Medicine & Science in Sports & Exercise
The Official Journal of the American College of Sports Medicine
www.acsm-msse.org

. . . Published ahead of Print

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Accepted for Publication: 3 January 2022

Medicine & Science in Sports & Exercise, Publish Ahead of Print
DOI: 10.1249/MSS.0000000000002870

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Conflict of Interest and Funding Source:

The Finnish Ministry of Education and Culture funded this study in 2017–2021. The authors do not have any professional relationships with companies or manufacturers who would benefit from the results of the present study. The results of the study are presented clearly, honestly, and without fabrication, falsification, or inappropriate data manipulation. The results of the present study do not constitute endorsement by the ACSM.

ABSTRACT

Purpose: This study examined school-aged children's actual motor competence (MC) and perceived physical competence (PC) over three years along with the covariate effects of gender and body mass index (BMI).

Methods: Participants were 1 121 (girls 573, boys 548) children (M_{age} 11.26 ± .32) from 35 randomly selected public schools across Finland. MC was assessed using three movement tests targeting locomotor, stability, and object control skills, and PC was assessed using the sport competence subscale of the Physical Self-Perception Profile via four-phase monitoring.

Results: MC and PC remained stable over time. Of the three variables, locomotor skills showed the strongest association with PC. Lower BMI was associated with advanced MC skills and a less steep decrease in locomotor and stability skills over time.

Conclusions: The acquisition of fundamental motor skills in childhood and early adolescence is a prerequisite for enhancing MC and PC. The contribution of locomotor skills to PC indicated that versatile lower limb strength, speed, dynamic balance, and movement skills are important for positive subjective beliefs about PC capability. Increasing the MC skills of the children in most need, particularly those with high BMI scores, merits special attention.

Key words: locomotor, stability, object control, childhood, adolescence, latent growth model

INTRODUCTION

The adoption of an active lifestyle involving participation in regular physical activity in childhood and adolescence has been associated with several physical and psychological health benefits, including healthy weight, lower blood pressure, higher HDL-cholesterol, muscular and cardiovascular fitness, sport competence, and relief from depression and anxiety (1,2,3). Motor competence (MC) has been considered an essential element explaining physical activity behavior in children and youth (4,5), although the most recent review on the topic found indeterminate evidence for a pathway from MC to engagement in physical activity (6). Perceived physical competence (PC) has also been considered a significant motivational determinant of voluntary physical activity participation (3,5,7). Although the cross-sectional relationship between MC and PC in children and adolescents has been widely studied, the evidence on change and interaction over time is limited (1,4,6,8,9). This study investigated the changes and interactions patterns of MC and PC over three years, from late childhood to early adolescence.

PC is defined as an individual's perception and judgement about his or her ability to perform a given task (10,11). According to Fox and Corbin (12), PC comprises four sub-dimensions: sports competence, body attractiveness, physical strength, and physical condition. Estevan et al. (13) pointed out that one reason for the past conflicting findings on the relationships between cross-sectional PC and actual MC is the multiplicity of definitions of PC, which include perceived physical competence, perceived motor competence, perceived motor proficiency, perceived physical ability, perceived physical self-concept, and perceived sport competence. However, despite minor differences, perceived PC typically refers to awareness of and beliefs about one's personal ability to perform both gross and fine motor tasks, making it a strong motivational determinant of voluntary participation in any physical activity (7,14). PC tends to decrease over time, partly because bodily changes and growth spurts in puberty may interfere with motor performance (15) and partly because children's perceptions of their competence become increasingly accurate in late childhood and early adolescence (3,5). Stodden et al. (16) argued that PC is not dependent on self-perceptions of ability alone but is also linked to actual MC.

MC refers to a person's ability to perform a wide range of motor acts in a proficient manner, including coordination of the fine and gross motor skills needed to manage physical tasks in everyday life (17). Gross motor competence is often specified as proficiency in a range of fundamental movement skills, including locomotor skills (e.g., running and hopping), object control skills (e.g., catching and throwing), and stability skills (e.g., upright balancing, starting, and stopping) (18,19). Ideally, MC related movement skills are acquired during the preschool and early school years (18,19), not, however, only through the maturation process but also through practice, instruction, and structural training (20,21). These skills provide a foundation for the development of more specialized movement sequences, such as sport-specific movement skills (22) and lifelong physical activity (23). Therefore, to improve children's MC, it is important that fundamental movement skills are taught and reinforced in childhood (5,24).

Among the individual characteristics related to MC, Barnett et al. (6) found a strong negative association between MC and body mass index (BMI). They found no evidence for locomotor, coordination, nor stability skills as predictors of BMI status, owing to the scarcity of studies on the topic. However, higher BMI scores in children and adolescents have been associated with a lower level of PC (27,28), although these associations have not been studied longitudinally. In gender comparisons, girls have typically demonstrated lower MC skills than boys, especially in object control skills (27,28). Bolger et al. (28) reported higher locomotor skill levels in girls than boys. Findings on gender differences in MC skills appear to be confounded by marked individual differences in how skills develop throughout childhood and adolescence (1,29) and differences in the mode of MC assessment used.

While a few studies (5,30) have reported that the associations between MC and PC may be stronger in early childhood than in middle to late childhood (age 6–12 years), such evidence remains scarce (6). Generally, if individuals rate themselves as competent in a specific activity compared to peers, they may be more willing to invest effort in more challenging activities (10). Thus, PC is important as it can hinder or enhance the development of fundamental movement skills and MC acquisition (31,32,33). Conversely, positive MC is believed to enhance perceived PC (5,16). A broad consensus has not yet been reached, as the evidence linking actual MC and perceived PC in either direction has been found to be insufficient and inconsistent (6). Nevertheless, it is reasonable to argue that the combined effect of positive PC and MC may promote physical activity participation, thereby lowering, at least in part, the risk for overweight and obesity (5).

While the cross-sectional relationships between perceived PC/MC and actual MC in school-aged children have been widely studied (1,6,8,9,31,34,35,36,37,38,39), only a few longitudinal MC studies have examined the transition from elementary to secondary school and entry into puberty (1,21,40,41,42). Moreover, fewer longitudinal studies on this age group have reported changes in and interaction between different components of MC and PC over a longer period (4). One such study, by Estevan et al. (43), studied PC and MC among Spanish children over a three-year period. However, their sample of 104 participants was relatively small. In other MC follow-up studies with school-aged children, sample sizes have typically varied between 100 and 300 participants and skills have been assessed at only one follow-up, typically two to three years post-baseline (1,6). Considering all above, evidence supporting longitudinal relationships between perceived PC and actual MC is insufficient (1,4,6,8,9). The present study deviates from customary practice in that the data were collected at baseline and at one, two, and three years thereafter in a large sample of children. According to current thinking, latent growth curve models are superior to traditional variance analyses as instead of focusing on group mean differences, they capture individual heterogeneity in longitudinal patterns (44,45). Thus, this study on the relationship between MC and PC contributes to filling the above-mentioned gaps in the research literature. Investigating the associations of MC measured as locomotor, stability, and object control skills collectively and separately with PC using four-phase monitoring from late childhood to early adolescence was expected to yield important insights on an under-researched topic (6).

Specifically, this study examined trends in and the interactions and between MC, measured as locomotor (five-leaps), stability (side-to-side jump), and object control (throw-catch) skills, and PC, over a three-year follow-up, and the covariate effects of gender and BMI on MC and PC. Based on past findings, MC levels were expected to increase (1,6) and PC levels to decrease (3). Children with higher MC levels were expected to also show higher PC levels than less competent children (8) and boys were expected to show higher MC (34) and PC levels than girls (46). Finally, lower BMI scores were expected to be associated with higher MC skills (34) and higher PC (25).

METHODS

Participants

Participants were 1 121 (girls 573, boys 548) Finnish children with a mean age of 11.26 ± .32 at the beginning of the data collection. Children were recruited from 35 randomly selected public schools in Southern (46% of students), Central (41%), Eastern (6%), and Northern Finland (7%). Nearly two percent of the 61 062 fifth-grade children in Finland participated in the baseline measurements. The participating schools manifested the characteristics typical of Finnish comprehensive schools, i.e., Finnish-speaking, ethnicity mostly Caucasian, approx. 300 to 500 students, and following the national curriculum. Grade 5 students were invited to participate through direct contact with principals. The children were drawn from 67 classes taught by the same classroom teachers at both T0 and T1. After transitioning to the secondary level, the students were instructed by specialist physical education teachers at T2 and T3. All students participated in regular classes (two x 45 minutes per week). No students with special needs or disabilities participated in the study, although the opportunity was given to all students equally.

Procedure

Data were collected using identical procedures at all measurement points (August to September) in 2017 (T0), 2018 (T1), 2019 (T2), and 2020 (T3). The research work group informed schools and homes about the study and obtained a written informed consent from parents for the voluntary participation of their child. Children could terminate their participation at any time without consequences. The ethics committee of the local university approved the study protocols.

Measurements

Covariate variables. Covariates were assessed during the same period as the movement tests at T0. Gender (girl/boy) was asked in a structured online questionnaire, which was administered in the classroom using laptop computers. Items were prefaced by the stem: "*Using the given options, please select the one that best describes your personal qualities*." BMI was calculated using weight and height scores (kg/m^2) measured by the researchers using a digital scale (kg) and measuring instrument (cm). The proportions of overweight/obese children (11 to 14 years) were calculated using the cut-off points proposed by Cole and Lobstein (47).

Motor competence. Children's MC was measured using three skill tests: the side-to-side jump test (stability) (48), throw-catch test (object-control) (49), and five-leap test (locomotor) (50). The side-to-side test consisted of jumping consecutively for 15 seconds back and forth over a small wooden beam (60 × 4 × 2 cm). The test was performed twice, with legs parallel, and the final score (reps) was the mean score of the two scores. The throw-catch test comprised throwing a tennis ball at a target square measuring 1.5 × 1.5 m, located 90 cm above floor level, from a throwing distance of 7 m for girls and 8 m for boys. Children were allowed 20 attempts at throwing the ball from behind the marked line, hitting the target area, and catching the ball after one bounce. The total score was the number of correctly performed throw-catches (reps). The five-leap test score was the distance (cm) traveled from the starting line to landing point (measured from the heel of the nearest foot) after five consecutive leaps. Latent growth curve models were estimated using z-scores. The side-to-side, throw-catch, and five-leap test scores were standardized and summed to form an overall MC score. Further details on the present MC tests were recently reported (50).

Perceived physical competence. Children's perceived PC was assessed using the Physical Self-Perception Profile (PSPP) (12). The original scale comprises four domains, i.e., sport competence, attractive body, physical strength, and physical condition. In this study, only the sport competence subscale was used, as it measures the most relevant subjective beliefs in relation to MC skills. The item stem was "*What am I like*?" The subscale consisted of five pairs of items on a five-point Osgood scale (1 = *I am among the most skillful at sport*, 5 = *I am not good at sport)*. The mean score of the five items were recorded as the participant's PC value. In a sample of 639 Finnish school children, Gråstén (51) showed that the composite reliability for the factor loadings was .90 and that the construct validity of the scale was supported by confirmatory factor analysis ($\chi^2(5) = 22.67$, $p < .001$, $CFI = .98$, $TLI = .97$, $RMSEA = .074$, $SRMR = .020$).

Statistical analyses

Prior to the main analyses, the normality of the distribution, outliers, and missing values were examined. Next, the correlations, means, and standard deviations of the observed variables were analyzed. Confirmatory factor analysis was implemented to test the construct validity of the PC scale. To answer the research questions, a parallel latent growth curve model including both MC and PC was used. Latent variables ($Level_{MC}$, $Slope_{MC}$, $Level_{PC}$, $Slope_{PC}$) based on the observed variables at T0 to T3 were estimated. The latent level variables refer to the initial values at the baseline. The latent slopes refer to the angle of growth after the determination of the initial levels. The default models for the longitudinal measures were constructed by fixing the loadings of the latent variables to one on the initial level and to zero to three on the slopes (44). To examine the covariate effects on the latent MC and PC variables, gender and BMI were added into the model. In addition, equality of means and variables between girls and boys were tested using two-group tests. Preliminary analyses were conducted using SPSS 26.0 and the main analyses using Mplus 8.4.

RESULTS

Preliminary analyses

The descriptive statistics showed that the observed variables were normally distributed, and the standardized values (± 3.0) indicated no significant outliers. The percentage of missing values in the variables used in the latent profile analysis was 17% (3 437 out of 20 178 values). The missing completely at random (MCAR) test (χ^2 = 3523.33, *df* = 3039, *p* < .001) showed that the data with and without missing values were unequal (52). Closer examination of the observed variables revealed that while the proportion of students participating in the measurements at T2 and T3 decreased, the missing scores did not cluster in any specific school or group. Thus, the missing values were expected to be missing at random (MAR). Missing scores were estimated using the Full Information Maximum Likelihood method, which has been shown to produce unbiased estimates and standard errors under the MAR conditions (53). The present sample was large enough to tolerate a possible loss of data, as a sample size analysis with a statistical significance level of p < .05 and power of 95% indicated that a minimum of 287 participants was needed.

Descriptive statistics

Correlation coefficients, means, and standard deviations of the study variables were examined (Table 1). Nearly half of the participants had higher PC scores (T0 48%, T1 49%, T2 46%, T3 46%) and just over half had higher MC scores (T0 49%, T1 65%, T2 57%, T3 55%) than the sample means over time. BMI values varied in both girls (13.54 to 35.69) and boys (13.72 to 38.51), while overweight/obesity rates remained relatively constant within girls (22%, 22%, 19%, 21%) and boys (23%, 23%, 24%, 22%) over time.

Confirmatory factor analysis

To test the factor structure of the PC scale from T0 to T3, a series of confirmatory factor analyses was performed. The construct validity of the scale at T0 ($\chi^2(4) = 26.45$, $p < .001$, $CFI = .99$, $TLI = .97$, $RMSEA = .072$, $SRMR = .016$), T1 ($\chi^2(4) = 10.22$, $p < .05$, $CFI = 1.00$, $TLI = 1.00$, $RMSEA = .039$, $SRMR = .011$), T2 ($\chi^2(4) = 14.57$, $p = .01$, $CFI = .99$, $TLI = .98$, $RMSEA = .054$, $SRMR = .013$), and T3 ($\chi^2(4) = 16.90$, $p = .01$, $CFI = .99$, $TLI = .97$, $RMSEA = .062$, $SRMR = .017$) was confirmed. To improve the fit indices, residual correlations between items with similar wording (“*I am among the best when it comes to joining sport activities”* and “*I am among the first to join in sport activities”*) at T2 and T3 were accepted. Correlated residuals between items using similar wording are sometimes necessary in some models, although they should be used cautiously (54). The Cronbach alphas for the scale were acceptable (Table 1) across the measurements. Hence, the scale provided reliable results for the subsequent latent growth curve analyses.

Latent growth curve models of MC and PC

The first latent growth curve model examined the reciprocal relationships between the MC and PC levels and slopes from T0 to T3. Intraclass correlations indicated that the MC scores varied between classes (Table 2), and therefore, the growth curve model was estimated using the complex model option to adjust parameters for sampling weights. The theorized model showed excellent fit to the data ($\chi^2(30) = 128.14$, $p < .001$, $CFI = .97$, $TLI = .96$, $RMSEA = .054$, $SRMR = .048$, *90% CI* [.05, .06]).

The standardized results showed that $Slope_{MC}$ ($\beta = -.19$, $SE = .32$, $p = .546$) and $Slope_{PC}$ ($\beta = -.39$, $SE = .30$, $p = .194$) were stable over time. $Level_{MC}$ was positively associated with $Level_{PC}$ ($\beta = .56$, $SE = .03$, $p < .001$) and $Slope_{MC}$ ($\beta = -.27$, $SE = .05$, $p < .001$). In addition, $Slope_{MC}$ positively correlated with $Slope_{PC}$ ($\beta = .38$, $SE = .10$, $p < .001$). Squared multiple correlations revealed that the model explained 10% of the variability in $Level_{MC}$ ($\beta = .10$, $SE = .02$, $p < .001$) and 9% of the variability in $Level_{PC}$ ($\beta = .09$, $SE = .02$, $p < .001$).

Latent growth curve models of PC, locomotor, stability, and object control skills

The second growth curve model examined locomotor (five-leap), stability (side-to-side jump), and object control (throw-catch) skills separately in relation to PC from T0 to T3 along with the covariate effects of gender and BMI. The theorized model with the complex model option showed acceptable fit to the data ($\chi^2(123) = 627.78$, $p < .001$, $CFI = .92$, $TLI = .91$, $RMSEA = .061$, $SRMR = .065$, *90% CI* [.06, .07]). The standardized results showed that the stability ($\beta = 2.89$, $SE = .54$, $p < .001$), locomotor ($\beta = 1.12$, $SE = .32$, $p < .001$), and object control ($\beta = 3.07$, $SE = .63$, $p < .001$) scores increased from T0 to T3. $Level_{PC}$ was positively associated with the locomotor (β = .40, *SE* = .05, *p* < .001) and object control (β = .20, *SE* = .05, *p* < .001) levels. Squared multiple correlations showed that the model significantly explained the variability in $Level_{PC}$ (42%) and $Slope_{PC}$ (26%), in the locomotor skill level (15%) and slope (19%), in the object control level (8%) and slope (45%), and in the stability level (9%).

Covariate effects of gender and BMI

Gender showed significant covariate effects on $Level_{PC}$ (β = .11, *SE* = .04, *p* < .01) and object control level (β = .20, *SE* = .05, *p* < .001) and on the slopes of locomotor (β = .42, *SD* = .05, *p* < .001) and object control skills (β = -.67, *SE* = .11, *p* < .001). These gender differences were subsequently confirmed using two-group tests, as boys had a higher initial PC ($\chi^2(1)$ = 307.27, *p* < .001) and object control level ($\chi^2(1)$ = 4.44, *p* < .05) and larger positive increase in locomotor ($\chi^2(1)$ = 307.66, *p* < .001) and object control ($\chi^2(1)$ = 48.72, *p* < .001) slopes than girls. Significant covariate effects of BMI on the levels of stability (β = -.29, *SE* = .04, *p* < .001), locomotor (β = -.39, *SE* = .03, *p* < .001), and object control skills (β = -.13, *SE* = .04, *p* < .001) were also found, indicating that lower BMI was associated with more advanced MC skills and vice versa. In addition, the slopes of locomotor (β = -.12, *SE* = .04, *p* < .01) and stability (β = -.13, *SE* = .06, *p* < .05) were associated with BMI, with higher BMI values correlating with greater decreases in locomotor and stability skills over time.

DISCUSSION

This study examined trends in and interactions between MC and PC along with the covariate effects of gender and BMI over three years. Both MC and PC remained stable over time. The MC and PC slopes were positively associated, indicating that when MC changes, PC changes, and vice versa. Locomotor and stability skills showed the strongest association with PC, and BMI showed inverse associations with locomotor and stability skills.

Stability of MC and PC over time.

PC remained stable across the measurement period. First, contrary to the hypothesis, PC did not decline with age (3,5). Similar stability in physical self-perceptions was found, for instance, in a Dutch study of preschool children and children in Grades 2 to 4 (55) and in a study comparing German and Dutch Grade 3 children over one year (56). A possible explanation for this may be that the present participants were Finnish school-aged children who had previously self-reported relatively high PC scores. Moreover, nearly 62% of the Finnish children in this age cohort (9–15 years) were actively involved in sport club activities (57), which may help to maintain PC levels. Viewed in this light, it was encouraging that this study indicated stable PC, even during entry into puberty.

Similarly, actual MC remained stable over time against the hypothesis (1,4,28). A possible explanation for that may be the decrease in daily physical activity participation at this age (58), as higher physical activity levels have been found to correlate with advanced MC skills (1,5,6). In addition, previous longitudinal MC studies have used a one-phase follow-up procedure, separated by an interval of from two (21,41,42) to six (40) years, compared to the present four phases with a one-year interval between each, a design which may explain the differences between the present and prior findings. However, the main issue arising from these results on the relationship between MC and PC concerns children with lower levels of MC or severe difficulties in MC (59). These children could be given additional opportunities for physical activities that require versatile MC skills, as advanced MC skills have also been shown to influence physical activity behavior later in life (59,60). It would seem particularly important for schools and healthcare professionals to identify and monitor children with lower MC skills, so that movement-related difficulties would not continue from childhood into adolescence and possibly adulthood.

Positive correlation between slopes in MC and PC.

The present study showed that MC and PC skills followed similar trends. This finding supported earlier cross-sectional studies reporting higher PC levels in children with more advanced MC skills (1,5,8,9). Unlike many previous studies, this study measured perceived PC rather than perceived MC. A further novelty of this finding is that the data covered the critical period from late childhood to early adolescence when children's physical activity participation usually declines (58,61). Earlier studies, such as that reported by Estevan et al. (43) who followed four- to nine-year-old children over three years, have studied children at a time of life when most have not yet entered puberty. The strong positive correlation between the latent MC and PC slopes may partly arise from the fact that children's self-assessments become more accurate at this developmental stage (30). This finding nevertheless reinforces the assumption that the relationship between MC and PC may be reciprocal (5,16) with change in one accompanied by change in the other. Thus, positive change in at least one of the two may, as underlined by Barnett et al. (62), enhance motivation to engage in physical activity.

Strong associations of locomotor skills and PC.

These results showed that, in contrast to the earlier studies by Morano et al. (9) and Barnett et al.

(63), the level of PC showed the strongest association with locomotor skills. Morano et al. (9), whose process-oriented test protocol (i.e., focus on the qualitative process of the movement) differed from the product-oriented skill test protocol (i.e., focus on the outcome of the movement) applied in the present study, found object control skills to be the factor with the strongest influence on PC. Specifically, Morano et al. (9) used the gross motor skill measurement protocol, including striking, dribbling, catching, kicking, throwing, and underhand rolling a ball, whereas in this study, object control skills were assessed using the throw-catch test. Barnett et al. (63), in turn, used test protocols similar to ours with younger children but they did not directly examine the contribution of movement skills to PC as an outcome variable. When children transition into adolescence, biological differences between individuals (e.g., muscular development) become more evident and may advantage children with rapid maturation in many gross motor skills involving larger or multiple muscles or muscle groups (5). Likewise, younger children's ability to self-perceive may be limited because of individual differences in timing of cognitive development, which can vary widely in children (30). Thus, differences between studies in the samples, measurement protocols (process/product-oriented), and analyses used may explain some of the variation in these results. In line with the review findings of De Meester et al. (8), this should be considered when interpreting MC studies in children.

However, the present results highlighting the important role of locomotor skills in PC indicate that versatile motor skill training, especially in jumping, which requires lower limb strength, speed, dynamic balance skills, and movement skills, could contribute to positive subjective beliefs about PC capability. All the above-mentioned qualities may also advance learning in other skills, as they are essential in the performance of many different activities. The product-oriented locomotor skill test may require higher dynamic balance, speed, and lower limb strength than the other two MC tests used in this study, i.e., the throw-catch and side-to-side jump tests, which in turn may reflect predominant contribution of five-leap test scores to PC. In conclusion, these findings support the importance of versatile MC acquisition in early childhood (46,50), starting in kindergarten and continuing across the primary school years.

Association of lower BMI with more advanced MC skills and a smaller decrease in locomotor and stability skills over time.

In line with past findings (1,5,6), lower BMI correlated with more advanced MC skills and a smaller decrease in locomotor and stability skills over time. The present study extended previous research in the area by examining the contribution of single MC skills to BMI at several measurement points. The results showed that the lower the level of BMI, the smaller the decrease in locomotor and stability skills. While this finding may also be due to more frequent daily activity (59), the children with lower BMI also clearly had higher locomotor, stability, and object control scores. This, in turn, points to the importance of early intervention, not only in training MC skills but also in lowering BMI levels (5). As suggested in earlier studies, there is a close relationship between MC and BMI (1,5,43) as well as between MC and physical activity (4,5). In view of these findings and the tendency for physical activity levels to decrease in late childhood (58) or already at school entry (64), it might be worthwhile providing interventions for overweight and obese children and for children with lower MC skills already at school entry to help them acquire sufficient MC skills to participate in physical activities in later life.

Strengths and limitations

The novelty of this study was the four-phase monitoring of MC and PC over three years in a large sample of school-aged children. Furthermore, the use of latent growth models to examine the longitudinal trends from late childhood to early adolescence extended previous MC research (6). The study also has its limitations. First, although the MC measurement protocol used in this study included versatile locomotor, stability, and object control skills, the emphasis remained strongly on locomotor and stability skills. The inclusion of additional object control skills, such as kicking, striking, or bouncing a ball, might have benefited the current set of MC measures. Second, the MC test protocols used here were product-oriented, meaning that other qualities such as power and strength may have been mixed in with pure skills. Third, the PC scores were collected solely from the children themselves, whereas parent- or teacher-initiated assessments might have provided deeper insights into the trends in PC, following the protocol reported by Estevan et al. (65). Finally, since participation was voluntary, it is difficult to know whether the sample was representative of children whose MC skills and PC are generally weaker and who participate less frequently in daily physical activities than their peers.

Future research

The results indicate some directions for future research on the topic. For instance, more follow-up studies are needed to clarify the interaction of actual MC and perceived PC/MC. Longitudinal studies are also needed on the trends of both actual and perceived MC in relation to physical activity participation. Furthermore, more information on the factors underlying MC, gained from, e.g., interventions and randomized controlled trials, would be welcome.

CONCLUSIONS

The acquisition of fundamental movement skills in childhood and early adolescence is essential in seeking to enhance MC and PC. In particular, the contribution of locomotor skills to PC indicates that versatile strength, coordination, and locomotor skills can promote positive subjective beliefs about PC capability. Increasing the MC skills of the children in most need, particularly children with high BMI scores, warrants special attention.

Acknowledgements

The Finnish Ministry of Education and Culture funded this study in 2017–2021.

Conflict of Interest

The authors do not have any professional relationships with companies or manufacturers who would benefit from the results of the present study. The results of the study are presented clearly, honestly, and without fabrication, falsification, or inappropriate data manipulation. The results of the present study do not constitute endorsement by the ACSM.

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Table 1. Variable-specific numbers of participants, correlations, means, and standard deviations of the study variables.

-	n	1	2	3	4	5	6	7	8	M	SD	α
LATENT VARIABLES T0-T3												
1 Perceived physical competence T0	1083		.548***	.447***	.420***	.378***	.364	.362	.358*	3.48	.81	.87
2 Perceived physical competence T1	976			.666***	.604***	.485***	.474	.479	.492**	3.48	.87	.90
3 Perceived physical competence T2	857				.657***	.426*	.449	.501***	.499***	3.38	.93	.89
4 Perceived physical competence T3	806					.426***	.383*	.471**	.517***	3.42	.95	.89
5 Motor competence T0	1068						.823***	.750***	.703	.02	2.37	
6 Motor competence T1	932							.825***	.774***	-.08	2.43	
7 Motor competence T2	810								.792***	-.03	2.39	
8 Motor competence T3	663									-.01	2.36	
STABILITY SKILLS T0-T3												
Side-to-side jump T0	1080	.250***								37.28	6.56	
Side-to-side jump T1	953		.337***							39.97	7.00	
Side-to-side jump T2	829			.405***						44.39	7.13	
Side-to-side jump T3	697				.326***					46.57	7.30	
LOCOMOTOR SKILLS T0-T3										7.74	.89	
Five-leaps T0	1084	.351***										

Five-leaps T1	945		.429***			8.20	1.01
Five-leaps T2	821			.467***		8.58	1.09
Five-leaps T3	723				.486***	8.98	1.23
OBJECT CONTROL SKILLS T0-T3							
Throw-catch T0	1091	.290***				10.38	5.27
Throw-catch T1	948		.329***			12.85	4.73
Throw-catch T2	845			.265***		11.02	5.04
Throw-catch T3	761				.348***	12.91	4.84
COVARIATES T0							
BMI	1121	-.152***	-.225***	-.205***	-.128**	18.88	3.12
Gender	1121	.129***	.159***	.165***	.213***		

***p < .001, **p < .01, *p < .05, Cronbach alpha (α)

Table 2. Intraclass correlation coefficients between classes from T0 to T3.

Outcome	**Grouping variable**	**Time**	**β**	**SE**	**p**
PC	Class	T0	.01	.02	.437
		T1	.01	.01	.242
		T2	.02	.02	.316
		T3	.01	.04	.844
MC	Class	T0	.13	.03	.000***
		T1	.19	.03	.000***
		T2	.13	.03	.000***
		T3	.08	.02	.000***

***$p < .001$