Associations between basic motor competencies, club sport participation, and social relationships among primary school children

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ABSTRACT

Children learn and deepen their motor competencies in a social context. Basic motor competencies (BMC) enable children to actively co-act and participate in sports situations with peers. Participation in club sport activities has a positive influence on the development of motor and social competencies. The purpose of this study is to describe the connection between basic motor competencies, club sport participation and interpersonal relationship skills among 6 to 8 years old children. In the present study, the BMC of N = 880 first and second grade primary school children (48.9% girls, aged M = 90.36 months, SD = 6.90) in Switzerland were tested in the competence domain of self-movement and object movement. The children's club sport participation and the relationship skills were recorded from the parents' perspective. Data was analysed using correlations and mixed regressions. The results show a connection between relationship skills, basic motor competencies and club sport participation in school children. For boys, significant correlations were found between relationship skills and BMC (r = .186, $p \leqslant .01$) so as with the club sport frequency (r = .184, $p \leqslant .01$). For girls, only the correlation between relationship skills and club sport frequency (r = .137, $p \leqslant .01$) was significant. The frequency of club sport participation (β = .13, p = .009), motor competencies (β = .09, p = .016) and sex (β = .10, p = .004) of the children were found to be predictors for the relationship skills. The results of this study suggest that children with higher motor competencies

and children who participate more often in club sport seem to have better relationship skills. These findings are relevant as they indicate a link between motor competen*cie*s and interpersonal relationship skills in middle childhood.

Keywords

motor skills, sport, club sport participation, relationship skills, physical education, primary school

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Introduction

In physical education (PE) and extracurricular physical activity, primary school children learn and practice motor competencies in a social context which enhances a healthy motor development and enables them to participate in sports and physical activities with peers (Lopes et al., 2021). To actively participate in the culture of sport and movement, children need a minimum level of motor competencies, the so-called basic motor competencies (BMC; Herrmann, 2018). BMC are understood as context-dependent and functional performance dispositions that develop out of situation-specific requirements of physical activity situations (Herrmann, 2018). Some play situations among children presuppose a minimum level of motor competencies to be able to co-act with peers (Giske et al., 2018). For example, playing ball games requires throwing and catching a ball and children, who are not sufficiently confident in it will not participate. Thus, a certain level of motor competencies enables children to participate in social interactions in the context of sports and play situations (Herrmann et al., 2021).

BMC represent a prerequisite for the development of higher competency levels and are the base for the acquisition of more sport-specific skills which promote physical activity over the lifespan of an individual (Hulteen et al., 2018). A higher physical activity level is known to be positively associated with several physical, social, and psychological health benefits (Eime et al., 2013).

Primary school and PE lessons are a precious setting, which reaches all children and provides opportunities for interaction and motor competence development. In Switzerland, the BMC are taught in school, as they are in line with the minimal curricular demands in PE (Deutschschweizer-Erziehungsdirektoren Konferenz, 2017; Herrmann, 2018). The promotion of BMC and a common level of competencies is of interest, as a lack of motor competence development can lead to a negative spiral of disengagement in physical activity. Children with poor motor competencies and poor confidence to move will not enjoy participating in activities that they are not good at (Robinson et al., 2015). By participation in sports in this study we understand the active participation of the children to classical sport activities and the prerequisite for the participation are the BMC. PE has the pedagogical purpose to compensate for differences in extracurricular sports socialization (e.g., sport club, family), to ensure a minimum level of BMC, and thus to create the conditions for active participation in sports. Through the basic development of participation skills (BMC are necessary for

this) the children can participate in sports in a reflective way and act in a self-determined way (so-called reflexive ability to act; Herrmann et al., 2017; Schierz & Thiele, 2013).

In primary school, the BMC-level of children differs due to endogenous and exogenous factors. Various studies investigated the relationship between the BMC and determinants like age, sex and extracurricular physical activity (Herrmann, 2018; Quitério et al., 2018; Scheuer et al., 2019). Studies showed that older children achieved higher scores in BMC than younger children of the same school grade (Herrmann, Heim, et al., 2017). Furthermore, gender differences in BMC have been found. While boys performed significantly better in the competence domain of object movement (OM), girls achieved slightly better results in the competence area of self-movement (SM; Herrmann et al., 2019). Gramespacher et al. (2020) analysed these gender-related findings including the impact of club sport participation (CSP) of children and showed, that the CSP had a mediating effect on the BMC. Thus, not gender itself, but gender-specific sport socialization is a predictor of BMC.

Children who participate in club sport have additional, organized opportunities to be physically active and practice their movement skills. Opportunities to practice are seen as factors with a strong influence on the process of motor development (Gallahue & Ozmun, 2006). In general, children who were engaged in extracurricular sport activities improved more in BMC than those not participating in extracurricular sport activities, whereby the type of sport activity was meaningful (Herrmann, Heim, et al., 2017). Children who participated in extracurricular ball sports showed higher BMC values in the competence area OM, whereas children who practiced individual sports performed better in the SM area (Herrmann, Heim, et al., 2017). Moreover, Herrmann, Heim, et al. (2017) found, that the competence levels at the beginning of the school year were a predictor for extracurricular sport participation at the end of the school year. This finding corresponds with the results of other studies (e.g. Holfelder & Schott, 2014; Logan et al., 2015) and underpins the pathway of a positive correlation between motor performance dispositions and sporting activity proposed in the conceptual model of Stodden et al. (2008). This model also assumes the existence of the reverse pathway, therefore higher involvement in sports should promote motor skill development (Stodden et al., 2008). However, the hypothesis of this positive relationship remains yet to be evidenced (Barnett et al., 2022).

Participation in sports does not only promote motor development and physical health, but it is also an important contributor to the positive psychosocial development in youth (Bedard et al., 2020; Eime et al., 2013). Participation in sports and games provides a socialization context in which children need to coordinate their movements with their teammates, learn from and communicate with peers and coaches, resolve conflicts and work cohesively to achieve a goal (Bedard et al., 2020). Thus, sports situations present several opportunities to develop personal and interpersonal skills, which can enhance psychosocial well-being (Bedard et al., 2020). Howie et al. (2010) reported that in middle childhood, the social competencies of children participating in sports and sport club activities were higher compared to children who did not participate in any outside-school activity. Furthermore, it was described that children who were members of a sport club and who participated moderately to frequently were longitudinally associated with better prosocial behaviour. This relationship was more pronounced for girls, whereas the type of club sport did not influence the association (Moeijes et al., 2018). The results of the longitudinal study of Bedard et al. (2020) demonstrate that higher participation in sport is associated with small gains in the perception of social competence during childhood and early adolescence. The study suggests that sport may be a small but important contribution to children's perception of their social capabilities. It is widely established, that high levels of prosocial behaviour are associated with peer acceptance (Slaughter et al., 2015; Will et al., 2018).

Children with better performances in motor competencies are more popular and better socially integrated than children with poor motor performances (Herrmann et al., 2021; Kauer & Roebers, 2012; Schwarz, 2013). Specially children with developmental coordination disorder (DCD) are less socially integrated and are more likely to suffer from peer neglect and rejection (Livesey et al., 2011; Mancini et al., 2016). For children in preschool, a positive relationship between motor competencies and social relationships has been documented (Herrmann et al., 2021). The development of social relationships in peers so as of the motor competencies is a core developmental task in early and middle childhood. These competencies positively influence the children's physical and mental health (Redondo-Tébar et al., 2021).

Both motor competencies and interdisciplinary competencies are addressed as learning objectives in the Swiss school curriculum of PE. These are promoted in the context of subject-related learning processes (Deutschschweizer-Erziehungsdirektoren Konferenz, 2017). Interdisciplinary competencies include personal, social and methodological competences such as self-reflection, the ability to cooperate (e.g. in games) and to use information. Interdisciplinary competencies are based on the "life skills", defined by the World Health Organization (WHO) by "abilities for adaptive and positive behaviour, that enable individuals to deal effectively with the demands and challenges of everyday life" (World Health Organization, 1994, p. 1) and include for example, self-efficacy, relationships skills and emotion regulation. The promotion of interdisciplinary competencies is of interest as they enable individuals to successfully deal with demands of everyday life and should lead to well-being and healthy development (Kirchhoff & Keller, 2021).

We have solid knowledge about the influence of endogenous and exogenous factors on BMC (e.g. Herrmann et al., 2019; Lopes et al., 2021; Strotmeyer et al., 2020). Psychosocial benefits of participation in sports have been investigated in a few studies as well (Eime et al., 2013; Moeijes et al., 2018). Previous studies have shown that children who participate in organised sport also have better motor competencies (Gramespacher et al., 2020). In addition, a positive correlation between BMC and social relationship skills has been identified (Herrmann et al., 2021). The extent to which interdisciplinary competencies has been a topic of interest for researchers, especially in sport psychology and the context of competitive sport (Gould et al., 2007; Pierce et al., 2017). However, little attention has been paid to the interrelationship and linkages between the three factors of motor skills, social relationships, and participation in extracurricular physical activity. It is the intention of this study to shed light on the relationship between BMC, interpersonal relationship skills and CSP in children of the first and second grades in primary school.

Based on previous longitudinal studies (e.g. Herrmann, Heim, et al., 2017; Sallen et al., 2020) on motor competencies, we assume that BMC influence the participation in club sport and that this could have an impact on children's relationship skills (based on the findings of Bedard et al., 2020). However, it should be noted that the current studies present an inconsistent picture of causal effects between participation in extracurricular sports and BMC (e.g., Barnett et al., 2022; Robinson et al., 2015).

Methods

In this cross-sectional study, we analysed data collected in the monitoring of children's basic motor competencies in Switzerland. Data was collected in the French-speaking parts of the Swiss cantons Bern, Jura, Neuchâtel, and Fribourg and the Italian-speaking canton Ticino. The participating schools and classes were selected by local coordinators of the study. Results of first and second grade primary school children were analysed.

From February to June 2021, we have measured basic motor competencies of 6 to 8-year-old children. Further data about relationship skills and club sport participation of the children was collected among the children's parents (or legal guardians) through a questionnaire (for details see Herrmann, Bretz, Kühnis, Keller, et al., 2021).

Prior to the testing, teachers and parents (or legal guardians) of the involved children were informed about the purpose of the study, the voluntary nature of the participation and the anonymous handling of the data. Both teachers and parents (or legal guardians) provided written consent to the participation. Children assented orally.

This study fully conforms with the Declaration of Helsinki and was approved by the Ethics Commission of the University of Zurich (No. 21.2.5) and the Directorate of Education, Culture and Sport of the Canton Ticino (No. 2021-00252, Rif CE Ti 3819) as well as by the school principals of the concerned primary schools.

Participants

For the present study, we contacted 1,163 parents (or legal guardians) of first and second graders. In the sample of this study, we only included data from children who had parental consent. A total of 901 parents (response rate: 77.5%) gave their written consent for the participation of their children in the study. Since there are age guidelines for the different primary school levels in Switzerland, only children aged 77 to 105 months who also participated in the basic motor competencies test, were included in the sample.

The total sample comprised N = 880 (age: M = 90.36 months, SD = 6.902, 48.9% girls) first and second grade children of the Italian and French-speaking regions from 64 classes in 21 primary schools. In Switzerland, primary school classes have approximately 15 to 24 children per class. PE lessons are taught coeducational and include typically developing children as well as children with special educational needs. It has to be taken into account, that in spring 2021 the pandemic situation of COVID-19 had a negative influence on the attendance rate.

Test instruments and data collection

Basic motor competencies (BMC; children tests. In German: Motorische Basiskompetenzen [MOBAK])

The basic motor competencies were assessed with the standardized MOBAK-1-2 test instrument (Herrmann, 2018) for 6 to 8- year-old children during PE classes. This instrument is age specific and presents curricular validity. It consists of eight test items (Table 1) developed based on central learning objectives of PE (e.g. Deutschschweizer-Erziehungsdirektoren Konferenz, 2017) which measure the basic motor qualifications in the competence domains of self-movement (SM; 4 Items) and object movement (OM; 4 Items). For each test item (in SM: balancing, rolling, jumping, running; in OM: throwing, catching, bouncing, dribbling) the children have two attempts (no trial run). The single attempts are rated on a dichotomous scale (0 = failed, 1 = successful) according to the evaluation criteria and later summed up for the final item score (0 = no successful attempt, 1 = one successful attempt, 2 = two successful attempts). The test items throwing and catching are designed differently. The children have six consecutive attempts, and the number of successful attempts is recorded. The transformation for the score is as follows: 0 points for 0-2 successful attempts, 1 point for 3-4 successful attempts and 2 points for 5-6 successful attempts. In each competence domain, it is possible to achieve a maximum sum score of 8 points. The scores of the competence domains SM and OM can be summed up to a total score of BMC (BMC sum) which can reach a maximum score of 16 points.

Various studies confirmed the psychometric quality criteria of the MOBAK-1-2 instrument by confirmatory factor analysis (e.g. Herrmann, 2018; Herrmann et al., 2015).

The BMC data was collected in classes during a regular 45-minutes PE lesson. The classes were split up into small groups (3-4 children) and assigned to a trained test leader who guided the group through the eight test stations. For each item, the test leader gave a

Table 1

Description of the MOBAK test items

Self-movement[a] (Herrmann, 2018)	
Balancing	The child balances across an overturned see-sawing long bench without stepping off the bench.
Rolling	The child performs a forward roll on a mat and is able to land fluently in a standing position on his/her feet.
Jumping	The child jumps between and beneath carpet tiles fluently. On one leg between the tiles and with straddled legs beneath the tiles.
Running	The child moves sideways from one cone to another, which are placed at a distance of 3 m from each other.
Object Movement[a] (Herrmann, 2018)	
Throwing	The child throws six juggling balls at a target of 1.3 m height at a distance of 2.0 m.
Catching	The tester drops a small ball to the ground from a height of 2.0 m so that the ball bounces back up at least 1.3 m from the ground. The child catches the ball after it has reached the highest point.
Bouncing	The child bounces a small basketball through a marked corridor (5.0 x 1.0 m) without losing the ball.
Dribbling	The child dribbles a futsal ball through a marked corridor (5.0 x 1.0 m) without losing the ball.

[a] 0 = no successful attempt, 1 = one successful attempt, 2 = two successful attempts

standardized explanation of the task and proficiently demonstrated it once. The performance of each child was assessed in a standardized protocol. The order of the items was randomly chosen by the test leader.

Interpersonal relationship skills (parent questionnaires. In German: Kompetenzen und Interessen von Kindern [KOMPIK])

The children's interpersonal relationship skills were measured using four items in line with the KOMPIK instrument (Mayr, 2012; Mayr et al., 2011), via the assessment of their parents on a five-point Likert

scale. For example, the statement "Your child is sought after as a playmate." could be answered with the response options *disagree*, *somewhat disagree*, *somewhat agree*, *mostly agree* and *agree*. The internal consistency of the scale is acceptable, with a Cronbach's alpha of $\alpha = .69$ and McDonald's omega $\omega = .71$.

Club sport participation (parents questionnaires)

In Switzerland, club sport is the main environment in which children participate in extracurricular sports. In the accompanying questionnaire, the parents were asked to provide information about their children's club sport participation. For this purpose, the type and frequency of club sport participation were enquired after the filter question whether the child participates in a club sport (for details see Herrmann, Bretz, Kühnis, Keller, et al., 2021). Thus, for each child, we have information about the frequency and type of club sport participation. The type of sport was posteriorly assigned to the categories team sports (e.g., soccer, handball, floorball) and individual sports (e.g., swimming, gymnastics), according to the social nature of the sport and based on prior classifications (Herrmann, Heim, et al., 2017). Moreover, the parents were asked to indicate the children's gender and date of birth. The parents turned back the completed questionnaire with their written consent.

Data analysis

The data editing and all statistical analyses were performed using the software IBM SPSS Statistics 28. The final sample consisted of data for SM, OM, sum value of BMC and data from the parents' questionnaire. The variable of club sport frequency captures how frequently a child participates in club sports in one week. Children who did not participate in club sports have a value of zero.

The descriptive statistics describes features of the gathered data (Table 2). For the comparison between the total sample and the subsamples, we indicated the 95% confidence interval (CI). In order to investigate differences between the subsamples (boys and girls or younger and older children) the Cohen's *d* was displayed (0.2 = small effect; 0.5 = medium effect; 0.8 = large effect; Cohen, 1988).

The linear relationship between the two BMC factors SM and OM, the total score of BMC, the relationship skills and the club sport frequency were calculated using partial correlations (Table 3 and Table 4). In the analysis of correlations, the age of the children was included as a covariate, as the BMC factors are closely associated with age (see Table 3). We calculated partial correlations with the same variables as in Table 3 separately for boys and girls (see Table 4) to compare correlation patterns between the genders. Cases with missing values were excluded listwise.

The influence of the hierarchical structure, in which children are nested in classes of different schools and regions, was considered in a mixed regression with random effects (Table 5) (statistical approach leaned on Kreft & Leeuw, 2000). We accounted for dependencies within the multilevel structure by correcting the standard error with the MIXED procedure implemented in SPSS. In the mixed regression, for the estimation of the parameters the method of restricted maximum likelihood (REML) was used and the analysis was modelled with fixed slopes and random intercepts (Field, 2015). The relationship skills were set as the dependent variable. The first step of the mixed regression analysis for relationship skills was divided into three sub-analyses. In step 1A, the dependent variable was regressed on the variables BMC sum, sex, and age on relationship skills. In the next step (1B), the exogenous factors of team and individual sports with sex and age were used as predictors for the relationship skills. In step 1C the exogenous factors were substituted by the frequency of club sport participation. In step 2, all variables listed previously were combined to determine the associations with the relationship skills in a more complex model. In these mixed regressions, both the original values and the standardized values (*z*-scores) were used, in order to calculate the unstandardized and the standardized betas, respectively. In the mixed regression analysis moderating effects between the

BMC and the type of sports were also tested. Therefore, we calculated interaction terms between the BMC values and the individual sports so as between the BMC values and the team sports. These two interaction terms were added as moderation factors in the mixed regression analysis described above.

Results

Sample characteristics

In the BMC domains, boys performed better in OM (boys: M = 5.87, girls: M = 5.13, d = 0.43) and girls achieved slightly better results in SM (boys: M = 4.79, girls: M = 5.08, d = 0.14; Table 2). In a comparison between the age groups, older children reached a much higher score in the OM (younger children [77–92-month-old]: M = 5.10, older children [93–105-month-old]: M = 6.15, d = 0.62) and a moderate higher score in the SM than younger children (younger children: M = 4.64, older children: M = 5.40, d = 0.37). The sum values of the BMC demonstrate that older children have achieved better results than the younger ones (younger children: M = 9.73, older children: M = 11.55, d = 0.61). In total, 62.3% of the children participate in club sports. Generally, boys and older children participate more often in club sports than girls and younger children (boys: M = 1.22, girls: M = 0.87, d = 0.33; younger children: M = 0.89, older children: M = 1.15, d = 0.16). Regarding the type of sports, 28.0% of the total sample participate in team sports, 42.3% of all children in individual sports and 7.0% in both team and individual sports. Boys engage clearly more often in team sports than girls (boys: M = 0.47, girls: M = 0.08, d = 0.94), who rarely participate in team sports, whereas girls participate more often in individual sports than boys (boys: M = 0.33, girls: M = 0.52, d = 0.39). Moreover, girls and older children were assessed with slightly better relationship skills (boys: M = 14.96, girls: M = 15.26, d = 0.12; younger children: M = 14.96, older children: M = 15.34, d = 0.16).

Table 2

Descriptive analyses of sum scores of the motor competency domains SM and OM (range: 0-8), sum score of BMC (range: 0-16), interpersonal relationship skills (range: 4-20), club sport frequency (range: 0-7), team and individual sports (range: 0-1)

Factors	**Overall**		**Boys**		**Girls**			**77-92 months**		**93-105 months**		
	M	95% CI	*M*	95% CI	*M*	95% CI	d	*M*	95% CI	*M*	95% CI	d
Self-movement	4.93	[4.79-5.07]	4.79	[4.60-4.98]	5.08	[4.88-5.28]	0.14	4.64	[4.46-4.81]	5.40	[5.18-5.62]	0.37
Object movement	5.51	[5.39-5.62]	5.87	[5.71-6.03]	5.13	[4.96-5.29]	0.43	5.10	[4.95-5.25]	6.15	[5.99-6.31]	0.62
BMC sum	10.43	[10.22-10.64]	10.66	[10.38-10.96]	10.18	[9.88-10.49]	0.16	9.73	[9.46-9.99]	11.55	[11.24-11.85]	0.61
Relationship skills	15.11	[14.94-15.27]	14.96	[14.72-15.19]	15.26	[15.03-15.50]	0.12	14.96	[14.74-15.17]	15.34	[15.07-15.61]	0.16
Club sport frequency	1.05	[0.98-1.12]	1.22	[1.11-1.32]	0.87	[0.78-0.96]	0.33	0.98	[0.89-1.07]	1.15	[1.03-1.27]	0.16
Team sports	0.28	[0.25-0.31]	0.47	[0.42-0.51]	0.08	[0.06-0.11]	0.94	0.26	[0.22-0.29]	0.32	[0.27-0.37]	0.14
Individual sports	0.42	[0.39-0.46]	0.33	[0.29-0.38]	0.52	[0.47-0.57]	0.39	0.43	[0.38-0.47]	0.42	[0.37-0.48]	|< 0.01|

Notes: *M* = mean, 95% CI = 95% confidence interval, *d* = Cohens' *d*.

Table 3

Partial correlations between motor competency domains, BMC sum score, interpersonal relationship skills, club sport frequency and type of sport with age as a covariate

Factors	(1)	(2)	(3)	(4)	(5)	(6)
(1) Relationship skills						
(2) Self-movement	.110**					
(3) Object movement	.052	.257**				
(4) BMC sum	.105**	.838**	.742**			
(5) Club sport frequency	.152**	.132**	.126**	.162**		
(6) Team sports	.064	-.013	.214**	.112**	.447**	
(7) Individual sports	.091**	.175**	-.013	.114**	.422**	-.221**

Notes: *$p \leqslant .05$, ** $p \leqslant .01$
Control variable: age of the children

Correlations of relationship skills, level of basic motor competencies and club sport participation

As represented in Table 3, relationship skills showed clear correlations with SM ($r = .110$, $p \leqslant .01$), the sum of BMC values (BMC sum: $r = .105$, $p \leqslant .01$), the club sport frequency ($r = .152$, $p \leqslant .01$) and individual sports ($r = .091$, $p \leqslant .01$). Furthermore, SM was significantly correlated with the frequency of club sport participation ($r = .132$, $p \leqslant .01$) and the individual sport ($r = .175$, $p \leqslant .01$) whereas OM was correlated with the club sport frequency ($r = .126$, $p \leqslant .01$) and the team sport participation ($r = .214$, $p \leqslant .01$). The total BMC level is significantly correlated with the club sport frequency ($r = .162$, $p \leqslant .01$) so as with the type of team ($r = .112$, $p \leqslant .01$) and individual ($r = .114$, $p \leqslant .01$) sports.

Taking the partial correlation with the total sample as a starting point, we accounted for gender differences by calculating the same correlations as before with age as a covariate separately for boys and girls (Table 4). Several differences in correlation coefficients between the subsample of boys and girls showed up. In the analysis for boys, relationship skills showed significant correlations with SM ($r = .158$, $p \leqslant .01$), OM ($r = .142$, $p \leqslant .01$), the sum of BMC values ($r = .186$, $p \leqslant .01$), club sport frequency ($r = .184$, $p \leqslant .01$) and team sport participation ($r = .119$, $p \leqslant .01$). On the contrary, for girls, a positive significant association was just found between relationship skills and club sport frequency ($r = .137$, $p \leqslant .01$). No significant correlations were found between relationship skills and SM, OM or total BMC values for girls. For both, boys and girls, a significant relationship was found between SM and club sport frequency (boys: $r = .134$, $p \leqslant .01$; girls: $r = .168$, $p \leqslant .01$), so as between SM and individual sports (boys: $r = .178$, $p \leqslant .01$; girls: $r = .154$, $p \leqslant .01$). No

Table 4

Partial correlations between motor competency domains, BMC sum score, interpersonal relationship skills, club sport frequency and type of sport with age as a covariate and split by sex

Factors	(1)	(2)	(3)	(4)	(5)	(6)	(7)
(1) Relationship skills		.158**	.142**	.186**	.184**	.119**	.062
(2) Self-movement	.053		.298**	.850**	.134**	.012	.178**
(3) Object movement	-.014	.255**		.756**	.170**	.202**	.024
(4) BMC sum	.030	.844**	.734**		.186**	.120*	.135**
(5) Club sport frequency	.137**	.168**	.002	.119*		.513**	.288**
(6) Team sports	.076	.045	.034	.050	.248**		-.234**
(7) Individual sports	.096	.154**	.038	.129*	.691**	-.039	

Notes: *$p \leqslant .05$, ** $p \leqslant .01$; girls below the diagonal, boys above the diagonal
Control variable: age of the children

correlation was found between SM and team sports. Significant correlations of the BMC domain OM with CSP were only found for boys. OM has a significant positive association with the frequency of CSP ($r = .170$, $p \leqslant .01$) and the team sport frequency ($r = .202$, $p \leqslant .01$).

For both, boys and girls, a significant relationship was found between the sum value of BMC and club sport frequency (boys: $r = .186$, $p \leqslant .01$; girls: $r = .119$, $p \leqslant .05$), so as between the sum value of BMC and individual sports (boys: $r = .135$, $p \leqslant .01$; girls: $r = .129$, $p \leqslant .05$). Furthermore, for boys, a positive association between the sum value of BMC and team sports ($r = .120$, $p \leqslant .05$) was found.

Predictors of relationship skills

Testing the prerequisites for performing mixed regression revealed that the *ICC* of relationship skills was 0.002 (*ICC* = 0.002). This value can be considered as a small level of within-cluster homogeneity (Kreft & De Leeuw, 2000). The values of relationship skills vary highly within the classes and the differences between classes are relatively small. Thus, 0.2% of the overall variation of this model is explained simply by clustering. Although recommendations in literature indicate that accounting for nested data wasn't necessary, we decided to use the MIXED-procedure to guarantee for correct standard error estimations (Huang, 2018). Furthermore, we tested for multicollinearity within the predictor variables. Resulting variance inflation factors (*VIF*) revealed the absence of multicollinearity in all regression models (all $VIF < 2$).

The mixed regression with random intercepts (Table 5) in step 1 reveals, that the sum value of BMC (step 1A; $\beta = .12$, $p = .002$), the type of club sport (step 1B; team: $\beta = .12$, $p = .002$; and individual: $\beta = .10$, $p = .005$), so as the club sport frequency (step 1C; $\beta = .17$, $p < .001$) independently from each other are positive determinants of relationship skills. In the sub-analysis of the mixed regression in step 1B (with the variables of the type of sports) and in step 1C (with the variables of frequency CSP), as well the sex of the children has proven significance (step 1B: $\beta = .10$, $p = .009$; step 1C: $\beta = .09$, $p = .007$).

In step 2 of the mixed regression, all the variables previously singularly analysed for the relationship skills (in step 1A-1C) are entirely considered. The sum values of BMC ($\beta = .09$, $p = .016$), the CSF ($\beta = .13$, $p = .009$), and the sex of the children ($\beta = .10$, $p = .004$) were found to be predictors for the relationship skills. In additional analyses of this model with moderation factors we found that the interactions of BMC and individual or team sports did not establish significant effects on the relationship skills of the children.

Table 5

Mixed regression with random effects of endogenous factors (sex and age), sum score of BMC, type of club sports and club sport frequency on relationship skills

Mixed regression results for relationship skills					
Variable	*B* [95% CI]	SE_B	β	*t*	*p*
Step 1A					
Constant	12.50 [10.25, 14.76]	1.15		10.89	< .001
Sex	0.35 [0.02, 0.69]	0.17	.06	2.08	.038
Age	0.01 [-0.01, 0.04]	0.13	.03	0.96	.339
BMC sum	0.09 [0.04, 0.15]	0.03	**.12**	3.18	.002
Step 1B					
Constant	11.81 [9.53, 14.10]	1.16		10.21	< .001
Sex	0.49 [0.12, 0.85]	0.19	**.10**	2.61	.009
Age	0.02 [-0.0003, 0.05]	0.01	.07	1.95	.053
Team sports	0.66 [0.25, 1.07]	0.21	**.12**	3.16	.002
Individual sports	0.50 [0.15, 0.84]	0.17	**.10**	2.85	.005
Step 1C					
Constant	12.05 [9.80, 14.30]	1.14		10.58	< .001
Sex	0.46 [0.13, 0.80]	0.17	**.09**	2.72	.007
Age	0.02 [-0.002, 0.05]	0.01	.06	1.79	.076
Club sport frequency	0.39 [0.24, 0.55]	0.08	**.17**	4.97	< .001

Mixed regression results for relationship skills					
Step 2					
Constant	12.13 [9.87, 14.38]	1.14		10.56	< .001
Sex	0.53 [0.18, 0.90]	0.19	**.10**	2.86	.004
Age	0.01 [-0.01, 0.04]	0.01	.04	0.89	.372
BMC sum	0.07 [0.01, 0.13]	0.03	**.09**	2.42	.016
Club sport frequency	0.29 [0.07, 0.50]	0.11	**.13**	2.61	.009
Team sports	0.27 [-0.24, 0.78]	0.26	.04	1.04	.300
Individual sports	0.09 [-0.34, 0.52]	0.22	|< .01|	0.41	.680

Abbreviations: *B* = unstandardized beta; CI = confidence interval; SE_B = standard error for the unstandardized beta, β = standardized beta.
Significant coefficients are bold (*$p \leqslant .05$, ** $p \leqslant .01$)

Discussion

The objective of the present study was to investigate the connection between BMC, interpersonal relationship skills and CSP in children of the first and second grade in primary school. The results of this study suggest that children with a higher level of BMC and children, who participate more frequently in club sport present better relationship skills. In these findings the gender of the children suggests to be relevant.

According to earlier findings, children at the age of 6.40 to 8.75 years showed gender-specific differences in motor performances. Boys achieved significantly better results in OM, whereas girls showed better performances in SM (Herrmann et al., 2019). Older Children achieved better results than younger children on the total value of BMC so as the domains of OM and SM (Table 2). As it was found in a recent study, girls and older children were assessed with better relationship skills (Herrmann, Bretz, Kühnis, Seelig, et al., 2021). Moreover, boys and older children participate more frequently in club sport than girls and younger children, whereby team sports are more popular among boys and girls engage mainly in individual sports. These findings are in line with previous studies (e.g., Herrmann, Heim, et al., 2017).

A positive relationship was found between the motor competencies and the frequency of CSP, so as with the type of individual sports (Table 3). This relationship is stronger for boys than for girls (Table 4). Further, a relationship between BMC and team sports was found for boys only. These gender-specific differences in BMC levels could be linked to gender-specific sport socialization, which is known to be a predictor of BMC (Gramespacher et al., 2020).

The type of sport (team and individual), so as the frequency of CSP, independently from each other were found to be predictors for the relationship skills (Table 5 steps 1B and 1C). Also, in this case, the correlations between the individual and team sports presented gender-specific differences. For boys, the participation in team sports had an influence on the relationship skills whereas for girls neither the individual nor the team sport participation had a significant effect on the relationship skills (Table 4). This could be related to the fact that, among peer groups of boys, the athletic ability and the participation in sport plays an important role (Blomberg, 2015). Furthermore, boys engage more frequently in team and in club sports than girls. Nevertheless, both boys and girls presented a positive correlation between the frequency of CSP and the social competencies. These findings are consistent with other studies (Howie et al., 2010; Moeijes et al., 2018). Children engaging in club sport spend more time in the social context of extracurricular sports in which they have more opportunities to gain social (and motor) experiences in sport situations with peers and to acquire social skills.

Children who were assessed with better relationship skills also showed a higher level of BMC (Table 5), although this correlation was only significant for boys (Table 4). BMC may be more relevant for boys to be accepted among peers. For girls, besides play and sport activities, also other extracurricular activities are important for friendship. Similar findings between motor competencies and social integration were found among preschool children (Herrmann, Bretz, Kühnis, Seelig, et al., 2021).

Overall, it appears that both BMC and frequency of CSP, so as the sex of the children, are related to interpersonal relationship skills demonstrated by children of the first and second primary school year (Table 5, step 2). When both, the type of sport and the frequency of CSP are considered in the model, only the frequency remains a predictor for the relationship skills (Table 5, step 2). This finding is consistent with the results of Moeijes et al. (2018) and could be related to the fact, that the type of sport is linked to the membership in a sport club and thus, indirectly with the frequency. This could lead to the assumption, that at this age not the type of sport but the frequency of engaging in sports is relevant for the acquisition of social competencies. A limitation of this study is, that, due to the cross-sectional design of this study, it was not possible to identify the direction of causality. In this case, further longitudinal studies are needed to determine if chil-

dren are more socially competent because they engage in club sport or vice versa. Furthermore, it should be pointed out, that the children were not directly interviewed about their relationship skills and their club sport participation. Thus, biases in the assessment by parents are possible. We chose this form of data assessment for feasibility reasons, because children in the focused age group are not yet fully literate, it can be assumed that they may have difficulties understanding questions about their social skills, and most of them are dependent on the parental support for CSP.

It has to be considered that in this study, the relationship skills were only addressed under the aspect of motor competence and CSP. Other extracurricular activities (for example music or arts activities) were not accounted for. However, these activities may also influence the children's social competencies.

Besides, we classify our study as one oriented to the common notion about the effects of sport participation. Therefore, our design only allows for a rudimentary reflection of our results in the light of segregation mechanisms of sport participation due to socioeconomic conditions or physical impairments (Maher et al., 2022). In our opinion, however, this might be considered in the design of (future) studies.

A strength of this study is the achieved high sample size. Furthermore, the combination of the factors BMC, frequency of CSP and the type of sports and their joint association with relationship skills is a new approach. Moreover, an additional strength of this study is that the used instruments (KOMPIK for the relationship skills and the MOBAK-test for the basic motor competencies) for the assessment are well established and economical. This contributes to the robustness of the findings.

Conclusions

The findings of this study provide an insight into the link between motor competencies and interpersonal relationship skills. Motor competencies enable children to participate in sport activities and, at the same time, in meaningful social interactions. This has a positive influence on physical and mental health.

Extracurricular sport activities can be seen as an important setting for the promotion of motor and social competencies. The participation in club sport is relatively selective and depends on various factors such as motivation of parents and socioeconomic status, thus not all children can participate. Children, who do not participate in such offers and may have poor motor competencies, should as well get the opportunity to gain social experiences in sports, enhance their BMC and relationship skills to avoid peer relationship difficulties. Thus, the promotion of these related competencies in PE in school is relevant as it reaches every child. In PE it is important to create situations in which all children can participate in social interaction. In contrast to club sport, PE has the opportunity to contribute to a broader and more socially just range of learning experiences that appeal to all (Luguetti & Oliver, 2021). The intertwined nature of the physical and social development of children is considered in school curricula such as the Swiss Lehrplan 21, and it includes subject-specific such as interdisciplinary competencies. This point raises a pedagogical-didactic question of how to design careful and integrative opportunities for movement to promote these competencies in PE and extracurricular activities. The approach of competency-oriented tasks (learning tasks) can be used during PE classes to create cooperative problem solving situations in which also children with poor motor competencies can play an participate (Kühnis et al., in press). The effect these measures have on the level of physical activity of the children still has to be analysed and can be discussed controversially. Accordingly, further longitudinal studies should focus on the causality between the three factors (BMC, CSP and relationship skills) to better understand how to promote motor and social competencies through sport activities in and outside school.

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Competing interests

The authors have declared that no competing interests exist. The funders had no role in the design of the study; in the collection, analyses, or interpretation of data; in the writing of the manuscript; or in the decision to publish the results.

Data availability statement

The data presented in this study are available on request from the corresponding author. The data are not publicly available due to ethical guidelines of the Cantonal School Authorities.