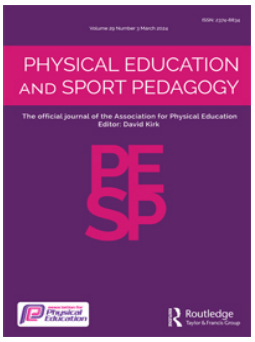

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Early childhood physical activity parenting and sport club participation as predictors of perceived motor competence – a three-year longitudinal study

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Early childhood physical activity parenting and sport club participation as predictors of perceived motor competence – a three-year longitudinal study

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ABSTRACT

Background & purpose: Enhancing perceived motor competence (PMC) is an important factor in increasing the physical activity and motor competence of children. Longitudinal research is needed to identify the factors that support children's positive and realistic PMC development. To address this research gap, we examined physical activity parenting (PAP) and sports club participation (SCP) as predictors of children's PMC.
Methods: We assessed PMC using a modified pictorial scale of perceived movement skill competence (PMSC) for young children at the following two time points: in early childhood education and care (ECEC) (T1; $N = 259$; $M_{age} = 6.27 \pm .67$; 50.2% boys) and approximately three years later in primary school (T2; $N = 259$; $M_{age} = 9.45 \pm .79$ years). PAP and SCP (the type and number of sports) were examined using a parental questionnaire ($N = 259$; $M_{age} = 36.2 \pm 5.64$). The children's actual motor competence (AMC) was assessed using the Test of Gross Motor Development – Third Edition (TGMD-3). Linear regression analyses were performed to examine how the number of sports in which a child participates (SCP_{sum}) predicted PMC. Then, we analysed how participation in a specific type of sport (locomotor and ball sports) predicted PMC in terms of locomotor skills, ball skills and total skills. The analyses were adjusted for the T2–T1 time difference and AMC.
Results: PAP was a significant predictor of PMC three years later for ECEC-aged girls but not for boys. Moreover, participation in a ball sport at T1 predicted higher scores for girls' PMC at T2. In addition, the girls who participated in more than one ball sport exhibited lower PMC at T2. For boys, higher AMC, higher BMI and less access to electronic devices at T1 predicted higher PMC at T2.
Conclusion: The results suggest that PAP in ECEC age is important for girls' PMC development over time. The role of SCP was ambiguous in girls. Participation especially in ball sports may have different influences on PMC in girls depending on the frequency of participation. Therefore, parents, sport instructors and coaches should adapt their child rearing and pedagogical practices by considering child PMC development in addition to promoting physical activity and skills.

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Introduction

Scholars have argued that children's perceived motor competence (PMC) is a relevant component and moderator of physical activity (PA) participation (Babic et al. 2014; Hulteen et al. 2018). PMC refers to individuals' perceptions of their competence levels in relation to movement (i.e. actual motor competence [AMC]) (Estevan and Barnett 2018). In longitudinal (participants aged 4–9 years) (Estevan et al. 2021) and cross-sectional studies (11-year-old participants) (Jaakkola et al. 2021), children with higher PMC and AMC exhibited higher PA and healthier weight status. In addition to higher exercise motivation and enjoyment in PE, higher actual and PMC significantly contribute to higher overall PA in schoolchildren (Carcamo-Oyarzun et al. 2023). Although researchers have investigated the relationship between AMC and PMC (e.g. De Meester et al. 2020), there is a lack of studies on other predictors, particularly for PMC development.

Children's cognitive abilities and perceptual skills become more sophisticated and mature with age, which affects the way how realistically children perceive their own capabilities and competencies (Harter 2012, 65). In early childhood, children start to compare themselves to their peers and develop their individuality and self-esteem (Eccles 1999). However, a child under the age of 10 uses primarily the outcome of a game or feedback from parents to evaluate their own physical competence (Weiss 2004). Relatedly, parental socialisation and role-modelling processes are significantly related to children's perceived physical competence (Brustad 1996), which includes PMC (Estevan and Barnett 2018). By supporting PA, parents can affect children's PMC (e.g. Menescardi and Estevan 2021).

In the context of PA, physical activity parenting (PAP) typically describes the PA support that children receive from their legal guardians, typically their parents. In other words, PAP refers to parental strategies for fostering a physically active lifestyle in children. According to the integrated model of PAP (Davison et al. 2013), these parental strategies include structure, responsiveness and demandingness. Parental structure refers to how parents arrange their children's surroundings to support their competency development (Grolnick, Deci, and Ryan 1997). In practice, structure involves (in)directly planning and leading family activities involving PA. Furthermore, responsiveness describes the extent to which PAP is child-oriented, and demandingness refers to the existence of controlling strategies in PAP. However, not all children benefit from PAP to the same extent – for example, children with low PMC may benefit from PAP the most (Laukkanen et al. 2023). In the context of physical education (PE), children with low AMC have the potential to benefit the most from support and encouragement to do sports (De Meester et al. 2016) to practise skills, have friends for active play and thus gain higher PMC. Further, supporting strengthening autonomous motivation and enjoyment in PE, can be crucial for PA in schoolchildren (Carcamo-Oyarzun et al. 2023). When it comes to sport club participation (SCP), according to the integrated model of PAP (Davison et al. 2013) and research on children's (aged 7–10 years) perceptions of PAP (Laukkanen, Sääkslahti, and Aunola 2020), SCP can be seen as a form of PAP, specifically of parental structure. This is because parents play a significant role in enrolling children in sport-related hobbies, paying the participation costs and encouraging children to participate in sport-related hobbies. SCP itself has been shown to be associated with PMC, particularly in relation to object control skills (Niemistö et al. 2019) and children who participate in sports clubs tend to overestimate their locomotor competence (Pesce et al. 2018). Therefore, PAP and SCP provide a solid framework for examining the predictors of young children's PMC development.

Gender differences in PMC are also observed but not always (De Meester et al. 2020). The gender differences are smaller at young age (e.g. Breslin et al. 2012), however, later boys tend to have higher perceptions (Duncan et al. 2018; Jacobs et al. 2002). Variables associated with PMC also vary by gender and, for example, AMC-PMC profiles differ and develop differently over time between girls and boys (Niemistö et al. 2023). When looking at AMC, boys have been shown to be better at ball skills than girls (Goodway, Robinson, and Crowe 2010; Spessato et al. 2013) and boys tend to participate to ball sports more than girls (Kokko et al. 2019). Overall, AMC has been found to be an important factor in active participation in PE classes (Spessato, Gabbard, and Valentini 2013). The above differences in AMC, SCP et cetera also partly explain the differences in PMC and should be considered when predicting the development of PMC.

While PMC and AMC have been frequently studied, longitudinal studies on the role of PAP and SCP in PMC development are limited. To address this research gap, we investigated how PAP and SCP predict subsequent PMC. We used the following two time points: early childhood education and care (ECEC; T1) and primary school age (approximately three years later; T2). Based on the presented literature, we hypothesised that higher PAP (e.g. Davison et al. 2013; Weiss 2004) and SCP (e.g. Niemistö et al. 2019; Pesce et al. 2018) at T1 would be positive predictors of PMC at T2 (age 7–11 years). Furthermore, we hypothesised that participation in ball manipulation and locomotion sports at ECEC age would predict higher subsequent PMC in relation to specific subdomains (i.e. perceptions of ball skills and locomotor skills, respectively). Practicing of certain motor skills is generally supposed to influence on the perceptions of these skills (De Meester et al. 2020). The effect of child gender was hypothesised to play a role in the main research question as gender differences in PMC (Duncan et al. 2018) and in associations between PMC and other related variables have been found previously (Spessato, Gabbard, and Valentini 2013). Lastly, time interval of the measurements was considered in analyses because differences in time intervals between T1 and T2 may cause bias in PMC change.

Materials and methods

Procedure and data collection

We used longitudinal data from two research projects. At T1 (2015–2016), data were collected from children of ECEC age, while at T2 (2018–2020), the same children were studied in primary school. The participants, both children and parents, were informed of the voluntary nature of the participation, and the parents provided written consent for participation. Metadata descriptions of the projects are published (Sääkslahti et al. 2023; 2017).

The study protocol has been presented in detail in previous publications (Laukkanen et al. 2018; Niemistö et al. 2019). In short, the data represented a geographically representative sample from Finland and were based on cluster random sampling. The samples were collected across two projects conducted in 24 localities. T1 involved randomly chosen ECEC units ($n = 37$) from Southern, Northern and Central Finland as well as the metropolitan area. Primary schools ($n = 97$) were selected based on the T1 research design.

PMC and AMC measurements were completed in ECEC and primary schools under the supervision of researchers and research assistants. The research assistants were trained in the research protocol by experienced researchers (AS, DN, AL). All measurement procedures were trained together to avoid measurement differences and biases among the researchers.

Study participants

At T1, 950 children and their parents participated in the study. Of these, 675 children and their parents participated at T2 (participation rate approximately 71%). At T1 only those children who were over 5 years old were assessed PMSC as this age has been found to be a reliable age to measure PMC (Barnett et al. 2016). When the datasets were combined, the longitudinal sample with valid data for all the examined variables comprised 259 children (mean $n_{girls} = 129$ and $n_{boys} = 130$) and their parents.

Perceived motor competence (PMC)

PMC was measured at T1 using the scale of Pictorial Movement Skill Competence (PMSC), which aligns with the test of gross motor development – third edition (TGMD-3) test. PMSC is a proper instrument when measuring young children´s PMC as it has indicated acceptable face validity (Barnett et al. 2015) construct validity (Barnett et al. 2016) and test – retest reliability (Diao et al. 2018). We calculated the internal consistencies of the questionnaire. The internal consistency of the T1 PMC_{total} was favourable (Cronbach's alpha = 0.82) and T2 PMC_{total} (α = 0.83). PMSC was measured according to the instructions before the TGMD-3 test to avoid post-test perceptions. At T1, the PMC was done in a quiet room one-on one with the child. Researcher showed the pictorial items and with each item (s)he asked the questions. The child answered by pointing the chosen item. The PMSC point scale was as follows: (1) 'not that good', (2) 'sort of good', (3) 'pretty good' and (4) 'really good'. The perceived locomotor skills ($PMC_{locomotor}$) comprised six locomotor skills (run, gallop, hop, skip, horizontal jump and slide), and the maximum points were 24 (6 × 4 points). The perceived ball skills (PMC_{ball}) comprised seven ball skills (one-hand forehand strike, two-hand strike of a stationary ball, one-hand stationary dribble, two-hand catch, kick a stationary ball, overhand throw, and underhand throw), and the maximum points were 28 (7 × 4 points). Together, these evaluations comprised the maximum score for the total PMC (PMC_{total}) (52 points). The totals of PMC_{total}, $PMC_{locomotor}$ and PMC_{ball} were examined separately.

The PMSC questionnaire was modified for use in small groups at T2 (Laukkanen et al. 2023). In brief, at T2, the PMSC instructions were given to the children in small groups, and then each child completed the questionnaire on their own. The children could not see one another's answers. Between group and one-on-one types of administrations has shown good-to-excellent agreement, but there has been shown higher internal consistency for group administration in children aged 8.0–10.9-years (Estevan et al. 2021). Thus, it was decided to use group administration in T2.

Actual motor competence (AMC)

At T1, AMC was measured using TGMD-3 (Ulrich 2017; 2019), which aligns with PMSC. For the TGMD-3, the children performed 13 tasks divided into the following two subcategories: six locomotor skills (run, gallop, hop, skip, horizontal jump and slide; max. 46 points) and seven ball skills (one-hand forehand strike, two-hand strike of stationary ball, one-hand stationary dribble, two-hand catch, kick a stationary ball, overhand throw and underhand throw; max. 56 points). The locomotor and ball skill scores comprised the total scores for the TGMD-3 test (max. 100 points). For the TGMD-3, both inter-rater and intra-rater reliability scores were fair-to-excellent (Hyokju Maeng, Andrew Pitchford, and Ulrich 2017; Niemistö et al. 2019). TGMD-3 assessments were held in the childcare centre and two observers were trained to observe and assess performances. Both observers passed Ulrich´s TGMD-3 reliability test. Performances were also video analysed at the beginning of data collection. This was to assure that inter-rater reliability between observers was appropriate and to be sure that the measurements were observed in reliable manner. Internal consistency of the T1 AMC_{total} showed acceptable reliability (α = 0.75).

Physical activity parenting (PAP)

A previously translated Finnish version (Laukkanen et al. 2017) of the Family Physical Activity Environment (FPAE) questionnaire (Cleland et al. 2011) was used to determine the PAP for children aged 4–7 years. The original questionnaire was found to be reliable (test–retest) based on parents of Australian children aged 5–12 years (Cleland et al. 2011). Among 195 parents of Finnish children aged 4–6 years (Laukkanen et al. 2021), 20-day (± 9.2 days) test–retest stability of the FPAE, without items of direct support, was moderate (intra class correlation (ICC) = 0.53–0.74).

One parent of each child responded to the questionnaire ($n = 259$, 229 females). The parents were asked to answer five questions related to the parental structure of PA: direct support for PA, encouragement of PA and co-participation in PA. In addition, if a respondent had a partner, they were asked to evaluate whether their partner provided direct support and encouragement for PA. The exact questions presented were as follows:

(1) Direct support: 'Evaluate how often you provide support for your child's participation in PA – for example, by taking him or her to a PA hobby or training, providing money for participation and buying sports clothing/equipment' and 'If you have a partner, evaluate how often (s)he provides support … '
(2) Encouragement: 'Evaluate how often you praise your child for participating in PA – for example, by saying positive things to him or her for being physically active or physically skilful' and 'If you have a partner, evaluate how often (s)he praises … '
(3) Co-participation in PA: 'Evaluate how often you engage in PA, such as cycling, walking, playing outdoors or indoors, hiking and playing games, as a family with at least one parent actively involved.'

For all these items, the parents were asked to pick an answer on a scale of 0–5 (0 = never, 1 = less than once a week, 2 = 1–2 times per week, 3 = 3–4 times per week, 4 = 5–6 times per week, 5 = daily). Single parents were asked to evaluate only their own support. Finally, the mean of the five (with partner) or three (single parents) questions constituted the total PAP score. The internal consistency of PAP questionnaire was checked. Cronbach´s alpha value was found to be 0.80 and corrected item-total correlations ranged between 0.39 and 0.72, both stating favourable consistency of the PAP items.

Sport club participation (SCP)

The children's SCP (0.81; 95% CI = 0.60–0.91) (Niemistö 2021, 69) at T1 was examined in the parental questionnaire with the following item: 'Does your child participate in an organised sport in a group or sport club?' The following answer options were provided: 'No/Yes, what kind of sport?' First, the reported sports were summed up, and the sum factor was named SCP_{sum}. In total, 31 sports were reported at T1. Second, the reported sports were divided into categories of locomotor skills and ball skills according to the typical motor skills practiced in the sports. For instance, football was categorised as a ball skill sport based on the predominance of kicking and object manipulation skills in this sport, while gymnastics was classified as a locomotor skill sport based on the predominance of running, jumping and other locomotor skills. This categorisation followed the same logic as the TGMD-3 (Ulrich 2017) and PMSC (Barnett et al. 2015) measures. The children involved in ball skill sports (SCP_{ball}) participated in eight sports (e.g. football, basketball and ice hockey). Locomotor sports ($SCP_{locomotor}$) included 23 sports (e.g. artistic gymnastics, synchronised skating, swimming and orienteering).

For examining the role of different volumes of SCP in child PMC, the number of sports participated overall (SCP_{sum}) was categorised as 0 = no sports, 1 = one sport, 1 = one sport, and 2 = two or more sports. The same logic was used to categorise the number of locomotor sports (0 = no locomotor sports, 1 = one locomotor sport, and 2 = two or more locomotor sports) and ball skill sports (0 = no ball skill sport, 1 = one ball skill sport, and 2 = two or more sports) participated.

Anthropometric measures

Weight (measured with Seca 877) and height (measured with Charder HM 200P) were measured before the AMC assessments at T1. Body mass index (BMI) was calculated using the formula of weight/height^2 (kg/m^2). National BMI references for BMI standard deviation scores were also calculated for use in analyses. These scores are nationally comparable and take into account age and gender (Saari et al. 2011).

Other measures

The children's genders and birth dates were established using the parent questionnaire. The exact ages of the children were obtained as follows: the difference between the test date and the child's birthday was divided by 365. We also calculated the time difference between the T1 and T2 test dates as follows: difference between test dates T2 and T1 was divided by 365. The parental education levels of both parents were established using the following four-point scale: (1) comprehensive school, (2) high or vocational school, (3) university of applied sciences, or (4) university. The parents' education mean was used in the analysis.

In the analyses, we included access to electronic devices because they can influence children's PMC in terms of locomotor skills (Niemistö et al. 2019). The parents were asked to evaluate if their children had access to the following electronic devices: (1) TV, (2) game console, (3) computer, (4) smart device (e.g. tablet, iPad and smartphone), and (5) other device, specify what these devices were. The sum of the accessible devices was used in the analyses.

Statistical analyses

We ran linear regression models using the following three different dependent variables: PMC_{total} (Model 1 and Model 2), PMC_{ball} (Model 3 and Model 4) and $PMC_{locomotor}$ (Model 5 and Model 6). In all the models PAP and SCP were considered as predictors and we used the following covariates: T1 PMC_{total}, T1 $AMC_{total,}$ parents' education, a child's BMI standard deviation score, gender, age, and time difference between T1 and T2. Furthermore, SCP was considered a predictor either as a sum or divided: in Models 2, 4 and 6, we used SCP_{sum}, and in Models 1, 3 and 5, we used SCP_{ball} and $SCP_{locomotor}$. Because child's gender was found to be a significant covariate (see supplementary Table 1), linear regressions were performed separately for girls and boys because gender may moderate associations between physical self-concept and other variables, such as PA (Babic et al. 2014).

An independent samples t-test was performed to consider the differences between the children's genders. Effect sizes for gender differences were estimated using Cohen's d in a t-test, where $p < .20$ was a small effect size, $p < .50$ was a medium effect size and $p < .80$ was a large effect size (Cohen 1977, 25–26). All analyses were performed using IBM SPSS Statistics 28, and statistical significance was set at $p < .05$.

Results

Descriptive statistics

Descriptive statistic of children´s results at T1 and T2 (mean and SD) and descriptive data of SCP (percentages of participation at T1) are reported in Tables 1 & 2. There were 259 children in the study. Most children were of normal weight (BMI standard deviations for normal weight = 73.7%).

At T1 in $PMC_{locomotor}$, girls rated themselves higher than boys ($p = .039$; d = 0.3). Boys perceived themselves as significantly better in ball skills than girls ($p = .007$; d = −0.3). At T2, boys perceived themselves as better than girls in PMC_{ball} (, $p = < .001$; d = −0.8) and PMC_{total} ($p = <.001$; d = −0.5).

At T1 for $AMC_{locomotor}$, girls exhibited significantly higher scores than boys ($p = .001$; d = 0.4). In line with the PMC results, girls exhibited significantly lower scores than boys at T1 for AMC_{ball} ($p = <.001$; d = −0.7) and AMC_{total} ($p = .036$; d = −0.3).

T1 – Physical activity parenting (PAP)

Of the 259 children´s parents, 32 were single parents and the others belonged to a core family with a partner including one or more children in the family. Regarding PAP, the mean of all five PAP items was 2.71 ± 0.90. Encouragement was the most common form of parental support ($M_{respondent}$ = 3.25, ± 0.90; $M_{partner}$ = 3.15, ± 1.34), followed by co-participation (M = 2.83, ± 1.15) and direct support ($M_{respondent}$ = 2.12, ± 1.10; $M_{partner}$ = 1.96, ± 1.12). The internal consistency of all five items was α = 0.799.

Table 1. Descriptive statistics (means, standard deviations, reliability coefficients) about children related factors in time point 1 (T1) and time point 2 (T2).

		N (T1–T2)	MEAN all participants (SD)		Internal consistency α		MEAN girls (SD)		MEAN boys (SD)	
			T1 (SD) min–max	T2 (SD) min–max	T1	T2	T1 (SD) min–max	T2 (SD) min–max	T1 (SD) min–max	T2 (SD) min–max
Age		259	6.27 (0.67) 4.85–7.80	9.45 (0.79) 7.67–11.44			6.22 (0.67) 4.85–7.29	9.40 (0.78) 7.90–11.44	6.32 (0.67) 4.89–7.80	9.49 (0.79) 7.67–11.23
PMC	locomotor skills (0–24 points)	259	19.94 (3.23)* 11– 24	19.49 (2.82)* 12–24	0.646	0.626	20.36 (2.96) 12–24	19.53 (2,66) 12– 24	19.53 (3.44) 11–24	19.45 (2.98) 12–24
	ball skills (0–28 points)		22.44 (4.36)** 7–28	22.10 (3.90)** 9.00–28.00	0.778	0.811	21.71 (4.75) 7–28	20.69 (3.76) 9–28	23.17 (3.80) 9–28	23.50 (3.53) 13–28
	total score (0–52 points)		42.38 (6.76) 20–52	41.59 (6.04) 23–52	0.819	0.832	42.06 (7.02) 22–52	40.22 (6.01) 23–52	42.70 (6.50) 20–52	42.95 (5.78) 27–52
T1 BMI SDS		259	3.21 (0.63) 1–5				3.16 (0.65) 1–5		3.27 (0.59) 1–5	
T1 AMC	locomotor skills (0–46 points)	259	30.87 (6.41)** 9–43		0.585		32.06 (5.84) 14–43		29.69 (6.75) 9–43	
	ball skills (0–54 points)		29.32 (7.94)*** 9–49		0.697		26.53 (7.19) 10–44		32.08 (7.69) 9–49	
	total score (0–100 points)		60.19 (12.24)* 18–88		0.748		58.60 (11.37) 33–86		61.78 (12.89) 18–88	
T1 Access to electronic devices	sum of accessible devices	259	0.69 (1.02) 0–5		0.592		0.57 (0.86) 0–4		0.81 (1.14) 0–5	

Note: Values are reported as mean scores or percentages (%). Standard deviation is marked in parentheses (SD).
The results are rounded to two decimal places.
Statistically significant gender differences are reported as * = $p < .050$, ** = $p < .010$ and *** = $p < .001$.
PMC = Perceived motor competence, AMC = actual motor competence & BMI SDS = Body Mass Index Standard Deviation Score.

Table 2. Descriptive statistics of children´s sport club participation at T1.

	T1 Sport club participation *N* (%)		Girls sport club participation *N* (%)	Boys sport club participation *N* (%)
T1 Sport club participation	1 sport	101 (39%)	50 (38.8%)	51 (39.2%)
	2 or more sports	59 (22.8%)	33 (25.6%)	26 (20.0%)
	(%) Don´t participate	99 (38.2%)	46 (35.7%)	53 (40.8%)
T1 SCP_{ball}	1 ball sport	44 (17.0%)	12 (9.3%)	32 (24.6%)
	2 or more ball sport	9 (3.5%)	2 (1.6%)	7 (5.4%)
	Don´t participate	206 (79.5%)	115 (89.1%)	91 (70.0%)
T1 $SCP_{locomotor}$	1 locomotor sport	87 (33.6%)	50 (38.8%)	37 (28.5%)
	2 or more locomotor sports	42 (16.2%)	29 (22.5%)	13 (10.0%)
	Don´t participate	130 (50.2%)	50 (38.8%)	80 (61.5%)

Note: The results are rounded to one decimal places.
SCP = Sport club participation.

Linear regression models predicting PMC at T2

The linear regressions were performed separately for girls and boys because a child's gender was found to be a statistically significant (B = 1.692–2.210, $p < .001–.007$) covariate in the initial models (see supplementary Table 1). When PMC predictors were examined solely for girls, a higher PAP at T1 predicted significantly (B = 0.515–1.795. $p < .000–.034$) higher PMC scores at T2, regardless of whether SCP was divided or summed (Table 3). In contrast, PAP was not a significant predictor of PMC in boys (Table 4). At T1 we found that, participation in a ball sport (compared to non-participation) significantly predicted PMC in girls (B = 1.770–4.491, $p < .012–.025$). However, participation in two or more ball sports at T1 predicted PMC_{total} and $PMC_{locomotor}$ scores but not PMC_{ball}. Overall SCP or participation in locomotor sports at T1 predicted neither girls' nor boys' PMC.

Regarding the model covariates, AMC at T1 was a significant predictor in all models of boys' PMC_{total} and PMC_{ball} at T2 (B = 0.117–0.138, $p < .003–.009$) but not of girls' PMC. In addition, BMI at T1 was a significant predictor of higher PMC scores at T2 for boys but not for girls. When boys had less access to electronic devices at T1, this predicted higher scores of PMC_{total} and $PMC_{locomotor}$. Access to electronic devices was not a significant predictor for girls. Shorter test intervals predicted the scores of T2 PMC_{total} and $PMC_{locomotor}$ (B = −1.456–−3.392, $p < .007–.031$) for girls, but for boys, this predicted only the $PMC_{locomotor}$ scores (B = −1.759–−1.824, $p < .011–.015$).

Discussion

This study examined PAP and SCP as predictors of ECEC-aged children's PMC three years later at primary school age. The results were analysed separately for boys and girls because gender was found to be a significant covariate in the statistical models. Unlike for boys, for ECEC-aged girls, PAP was found to be a significant predictor of PMC three years later. The results showed that of the sport types engaged with in early childhood, participation in one ball sport predicted higher subsequent PMC, but two or more ball sports predicated lower PMC for girls. For boys, better AMC, higher BMI, and less access to electronic devices at T1 predicted higher PMC scores at T2. From perspective of children's PMC development from ECEC to primary school age, the role of PAP and SCP, as part of the parental support, may be thus gendered.

It may be that the gender of the parent may play a role to the child´s experience of support. It is possible that the relatively low percentage (10%) of male respondents (fathers) in this study blurs the association between PAP and boys' PMC development when moving from ECEC to primary school. It has been shown that compared to girls' perceptions of fathers' support, boys perceive their relationship with fathers to be more supportive (Furman and Buhrmester 1992). Although

Table 3. Linear regression models predicting girls' T2 PMC (total, locomotor, and ball skills).

	T2 PMC total				T2 PMC – locomotor skills				T2 PMC – ball skills			
	Model 1		Model 2		Model 3		Model 4		Model 5		Model 6	
	SCP divided		SCPsum		SCP divided		SCPsum		SCP divided		SCPsum	
Variables	Unstrd. B	*P*	Unstrd. B	*P*	Unstrd. B	*P*	Unstrd. B	*P*	UnstrdB	*P*	Unstrd. B	*P*
T1 PMC (Total/locomotor/ball)	0.274	**0.000**	0.280	**0.000**	0.265	**0.001**	0.266	**0.001**	0.195	**0.005**	0.206	**0.003**
T1 PAP	1.795	**0.003**	1.273	**0.038**	1.037	**0.000**	0.837	**0.003**	0.834	**0.034**	0.515	0.187
T1SCP$_{sum}$ (one participated sport)			−1.863	0.102			−0.828	0.110			−0.894	0.226
T1 SCP$_{sum}$ (two or more sports)			1.456	0.289			0.402	0.511			1.311	0.138
T1 SCP$_{ball}$ (one ball sport)	4.491	**0.013**			1.770	**0.025**			3.025	**0.012**		
T1 SCP$_{ball}$ (two or more ball sports)	−9.260	**0.018**			−4.869	**0.006**			−3.782	0.135		
T1 SCP$_{locomotor}$ (one locomotor sport)	−2.318	0.083			−0.913	0.129			−1.365	0.119		
T1 SCP$_{locomotor}$ (two or more locomotor sports)	−1.266	0.309			−0.520	0,357			−0.507	0.532		
T1 AMC (total/locomotor/ball)	0.087	0.061	0.070	0.138	0.042	0.282	0.019	0.628	0.082	0.091	0.079	0.106
T1 child age	1.066	0.176	0.797	0.307	0.440	0.192	0.343	0.313	0.744	0.155	0.490	0.332
Test interval	−3.392	**0.021**	−2.694	0.070	−1.808	0.007	−1.456	**0.031**	−1.475	0.123	−1.109	0.245
T1 child BMI	−0.101	0.894	−0.058	0.940	0.158	0.638	0.180	0.602	−0.137	0.783	−0.107	0.830
T1 Access to electronic device	0.581	0.581	−0.020	0.972	−0.267	0.300	−0.143	0.578	−0.032	0.931	0.119	0.746
T1 parents' education mean	−0.134	0.851	0.127	0.854	−0.107	0.735	0.004	0.991	−0.174	0.708	0.015	0.973
Adjusted R square	0.253		0.284		0.309		0.258		0.262		0.241	

Note: Statistically significant results are bolded, and the significance level is set at $p < .05$.
PMC = Perceived Motor Competence, PAP = Physical Activity Parenting, SCP = Sport Club Participation & AMC = Actual Motor Competence.

Table 4. Linear regression models predicting boys´ T2 PMC (total, locomotor, and ball skills).

	T2 PMC total				T2 PMC – locomotor skills				T2 PMC – ball skills			
	Model 1		Model 2		Model 3		Model 4		Model 5		Model 6	
	SCP divided		SCPsum		SCP divided		SCPsum		SCP divided		SCPsum	
Variables	Unstrd. B	*P*	Unstrd. B	*P*	Unstrd. B	*P*	Unstrd. B	*P*	Unstrd. B	*P*	Unstrd. B	*P*
T1 PMC (Total/loco/ball)	0.169	**0.035**	0.169	**0.031**	0.161	**0.038**	0.186	0.014	0.186	**0.026**	0.170	**0.040**
T1 PAP	0.506	0.357	0.478	0.374	0.306	0.284	0.380	0.175	0.169	0.618	0.080	0.810
T1 SCP_{sum} (one participated sport)			−0.805	0.456			−0.197	0.725			−0.695	0.298
T1 SCP_{sum} (two or more sports)			0.339	0.806			0.209	0.769			0.115	0.893
T1 SCP_{ball} (one ball sport)	−0.310	0.795			0.632	0.304			−0.813	0.266		
T1 SCP_{ball} (two or more ball sports)	2.212	0.317			0.832	0.462			1.445	0.290		
T1 $SCP_{locomotor}$ (one locomotor sport)	−0.505	0.634			−0.261	0.636			−0.250	0.701		
T1 $SCP_{locomotor}$ (two or more locomotor sports)	−0.063	0.966			0.461	0.550			−0.756	0.398		
T1 AMC (total/loco/ball)	0.120	**0.009**	0.117	**0.008**	0.044	0.286	0.041	0.301	0.136	**0.004**	0.138	**0.003**
T1 child age	−0.958	−1.170	−0.781	0.339	−0.245	0.543	−0.109	0.785	−0.556	0.272	−0.511	0.314
Test interval	−2.496	0.074	−2.486	0.071	−1.759	**0.015**	−1.824	**0.011**	−0.755	0.376	−0.659	0.436
T1 child BMI	2.304	**0.007**	2.306	**0.006**	0.854	**0.051**	0.895	**0.041**	1.404	**0.007**	1.369	**0.009**
T1 Access to electronic device	−1.013	**0.023**	−0.981	**0.025**	−0.626	**0.007**	−0.577	**0.012**	−0.409	0.128	−0.413	0.123
T1 parents’ education mean	0.105	0.870	0.142	0.822	0.296	0.375	0.330	0.312	−0.066	−0.066	−0.101	0.798
Adjusted R square	0.231		0.227		0.226		0.214		0.221		0.207	

Note: Statistically significant results are bolded, and the significance level is set at $p < .05$.
Perceived Motor Competence (PMC), Physical Activity Parenting, Sport Club Participation (SCP) & Actual Motor Competence (AMC).

scholars have found that fathers' PA modelling is associated with boys' PA significantly more strongly than mothers' PA modelling, parental gender does not moderate the relationship between parental modelling and girls' PA (Yao and Rhodes 2015). In addition, boys tend to have higher perceptions of physical competence than girls (Duncan et al. 2018; Jacobs et al. 2002), and therefore, girls in particular may benefit from parental support providing structure for enhancing competence. According to Davison and Jago (2009), girls tended to maintain PA levels when parental support was higher, and higher PA tend to contribute to higher PMC in general (De Meester et al. 2016). Therefore, girls may particularly benefit from higher PAP at ECEC age in developing higher PMC later at primary school age. It has been also shown that children with low PMC in general may benefit from PAP in regard to subsequent PA (Laukkanen et al. 2023). When putting the associations of PAP and child PMC into wider social perspective, it is known that the parental support decreases and support from other social agents, such as friends and teachers, becomes more important across school-age (Furman and Buhrmester 1992). In relation to PE, teachers should notice that positive feedback is the most beneficial to motivation in students with low motor competence (De Meester et al. 2020). In order to enhance PA, the teaching methods should also support schoolchildren´s PMC and AMC development, together with didactic strategies supporting autonomous motivation and pleasant experiences in PE (Carcamo-Oyarzun et al. 2023).

The results suggest that the girls participating in two or more ball sports during the early years, compared to girls who do not participate in any or only one ball sport, may become aware earlier of the skills and demands required in sports and may thus begin earlier the realisation process of physical self-perceptions. The realisation of physical self-evaluations is a natural developmental process which is typically understood to take place with age and maturation (Harter 2012, 65). However, the current findings propose that sports participation during early years may affect this process significantly, especially in girls. In addition, girls in particular may feel that they need to meet the external requirements because it has been found that girls use evaluative feedback when assessing personal sport competence (De Meester et al. 2020; Horn, Glenn, and Wentzell 1993) and the number of feedback likely increases with the number of sports participated. In addition, ball sports typically offer a lot of possibilities for peer comparisons due to group activities, and thus information for developing one's individuality and self-esteem (Eccles 1999). More studies with longer and more frequent follow-ups are needed to answer the question how the early realisation of PMC may affect the child's PA, development and well-being in long-term.

Regarding the covariates, T1 AMC was a predicting variable of T2 PMC for boys. Previously, there has been no gender differences in the strength of AMC and PMC connections in general (De Meester et al. 2020). In this study, AMC´s role in the models when predicting PMC is clearly highlighted compared to PAP for boys. Thus, AMC can play a greater role in forming PMC for boys (Goodway, Robinson, and Crowe 2010) and girls may rely more on social support in forming PMC. In a school context, this may be reflected in the reality that boys primarily want school playground areas to be activity promoting whereas girls prefer more places for social interactions (Pawlowski et al. 2014). In addition to the above, there were other covariates that predicted the development of PMC over time when moving from ECEC to primary school in boys. A higher BMI and less access to electronic devices at T1 predicted better scores of T2 PMC for boys but not for girls. Boys who do not spend time with devices tend to use their time to engage in more PA (Al-Amri et al. 2023), and again, the engagement to PA tends to lead to enhanced AMC and also PMC (De Meester et al. 2016). Thus, it is important for parents to understand the importance of PAP for a child's motor development for example, by limiting the use of smart devices and encouraging to be more physically active. Shorter test intervals predicted the scores of T2 PMC_{total} and $PMC_{locomotor}$ for girls, but for boys, this predicted only the $PMC_{locomotor}$ scores. The covariates used in this study help us understand PMC development differences between boys and girls. These covariates should be considered in future studies, particularly when predicting boys' PMC development.

Our study had certain limitations. First, self-reported questionnaires, such as those for PMSC and PAP, may suffer from social desirability bias, and answers may not necessarily reflect a parent's or child's intrinsic thoughts or actual behaviours. Further bias may arise when a parent reports not only their perceptions of PAP but also those of their partner. However, the information provided by respondents about partners' perspectives on PAP can constitute valuable information, as partners' PAP views have been ignored in research (Yao and Rhodes 2015). The strength of the questionnaires for measuring PAP and PMC was their moderate-to-high internal consistency (α = 0.626–0.832). Another limitation arises from the division of sports participated. Division of sports to locomotor and ball skill sports was theory-driven (Goodway, Ozmun, and Gallahue 2021) but validity of division was not examined and warrants attention in the future.

Another strength of our research was the geographically representative and cluster randomised sample of children. The longitudinal data further improved the credibility of our results. At the same time, the majority of the children in the sample were of normal weight, and most families belonged to a high socio-economic class, which means the results cannot be generalised to overweight and obese children as well as families of low socio-economic status. Future studies should investigate the connection between PMC and social relations more closely. In this study, parents were the only kind of social agent considered; future research should include other social agents, such as teachers, coaches, and peers, when predicting children´s PMC scores.

A guideline for the divisions of different sports would help conduct consistent research when comparing sports and PMC subcategories. Moreover, to better understand the impact of sports clubs, it would be highly useful to have information about how and what kinds of skills are practiced in each sport, which would also improve our understanding of AMC and PMC. Furthermore, versatility in practicing skills within SCP can help children comprehensively develop their skills, and a division of sports to different categories is not necessarily needed for ECEC-aged children. A division of sports in relation to PMC development indicates that too early specialisation in sports is not important in early childhood. For the future studies, SCP´s and PAP´s role should be studied also using person-centered approaches, such as using profiling, to see the effects more individually.

The child-oriented interactions should communicate the appreciation and acceptance as an individual to children and support their efforts and the development of competence (Davison et al. 2013). Especially emphasising development of PMC in children with low AMC, would engage them to sports and PE (De Meester et al. 2016). On the other hand, a focus on the holistic development of children, by enhancing PMC and AMC, as well as enjoyment and motivation towards PE (Carcamo-Oyarzun et al. 2023) may provide a relevant pedagogical perspective to promote a physically active lifestyle.

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