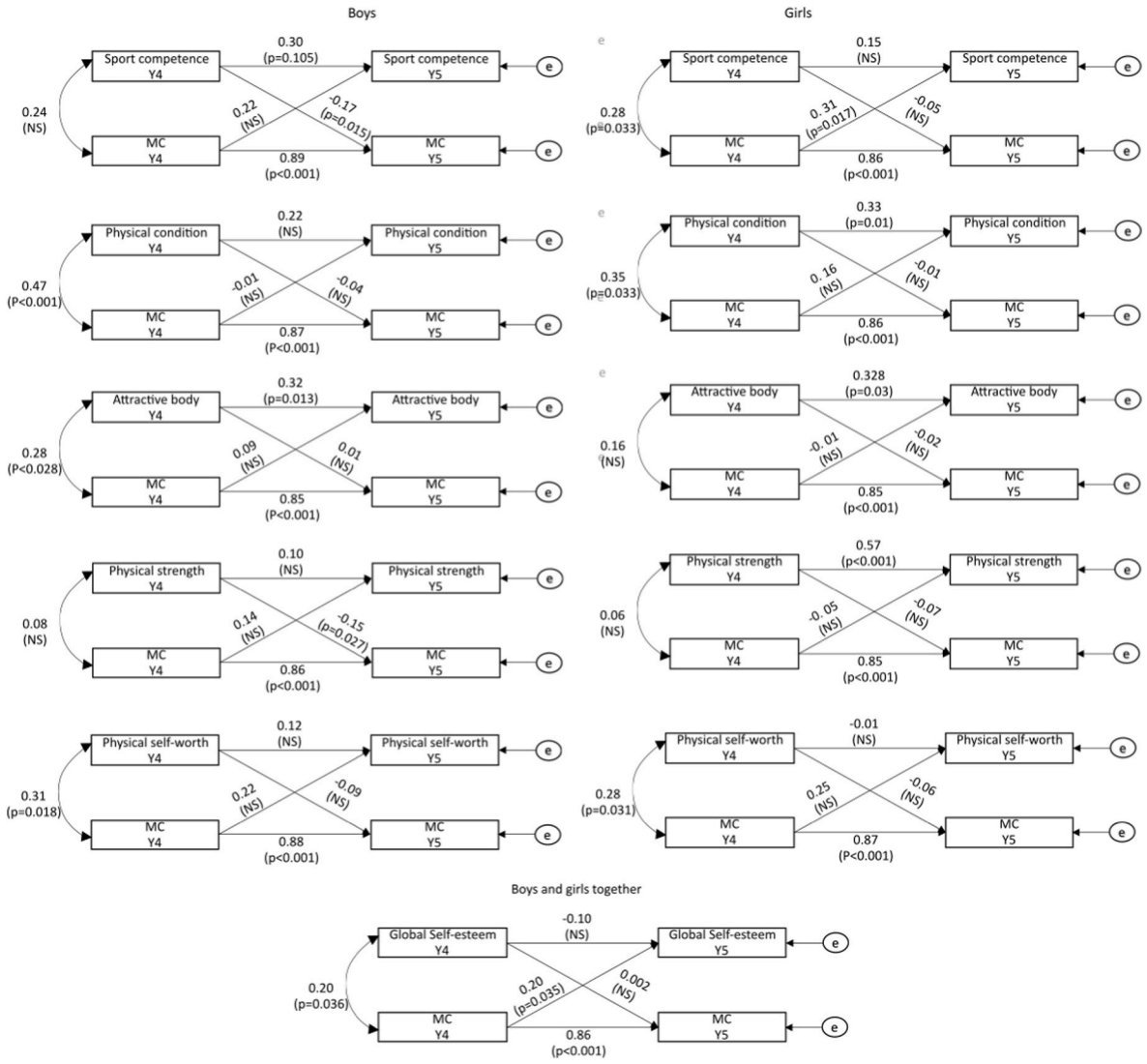

Fig. 1. Cross-lagged models of the reciprocal relationships between motor competence (MC) and each PSPP-CY′ subscale between the 4th (Y4) and 5th (Y5) years of evaluations. Path coefficients are standardized. NS=Statistically non significant for $p < 0.05$.

Table 4
Goodness-of-fit results for cross-lagged models of the reciprocal relationships between motor competence (MC) and each PSPP-CY' subscale.

PSPP-CY′ subscale		χ2	df	p	χ2/df	SRMR	NFI	TLI	CFI	RMSEA
Global self-esteem	Boys and girls	0.580	1	0.615	0.580	0.004	1	1.060	1	0.000
Physical self-worth	Boys	0.038	1	0.846	0.038	0.004	1	1.068	1	0.000
	Girls	1.783	1	0.182	1.783	0.010	0.979	0.940	0.990	1.119
Sport competence	Boys	0.114	1	0.735	0.114	0.006	0.999	1.058	1	0.000
	Girls	0.292	1	0.589	0.292	0.011	0.997	1.052	1	0.000
Physical condition	Boys	1.823	1	0.177	1.823	0.028	0.981	0.946	0.991	0.120
	Girls	0.061	1	0.805	0.061	0.005	0.999	1.064	1	0.000
Attractive body	Boys	0.482	1	0.449	0.482	0.014	0.995	1.038	1	0.000
	Girls	0.262	1	0.609	0.262	0.011	0.997	1.059	1	0.000
Physical strength	Boys	0.535	1	0.465	0.535	0.015	0.994	1.036	1	0.000
	Girls	2.267	1	0.132	2.267	0.027	0.977	0.918	0.986	0.152

3.2. Mixed models

Mixed models' analysis was done only for the PSPP-CY subscales where cross-lagged models showed a significant effect.

Results to predict MC in boys having sport competence and physical strength as predictors are presented in Table 5. In both cases the predictors effect was not significant. In Table 6 are the results of mixed models to predict sport competence in girls having MC as predictor, the results show no significant changes (time effect) in sport competence.

In Table 7 are the results of mixed models to predict self-esteem. Since multigroup analysis revealed that the SEM cross-lagged model was invariant between boys and girls in global self-esteem both sexes were included in the mixed analysis.

In model 1, it was found that the sex and cohort variables had no effect on the baseline or on the change (without interaction with the time variable), which means that there were no significant differences

Table 5
Summary of unstandardized estimates of regression coefficients (fixed effects) of mixed models to predict motor competence in boys.

Sport competence	Model 1		
	b	se	*p*
Intercept	69.26	3.79	<0.001
Time	3.37	1.08	0.003
Time * Cohort	−0.59	0.32	NS
Sport competence	1.27	1.11	NS
Physical strength			
Intercept	66.19	4.94	<0.001
Time	4.26	1.48	0.006
Time * Cohort	−0.61	0.33	NS
Physical strength	2.41	1.64	NS

Note. Model 1 = linear mixed growth model controlled for cohort.

Table 6
Summary of unstandardized estimates of regression coefficients (fixed effects) of mixed models to predict sport competence in girls.

sport competence	Model 1		
	b	se	*p*
Intercept	3.332	0.382	<0.001
Time	−0.201	0.106	NS
Time * Cohort	−0.024	0.009	0.016
MC	0.010	0.004	0.023

Note. Model 1 = linear mixed growth model controlled for cohort. Model 2 = final linear mixed growth model. MC = motor competence

between girls and boys, nor was there a cohort effect. In models 2 and 3, the variables under analysis are significant, however, model 2 turns out to be better than model 3 and all the others because it has a lower BIC value. In this model it is shown that self-esteem had a significant decrease (−0.58) between 7 and 13 years of age, and that MC is positively associated with self-esteem (b = 0.006), even though due to the low b value, this association could be seen as trivial.

4. Discussion

The purpose of the present study was to examine longitudinally the relationship of MC and self-esteem and physical self-worth during childhood (7–13 years of age).

Although cross-lagged models results indicate the possibility of in boys, perceived physical strength and perceived sport competence predict MC (negative) and in girls MC positively predict perceived sport competence, this was not confirmed in mixed models results. It should be borne in mind that the cross-lagged models, unlike the mixed models, does not consider the change that occurred either in the predictors and in the outcomes. Therefore, it was found that MC is a significant predictor of self-esteem during childhood but is not predictor of physical self-worth and its subdomains (sport competence, physical condition, attractive body and physical strength), confirming in part our hypothesis. That is, despite the decline found on of self-esteem during the 7 to 13 age it was observed that children with higher levels of MC demonstrated better self-esteem than children with low levels of MC, although the strength of this longitudinal association was weak. This results are similar to the results of Rose et al. (2015), they found that mean ratings in athletic competence, physical appearance, and global self-worth were lowest for the very low or low MC groups and highest for the average or high MC groups. However, the study of Rose et al. (2015) is cross-sectional and therefore causality could not be deduced.

Although the cross-lagged models indicated that sport competence and physical strength in boys were predictors of MC and not the reverse, the mixed modelling results showed that this effect was not significant between the 7 and 13 years of age. Cross-lagged models results also showed that MC was precursor of MC in girls, but mixed modelling results showed that this effect was not significant between the 7 and 13 years of age.

Cross-sectional and longitudinal research has shown that self-esteem is likely to decrease at adolescence and gradually increases in adulthood (Huang, 2010; Orth & Robins, 2014). Longitudinal research examining the middle childhood period are scarce and with inconsistent results. Noordstar et al. (2016) found that self-esteem remain stable from kindergarten to grade 4 with no significant differences between boys and girls. Also Magro et al. (2018) found that self-esteem remain stable during a period of three years between 8 and 11 years of age, while others found an increase in the mean level of the self-esteem trait (Baldwin & Hoffmann, 2002; Huang, 2010) during childhood. Other research suggest that self-esteem are lower in middle and late childhood than in early childhood because young children, who usually show inflated levels of self-esteem (Goodway & Rudisill, 1997; Harter, 1999), do not have the cognitive skills that allow them to judge their own competencies in a realistic way. In middle and latter childhood children develop these cognitive skills allowing a more realistic judging of own competencies (Marsh, 1985, 1989). According to Bos et al. (2006) who performed a narrative review of the level of global self-esteem, mention that self-esteem is generally high during childhood, and it drops dramatically when children enter adolescence. The results of the present study are in line with previous research that found a self-esteem decline at the beginning of adolescence.

In accordance to the results of the present study, Henderson et al. (1989) found that children with movement difficulties had lower self-esteem than well-coordinated children. Likewise, Rose et al. (2015) found that low MC adolescents demonstrate low mean rating across all self-perception domains including self-esteem. Also Skinner and Piek (2001) found that children with development coordination disorder had lower self-worth. Similar results were reported in review papers (Hands

Table 7
Summary of unstandardized estimates of regression coefficients (fixed effects) and random effects for intercept of mixed models to predict self-esteem.

	Model 1			Model 2			Model 3		
	b	se	p	b	se	p	b	se	p
Fixed Effects									
intercept	3.990	1.509	0.008	5.053	0.309	<0.001	4.945	0.307	<0.001
Sex	−0.490	0.488	0.315						
Time	−0.304	0.411	0.460	−0.578	0.071	<0.001	−0.567	0.069	<0.001
MC	0.005	0.002	0.030	0.006	0.002	0.023	0.006	0.002	0.006
Cohort	0.177	0.190	0.351						
Time*Sex	0.146	0.139	0.294						
Time*Cohort	−0.047	0.054	0.384						
Random Effects									
Intercept	0.186			0.166					
Residual	0.524	0.027		0.527	0.026		0.537	0.024	
BIC	424.500			407.530			420.184		

Note. MC = motor competence; BIC = Bayesian Information Criterion

et al., 2020; Lodal & Bond, 2016).

The results of the present research show that there are no differences between the sexes either in self-esteem levels or on the influence of MC to self-esteem changes (the interaction term was not significant). This topic has received little attention in the literature. Research mostly show that boys tend to have higher self-esteem than girls. For instance, Labbrozzi et al. (2013) observed that 13-year- olds had a poorer physical perception, lower intrinsic motivation, and enjoyment of physical activity when compared with younger girls. In a meta-analyse (Kling et al., 1999) it was found that an effect size of d = 0.21, a small difference favouring males, and that the largest effect emerged in late adolescence (d = 0.33). Rose et al. (2015) found that, although adolescent males rate their global self-esteem as significantly higher than adolescent females, this difference remains constant independently of MC differences. Which is in consonance of the results of the present research. That is, the difference between boys and girls seems to be independent of the difference in MC levels.

According to Harter (2012) actual competence in a domain is a major contributor to the associated self-perception. Our results also show that MC is a factor positively associated with self-esteem, but further demonstrate that MC appeared to be an enhancer of self-esteem, in accordance with the results reported in literature (Piek et al., 2006; Rose et al., 2015; Skinner & Piek, 2001). Having this in mind, the promotion of MC throughout childhood and adolescence should be a central aspect in physical education and sport, thus seeking for the child to adopt an active lifestyle. In the context of games and sport practices, low MC is difficult to hide from peers which can result in a withdraw from the activities, so, children and adolescents with low MC should be supported, as much as possible, to prevent dropout from physical activities due to social comparison. Skinner and Piek (2001) described those with low MC as having higher anxiety and perceived themselves as less skilful. Low self-esteem, and low self-perceptions of MC could be a significant factor for sport's dropout during adolescence (Møllerløkken et al., 2015). Different systematic review studies indicate several factors associated with dropout in sport, and always including the perception of competence and fear of being judged/embarrassed as major factors (Crane & Temple, 2014; Somerset & Hoare, 2018). Psychologically, low MC children and adolescent often perceive their abilities as poor, and feel vulnerable in the presence of teammates, influencing their self-esteem and, therefore, their psychological well-being (Harter, 1987).

The present study was carried out with a convenience sample which is certainly a limitation. Also, being a mixed longitudinal cohort study, it was not fully longitudinal, and so the results can have been biased by the different cohorts' characteristics, although the results shown no cohort effect. Anyway, the mixed longitudinal design of the study is a strength since there are only a few longitudinal studies in this topic, and with a longitudinal design it is possible to establish causality between MC and self-esteem.

In conclusion, self-esteem decreased between 7 and 13 years of age in both boys and girls, and MC was weakly associated with self-esteem. Promoting MC during childhood and adolescence might have a positive effect on children's well-being and mental health and prevent them to withdraw from physical activities.

Declarations of competing interest

None.

Data availability

The authors do not have permission to share data.

Acknowledgements

Funding: This work was partial supported by national funding through the Portuguese Foundation for Science and Technology, I.P., under project UID04045/2020, and by the project TECH - Technology, Environment, Creativity and Health, Norte-01-0145-FEDER-000043, supported by Norte Portugal Regional Operational Program (NORTE 2020), under the PORTUGAL 2020 Partnership Agreement, through the European Regional Development Fund (ERDF).

References

Baldwin, S. A., & Hoffmann, J. P. (2002). The dynamics of self-esteem: A growth-curve analysis. *Journal of Youth and Adolescence, 31*(2), 101–113. https://doi.org/10.1023/a:1014065825598

Barnett, L. M., Webster, E. K., Hulteen, R. M., De Meester, A., Valentini, N. C., Lenoir, M., … Rodrigues, L. P. (2021). Through the looking glass: A systematic review of longitudinal evidence, providing new insight for motor competence and health. *Sports Medicine*. https://doi.org/10.1007/s40279-021-01516-8

Bernardo, R. P. S., & Matos, M. G. (2003). Adaptação portuguesa do physical self-perception profile for children and youth e do perceived importance profile for children and youth. *Análise Psicológica, 2*(XX1), 127–144.

Bond, C., Cole, M., Fletcher, J., Noble, J., & O'Connell, M. (2011). Developing and sustaining provision for children with motor skills difficulties in schools: The role of educational psychologists. *Educational Psychology in Practice, 27*(4), 337–351. https://doi.org/10.1080/02667363.2011.624276

Bos, A. E. R., Muris, P., Mulkens, S., & Schaalma, H. P. (2006). Changing self-esteem in children and adolescents: A roadmap for future interventions. *Netherlands Journal of Psychology, 62*(1), 26–33. https://doi.org/10.1007/BF03061048

Bunker, L. K. (1991). The role of play and motor skill development in building children's self-confidence and self-esteem. *The Elementary School Journal, 91*(5), 467–471. http://www.jstor.org/stable/1001887.

Byrne, B. M. (2016). *Structural equation modeling with AMOS: Basic concepts, applications, and programming* (3 ed.). Taylor & Francis Group, LLC.

Camacho-Araya, T., Woodburn, S. S., & Boschini, C. (1990). Reliability of the prueba de coordinación corporal para niños (body coordination test for children). *Perceptual & Motor Skills, 70*(3), 832–834. https://doi.org/10.2466/pms.1990.70.3.832

Cheung, G. W., & Rensvold, R. B. (2002). Evaluating goodness-of-fit indexes for testing measurement invariance. *Structural Equation Modeling, 9*(2), 233–255.

Crane, J., & Temple, V. (2014). A systematic review of dropout from organized sport among children and youth. *European Physical Education Review, 21*(1), 114–131. https://doi.org/10.1177/1356336X14555294

Davison, K. K., Werder, J. L., Trost, S. G., Baker, B. L., & Birch, L. L. (2007). Why are early maturing girls less active? Links between pubertal development, psychological well-being, and physical activity among girls at ages 11 and 13. *Social Science & Medicine, 64*(12), 2391–2404. https://doi.org/10.1016/j.socscimed.2007.02.033

van der Fels, I. M. J., te Wierike, S. C. M., Hartman, E., Elferink-Gemser, M. T., Smith, J., & Visscher, C. (2015). The relationship between motor skills and cognitive skills in 4-16 year old typically developing children: A systematic review. *Journal of Science and Medicine in Sport, 18*(6), 697–703. https://doi.org/10.1016/j.jsams.2014.09.007

Fox, K. R. (1990). *The physical self-perception profile manual*. Northern Illinois University.

Fox, K. R., & Corbin, C. B. (1989). The physical self-perception profile: Development and preliminary validation. *Journal of Sport & Exercise Psychology, 11*(4), 408–430. https://doi.org/10.1123/jsep.11.4.408

Fransen, J., D'Hondt, E., Bourgois, J., Vaeyens, R., Philippaerts, R. M., & Lenoir, M. (2014). Motor competence assessment in children: Convergent and discriminant validity between the BOT-2 Short Form and KTK testing batteries. *Research in Developmental Disabilities, 35*(6), 1375–1383. https://doi.org/10.1016/j.ridd.2014.03.011

Goodway, J. D., & Rudisill, M. E. (1997). Perceived physical competence and actual motor skill competence of african American preschool children. *Adapted Physical Activity Quarterly, 14*(4), 314–326.

Hands, B., Rose, E., Chivers, P., McIntyre, F., Timler, A., & Parker, H. (2020). The relationships between motor competence, physical activity, fitness and self-concept in children and adolescents with DCD. *Current Developmental Disorders Reports, 7*(2), 35–42. https://doi.org/10.1007/s40474-020-00189-8

Harter, S. (1982). The perceived competence scale for children. *Child Development, 53*, 87–97.

Harter, S. (1985). *Manual for the self-perception profile for children: Revision of the perceived competence scale for children*. University of Denver.

Harter, S. (1987). The determinants and mediational role of global self-worth in children. In M. E. Eisenberg (Ed.), *Contemporary topics in developmental psychology* (pp. 219–242). Wiley.

Harter, S. (1988). *Manual for the self-perception profile for adolescents*. University of Denver.

Harter, S. (1993). Causes and consequences of low self-esteem in children and adolescents. In R. F. Baumeister (Ed.), *Self-Esteem: The puzzle of low self-regard* (pp. 87–116). Springer US. https://doi.org/10.1007/978-1-4684-8956-9_5.

Harter, S. (1999). *The construction of the self: A developmental perspective*. Guilford Press. http://books.google.pt/books?id=ItqgOKmkpqcC.

Harter, S. (2012). *Self-perception profile for adolescents: Manual and questionnaires*. Denver, CO: Univeristy of Denver, Department of Psychology.

Harter, S., & Marold, D. B. (1991). A model of the determinants and mediational role of self-worth: Implications for adolescent depression and suicidal ideation. In J. Strauss, & G. R. Goethals (Eds.), *The self: Interdisciplinary approaches* (pp. 66–92). Springer New York. https://doi.org/10.1007/978-1-4684-8264-5_4.

Hattie, J. (1992). *Self-concept*. Lawrence Erlbaum Associates, Inc.
Henderson, S. E., May, D. S., & Umney, M. (1989). An exploratory study of goal-setting behaviour, self-concept and locus of control in children with movement difficulties. *European Journal of Special Needs Education, 4*(1), 1–15. https://doi.org/10.1080/0885625890040101
Hooper, D., Coughlan, J., & Mullen, M. (2008). Structural equation modelling: Guidelines for determining model fit. *Electronic Journal of Business Research Methods, 6*(1), 53–60. https://academic-publishing.org/index.php/ejbrm/article/view/1224.
Huang, C. (2010). Mean-level change in self-esteem from childhood through adulthood: Meta-analysis of longitudinal studies. *Review of General Psychology, 14*(3), 251–260. https://doi.org/10.1037/a0020543
Inchley, J., Kirby, J., & Currie, C. (2011). Longitudinal changes in physical self-perceptions and associations with physical activity during adolescence. *Pediatric Exercise Science, 23*(2), 237–249.
Kiphard, E. J., & Schilling, F. (1974). *Korperkoordinationstest Fur kinder [Body cooordination test for children]*. Beltz Test GmbH.
Kiphard, E. J., & Schilling, F. (2007). *Körperkoordinationstest Fur kinder [Body cooordination test for children* (2nd ed.). Beltz Test GmbH.
Kline, R. B. (2016). *Principles and practice of structural equation modeling* (3 ed.). Guilford publications.
Kling, K. C., Hyde, J. S., Showers, C. J., & Buswell, B. N. (1999). Gender differences in self-esteem: A meta-analysis. *Psychological Bulletin, 125*(4), 470–500. https://doi.org/10.1037/0033-2909.125.4.470
Labbrozzi, D., Robazza, C., Bertollo, M., Bucci, I., & Bortoli, L. (2013). Pubertal development, physical self-perception, and motivation toward physical activity in girls. *Journal of Adolescence, 36*(4), 759–765. https://doi.org/10.1016/j.adolescence.2013.06.002
Leary, M. R., & Baumeister, R. F. (2000). The nature and function of self-esteem: Sociometer theory. In *, 32. Advances in experimental social psychology* (pp. 1–62). Academic Press. https://doi.org/10.1016/S0065-2601(00)80003-9.
Lodal, K., & Bond, C. (2016). The relationship between motor skills difficulties and self-esteem in children and adolescents: A systematic literature review. *Educational Psychology in Practice, 32*(4), 410–423. https://doi.org/10.1080/02667363.2016.1206847
Logan, S. W., Ross, S. M., Chee, K., Stodden, D. F., & Robinson, L. E. (2018). Fundamental motor skills: A systematic review of terminology. *Journal of Sports Sciences, 36*(7), 781–796. https://doi.org/10.1080/02640414.2017.1340660
Lopes, V. P., & Rodrigues, L. P. (2021). The role of physical fitness on the relationship between motor competence and physical activity: Mediator or moderator? *Journal of Motor Learning and Development*, 1–14. https://doi.org/10.1123/jmld.2020-0070
Lopes, L., Santos, R., Pereira, B., & Lopes, V. P. (2013). Associations between gross motor coordination and academic achievement in elementary school children. *Human Movement Science, 32*(1), 9–20. https://doi.org/10.1016/j.humov.2012.05.005
Magro, S. W., Utesch, T., Dreiskämper, D., & Wagner, J. (2018). Self-esteem development in middle childhood: Support for sociometer theory. *International Journal of Behavioral Development, 43*(2), 118–127. https://doi.org/10.1177/0165025418802462
Marsh, H. W. (1985). Age and sex effects in multiple dimensions of preadolescent self-concept: A replication and extension. *Australian Journal of Psychology, 37*(2), 197–204. https://doi.org/10.1080/00049538508256398
Marsh, H. W. (1989). Age and sex effects in multiple dimensions of self-concept: Preadolescence to early adulthood. *Journal of Educational Psychology, 81*(3), 417–430. https://doi.org/10.1037/0022-0663.81.3.417
Møllerløkken, N. E., Lorås, H., & Pedersen, A. V. (2015). A systematic review and meta-analysis of dropout rates in youth soccer. *Perceptual & Motor Skills, 121*(3), 913–922. https://doi.org/10.2466/10.PMS.121c23x0
Neumark-Sztainer, D., Story, M., Hannan, P. J., Tharp, T., & Rex, J. (2003). Factors associated with changes in physical activity. *Archives of Pediatrics and Adolescent Medicine, 157*(8), 803. https://doi.org/10.1001/archpedi.157.8.803
Noordstar, J. J., van der Net, J., Jak, S., Helders, P. J. M., & Jongmans, M. J. (2016). Global self-esteem, perceived athletic competence, and physical activity in children: A longitudinal cohort study. *Psychology of Sport and Exercise, 22*, 83–90. https://doi.org/10.1016/j.psychsport.2015.06.009
Orth, U., & Robins, R. W. (2014). The development of self-esteem. *Current Directions in Psychological Science, 23*(5), 381–387. https://doi.org/10.1177/0963721414547414
Pesce, C., Masci, I., Marchetti, R., Vazou, S., Sääkslahti, A., & Tomporowski, P. D. (2016). Deliberate play and preparation jointly benefit motor and cognitive development: Mediated and moderated effects. *Frontiers in Psychology, 7*, 349. https://doi.org/10.3389/fpsyg.2016.00349
Piek, J. P., Baynam, G. B., & Barrett, N. C. (2006). The relationship between fine and gross motor ability, self-perceptions and self-worth in children and adolescents. *Human Movement Science, 25*(1), 65–75. https://doi.org/10.1016/j.humov.2005.10.011
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
Rodrigues, L. P., Cordovil, R., Luz, C., & Lopes, V. P. (2021). Model invariance of the Motor Competence Assessment (MCA) from early childhood to young adulthood. *Journal of Sports Sciences*, 1–8. https://doi.org/10.1080/02640414.2021.1932290
Rose, E., Hands, B., & Larkin, D. (2012). Reliability and validity of the self-perception profile for adolescents: An Australian sample. *Australian Journal of Psychology, 64*(2), 92–99. https://doi.org/10.1111/j.1742-9536.2011.00031.x
Rose, E., Larkin, D., Parker, H., & Hands, B. (2015). Does motor competence affect self-perceptions differently for adolescent males and females? *Sage Open, 5*(4), Article 215824401561592. https://doi.org/10.1177/2158244015615922
Schilling, F. (2014). Körperkontrolle und kindliche Entwicklung. KTK-Normentabellen erweitert [Körperkoordination; Test; motorische Entwicklung; Normentabellen; KTK]. https://doi.org/10.2378/mot2014.art29d, 2014, 37, 4, 167-177.
Selig, J. P., & Little, T. D. (2012). Autoregressive and cross-lagged panel analysis for longitudinal data. In B. Laursen, T. D. Little, & N. A. Card (Eds.), *Handbook of developmental research methods* (pp. 265–278). The Guilford Press.
Skinner, R. A., & Piek, J. P. (2001). Psychosocial implications of poor motor coordination in children and adolescents. *Human Movement Science, 20*(1–2), 73–94. https://doi.org/10.1016/s0167-9457(01)00029-x
Smits-Engelsman, B. C. M., Henderson, S. E., & Michels, C. G. J. (1998). The assessment of children with developmental coordination disorders in The Netherlands: The relationship between the movement assessment battery for children and the körperkoordinations test für kinder. *Human Movement Science, 17*(4–5), 699–709. http://www.sciencedirect.com/science/article/B6V8T-49NGF75-D/2/cdcefa59eb8349fd6a3f6eeea12fa0c6.
Somerset, S., & Hoare, D. J. (2018). Barriers to voluntary participation in sport for children: A systematic review. *BMC Pediatrics, 18*(1), 47. https://doi.org/10.1186/s12887-018-1014-1, 47.
Stodden, D. F., Goodway, J. D., Langendorfer, S. J., Robertson, M. A., Rudisill, M. E., Garcia, C., & E.Garcia, L. (2008). A developmental perspective on the role of motor skill competence in physical activity: An emergent relationship. *Quest, 60*, 290–306.
Utesch, T., Dreiskämper, D., Naul, R., & Geukes, K. (2018). Understanding physical (in-) activity, overweight, and obesity in childhood: Effects of congruence between physical self-concept and motor competence. *Scientific Reports, 8*(1), 5908. https://doi.org/10.1038/s41598-018-24139-y
Weiss, M. R. (2000). *Motivating kids in physical activity*. President's Council on Physical Fitness and Sports Research Digest.
Weiss, M. R. (2008). Motivational orientations and sport behavior. In T. S. Horn (Ed.), *Advances in sport psychology* (pp. 115–155). Human kinetics.
Weiss, M. R., & Ebbeck, V. (1996). Self-esteem and perceptions of competence in youth sport: Theory, research, and enhancement strategies: The child and adolescent athlete. In *The encyclopaedia of sports medicine: The child and adolescent athlete* (pp. 364–382). Blackwell Science, Ltd.
Whitehead, J. R. (1995). A study of children's physical self-perceptions using an adapted physical self-perception profile questionnaire. *Pediatric Exercise Science, 7*(2), 132–151.