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Socioecological correlates of perceived motor competence in 5–7-year-old Finnish children

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Abstract

We investigated child, family and environmental factors associated with young children's perceptions of locomotor (LM) and object control (OC) skills. The participants comprised 472 children (6.22 ± 0.63) and their parents. The children were assessed for their perception of motor competence in LM and OC skills (using the pictorial scale of Perceived Movement Skill Competence for young children), and actual motor competence (Test of Gross Motor Development 3rd edition and Körperkoordinationstest Für Kinder). Anthropometrics were calculated using the children's body mass index standard deviation scores. A parent questionnaire included questions about child factors (sex, child's independent walking age, time spent sedentary and outdoors, participation in organised sport activities and access to electronic devices), family factors (parent educational level, physical activity frequency and sedentary behaviour) and environmental factors (access to sport facilities). Variance analysis sought to identify age-related differences, and a linear regression model examined correlates of children's perception of LM and OC skills. The children's movement skill perceptions were found to be generally high. Four factors explained 5.7% of the variance in perceptions of LM skills and 7.5% of the variance in perceptions of OC skills. Two factors, lower age and higher actual motor competence, explained most of the children's skill perceptions. Access to electronic devices (less) and BMI (higher) were associated with perceptions of LM skills. Participation in organised sport activities (higher) and parental education (lower) were associated with perceptions of OC skills. When promoting children's physical activity and motor competence, perceptions of motor competence are an important consideration.

Keywords: self-perception, locomotor skills, object control skills, TGMD-3, KTK, childcare centre, BMI

Introduction

As society has changed, families with young children have encountered challenges such as growing obesity rates,[1] physical inactivity[2] and decreased motor competence (MC)[3] in children. Stodden et al. (2008) suggest that there is an interconnection between physical activity (PA), MC and the perception of motor competence (PMC). According to the abovementioned model and a subsequent review, which synthesized the research supporting the model,[5] children's PA participation influences their development of MC, and in turn, their MC influences their PA motivation and engagement. Conversely, PMC is considered to consist of a child's perceptions, awareness and beliefs regarding performing motor tasks.[4,5] PMC evolves over time[6] and contributes to PA behaviour. It is suggested that children with high PMC are more engaged, motivated and persistent during PA,[7,8] whilst children with lower PMC may lose interest and do not persist with mastering tasks. This spiral of (dis)engagement in terms of PA, MC and PMC contributes to the prevention of inactivity and obesity in childhood and later on in an individual's life.[4,5] Therefore, focusing research attention on how children develop their PMC is necessary to lay a foundation for PA behaviour and the development of necessary motor skills.

An essential component in the development of PMC is cognitive maturity.[6] Due to cognitive immaturity, young children tend to overestimate their mastery of motor tasks,[9] which can lead to engagement and persistence in PA behaviour despite unsuccessful outcomes.[10] Thus, according to Harter's (1999) construct of self-concept, the younger that children are, the more positive and unrealistic may be their PMC. In line with Harter's (1999) theory, recent studies have demonstrated that young children have relatively high perceptions of their skills.[3,11] However, after age seven, children's cognitive capacity permits them to evaluate their mastery with greater accuracy.[6] Simultaneously, the growth of comparison, rivalry and selectiveness in sport activities and schools may be associated with a decline in PMC with age.[12] The lack of these aforementioned factors in the early years could explain young children's positive PMC. However, as many health habits, especially PA, are traceable to the early years,[13] it is essential that we understand more about the factors that influence the construction of a child's PMC, especially that factors which are associated with low PMC.

Understanding the correlates of PMC is, therefore, important in order to develop effective means to prevent future inactivity and to enhance motor development. However, the previous literature has predominantly studied child-related factors of PMC.[11,14] According to the socioecological model,[15] a child's behaviour stems from reciprocal interactions between micro, meso, exo and macro systems, thus, in child, family, environmental and community levels. According to Sallis and collegues (2000), to be able to make substantial behavioural changes, interventions must target changes at each level of this model. However, before an intervention, there should be basic knowledge about factors that are associated with PMC. For example, Barnett et al. (2016) demonstrated that child-related factors are most important correlates for MC. As growing evidence demonstrates that even in young children PMC and actual MC are associated,[3,18,19] and that PA, MC and PMC are linked in Stodden et al.'s (2008) spiral of engagement, we believe it is important to understand the correlates of PMC. In the present study the aim was to examine the PMC and its association with different levels of the socioecological model and to broaden the existing PMC research to understand not only children's child-related factors (e.g. sex and age) but also family (e.g. parents' mean educational level and PA behaviour) and environment (access to sport facilities) related factors.

We investigated 5–7-year-old children’s perception of locomotor (LM) and object control (OC) skills, and their associated correlates, based on the socioecological model. We hypothesised that there may be some important hitherto undiscovered socioecological aspects at the family and environmental levels that relate to the child’s ability to evaluate his/her competence.

Materials and Methods

The Ethics Committee of the University of Jyväskylä, Finland, granted ethical approval for the study. The parents of the participating children provided written consent. The children were informed about their right to opt out of participation at any time.

Random sampling and recruitment

The aim of the larger study, *Skilled Kids,*[20] was to explore Finnish children’s MC and PMC as well as their covariates. The study design was aimed at a geographically representative sample of 1000 children aged 3–7 years from Finnish childcare centres. The Finnish national registry of early educators included 2600 childcare centres. Based on this registry, cluster-random sampling was carried out, i.e. childcare centres were chosen randomly from the metropolitan area, Southern, Central and Northern Finland based on postal codes. The number of childcare centres involved in one region was weighted with the population density of the area. The recruitment took place in the autumn of

2015. Altogether, 37 childcare centres participated: six from the metropolitan area, eleven from Southern, thirteen from Central and seven from Northern Finland. A total of ten childcare centres (27%) declined to participate, citing reasons such as lack of space, interest, time or low pupil numbers. If a randomly chosen childcare centre declined to participate, the following one on the list was recruited from the same area. For the recruited childcare centres, the respective directors would first approve the participation, and their staff were then informed about the study. Second, the staff received informed written study forms and questionnaires (n = 1579) and forwarded them to parent(s). The parents were asked to fill in the consent forms and questionnaires. The questionnaires were returned to the researchers in prepaid envelopes. In total, 1239 children (78.5%) received consent for study participation. The measurements were conducted in childcare centre settings between November 2015 and September 2016 by two researchers (DN and AS), along with two research assistants.

Participants

In this study, all those children in the *Skilled Kids* –study[20] who were over 59 months old and who had filled out the PMSC were included in the analysis. The study participants comprised 472 Finnish children who were 5–7 years old: boys, 247 (52.3%, mean 6.22 years) and girls, 225 (47.7%, mean 6.23 years).

Perceptions of motor competence

PMC was measured with the pictorial scale of Perceived Movement Skill Competence (PMSC)[21] for young children. The modified version of this scale is aligned with the items in the third edition of the Test of Gross Motor Development (TGMD-3).[22] The scale contains 13 items subdivided into two subscales, LM skills (run, gallop, hop, skip, horizontal jump and slide) and OC skills (two-hand strike of a stationary ball, one-hand forehand strike, one-hand stationary dribble, two-hand catch, kick a stationary ball, overhand throw, underhand throw), using gender-specific booklets. Each item in the subscale was presented in the form of bipolar statements accompanied by a picture for each statement; for example, two images show a boy running. The child was asked whether he was like the competent child or like the child who was not very competent at running. After the child picked one of the pictures, he was further asked to specify his answer. If the child chose the more competent child, he would then choose between 'really good' (4 points) or 'pretty good' (3 points) at running. If the child chose the less competent child, he would then choose between 'sort of good' (2 points) or 'not that good' (1 point) at running. The maximum score of one item was four. The maximum sum score for LM skills was 24 points (6 X 4) and for perception of OC skills 28 points (7 X 4). The maximum total score was 52 points. The higher the child scored, the higher the PMC. The test was done one-on-one with each child in a quiet room. If the child did not understand the picture or the question, the researcher demonstrated the skill once. If child had never tried the skill before, he/she was asked to imagine how good he/she would be at the given task with the aforementioned answer options. The test took an average of 10 minutes per child, and it was done before the actual MC measurements.

This modified version of the PMSC has demonstrated good face validity and test–retest reliability in children of similar age in perceptions of both six LM skills (ICC .62)[23] and seven OC skills (ICC .86).[24] The total PMC (ICC .78) showed good internal consistency (alpha coefficient range = .73 - .87).[23] In this sample, PMSC's test–retest reliability was conducted with 53 children, and the results indicated good consistency in terms of perception of LM skills (ICC .75), OC skills (ICC .82) and total PMC (ICC .85) (95% CI =.75 -.91).

The children's skill-by-skill PMC is reported in Table 2. The scores for LM and OC subtests were converted into four categories. Due to a distribution peak in the maximum score in both subtests, we converted the scores so that only those children who had maximum scoring in perception of LM skills (24p.) or OC skills (28p.) were allocated to the 'really good' category. Subsequently, regarding the perception of LM skills, the category for 'not that good' consisted of scores from 6 (6 X 1) to 11p. (6 X 1.9), 'sort of good' scores from 12 (6 X 2) to 17p. (6 X 2.9) and 'pretty good' scores from 18 (6 X 3) and 23p. (6 X 3.9). In terms of OC skills, the categories followed the same logic, but were multiplied for seven skills (Table 2).

Anthropometric measures

Weight (Seca 877) and height (Charder HM 200P) were measured directly. The measurements were undertaken before the MC assessments, and the children wore light clothing without shoes or socks. Body mass index (BMI) was calculated as weight/height^2 (kg/m^2) and converted to BMI standard deviation scores (BMI SDS) using national BMI references.[25] The BMI SDS categories in Table 1 follow the norm and value categories provided by Saari et al. (2011): significantly underweight, underweight, normal weight, overweight, and obesity.

Actual motor competence

Actual MC was operationalised and measured as process and product assessments, respectively (the Test of Gross Motor Development – third edition (TGMD-3)[22] and Körperkoordinationstest Für Kinder (KTK)[26]).

The TGMD-3 was administered individually, coding the 3–5 skill criteria as either present (1) or absent (0). Each skill was performed and observed twice, as instructed in the manual. The skills were divided into LM (6 skills, max. 46 points) and OC (7 skills, max. 54 points) skills. The total sum score was LM skills added to OC skills (max. 100 points). The test consisted of the same 13 items as in the modified PMSC assessment tool. Intrarater and interrater reliability were shown to be good to excellent.[22] Before starting the data collection, two observers were trained to observe the children's performance, and both passed Ulrich's official TGDM-3 reliability test. To determine interrater reliability, the observers both coded the same performance for the 167 children. One observer coded the performance during the assessment, while the other observer performed the coding from a recorded video. Interrater reliability was calculated as the intraclass correlation coefficient based on a two-way random model of consistency for single measures. Interrater reliability between the observers for the TGMD-3 total skills was 0.88 (95% CI = 0.85–0.92).

The KTK test included four items: 1) walking backwards (WB) on balance beams at decreasing widths of 6.0 cm, 4.5 cm and 3.0 cm (maximum score of 72p.); 2) hopping for height (HH) on one foot at a time, with consecutive steps of 5 cm (max. score of 78p.); 3) jumping sideways (JS) from side to side on a jumping base for 15 seconds (the sum of the number of correct jumps in two trials) and 4) moving sideways (MS) with wooden plates without stepping out as quickly as possible for 20 seconds (the sum of the number of points in 20 seconds for two trials). Each skill was performed and observed, carefully following the manual instructions. The observers were well-trained and experienced. Finally, the sum of these latter scores yielded one total sum score for the KTK test. The KTK test's raw score was used in the current analysis. This test has been shown to be highly reliable with a test–retest reliability coefficient of the total score of 0.97 and the subtests ranging between 0.80 and 0.96.[26]

Child-related factors

The parental questionnaire included questions about the child's sex, date of birth, age of independent walking and estimations about the amount of time the child spent in sedentary activities, time spent outdoors and participation in organised sports activities. The questions from two internationally valid and reliable questionnaires were modified for the Finnish culture: the Children's Leisure Activities Study Survey (CLASS)[27] and Affordances in the Home Environment for Motor Development Self-Report (AHEMD-SR).[28] Parents were first asked: "How old was your child when he/she learned to walk independently (in months)?" Sedentary time was assessed through the following questions: "Think about your child's typical day and situations when he/she is sitting, lying down, or in some other way is sedentary (e.g. in car, sand box, trolley, in front of TV or while playing with a puzzle). For how long, at the most, does such a sedentary activity last continuously and without breaks approximately?" (1 = 15 min>, 2 = 30 min, 3 = 60 min, 4 ≥ 90 min) and "How often is your child engaged in long and continuous sedentary activities during a day?" (1 = 1 time, 2 = 2-3 times, 3 = 4-5 times, 4 ≥ 6 times). The amount of sedentary time (in minutes) during a day was calculated using the abovementioned information (min/time * times/day). Time spent outdoors was divided into weekdays and weekends and assessed through the question: "How much, on average, does your child spend time outdoors after a preschool day/on weekends?" The weekday scale ranged between 0 and 3 (0 = not at all; 1 = under 30 min/d; 2 = approx. 30–60 min/d; 3 = over 60 min/d) and the weekend scale between 0 and 4 (0 = not at all; 1 = under 30 min/d; 2 = approx. 30–60 min/d; 3 = 1-2 hrs/d; 4 = over 2 hrs/d). Outdoor time was based on the sum of the scales. Furthermore, participation in organised sport activities (OSA) (min/week) was determined through the following question: "Does your child participate in organized PA or sport in a group or sports club?" If the response was "yes," further information was asked: "How many times a week?" and "For how many minutes at a time?" The total number of minutes spent in OSA a week was calculated and used in the analyses. Finally, the child's access to electronic devices was assessed through the question: "Does your child have access to any or some of the following: 1) TV, 2) game console, 3) computer, 4) smartphone, tablet, IPad or other smart device, 5) something else, what?" The number of accessible electronic devices was used in the analyses.

Family-related factors

Due to divergent family backgrounds, we used the concepts of respondent and partner instead of referring to mother or father. Later on, female respondents were called mothers and males fathers. Parent mean education level is a mean value of the respondent's and partner's educational level (1 = comprehensive school; 2 = high school/vocational school; 3 = polytechnic; 4 = university). Parent mean education level was used instead of separating the covariates into respondent and partner so that single parents would not be eliminated from the linear regression models. The respondents' own PA frequency was divided on a scale from 0 to 4 (0 = not at all; 1 = randomly few times a month; 2 = approximately once a week; 3 = 2-3 times a week; 4 = over four times a week). Their sedentary behaviour (SB) was collected using the International Physical Activity Questionnaire's (IPAQ) short form, which has provided acceptable reliability and validity in 12 countries.[29] The respondents had to evaluate, in hours and minutes, the time spent sitting on a regular weekday. Mean values and interquartile ranges were used.

Environmental factors

The parental questionnaire included questions about the child's access to sport facilities, e.g. "Evaluate how often your child has used sport or outdoor facilities situated in your own locality or municipality nearby." The questionnaire included 10 divergent and organised sport facilities (e.g. playing field, playground, swimming hall, sports indoor hall) and an open space for the facilities that were being used but were not listed. Additionally, the respondents were asked to estimate: "Is there a large area for the child's free-play on your home yard (front- or backyard, garden etc.)?" and furthermore, "How often is your child allowed to play in the yard?" Use of each facility was scored on a scale from 0 to 4 (0 = no access to a facility; 1 = nearly never; 2 = randomly; 3 = weekly; 4 = approximately daily). Total access to sport facility use was calculated by adding all the respondents' evaluations.

Statistical analyses

IBM SPSS version 24.0 was used for the analyses. Data normality was checked, and descriptive statistics for all variables (means, standard deviations, minimum and maximum values) and for girls and boys separately (mean and standard deviation) were calculated for covariates of perceptions of LM and OC skills (Table 1). Due to the non-normal distribution of the perception of LM and OC skills, sex differences were tested using the Mann–Whitney *U* test. Frequencies and sex differences in perceptions of individual skills are depicted in Table 2. Differences between the age groups were examined with a one-way ANOVA.

In order to analyse the associations between the covariates and dependent variable, linear regressions were carried out. First, the linear regression model with the enter method was used to examine the associations between perceptions of LM and OC skills and the predictor variables. In base model 1, all the child, family and environmental factors predicting PMC were entered into the base model simultaneously. The least significant factors were removed from the base model one at a time. The base model was re-run with all the remaining factors until there were only significant factors left in the final model 2. The order of removal from the base model is represented in Table 3. This so-called backwards method made it possible to take the interdependency (mutual covariance) of predictors into account at each step of modelling. The tolerance values (Tolerance) for all models were over 0.4, and the variance inflation factors (VIF) were all under 3, indicating no evidence of multicollinearity.

Because there were many children measured within the same childcare centre, intraclass correlations for skill variables within the centres were checked. Within the childcare clusters, the ICCs were small (0.06 for OC skills and 0.04 for LM skills). Therefore, it was not necessary to use linear mixed models to adjust for childcare clusters. The final models were therefore linear single-level regression models. In base model 1 and final model 2, the number of items varies due to missing data.

Results

Approximately half (n=247; 52.3%) of the 472 children were boys. All children were 5–7 years old (mean 6.2yrs, SD=0.63).The questionnaire respondents were more likely mothers (n=408/87.2%) than fathers (n=60/12.8%). The descriptive data are reported in Table 1.

The children generally recorded high PMC, and most of them evaluated themselves as 'pretty good' or 'really good' in terms of perception of LM and OC skills. Of the individual skills, the children had the lowest perceptions in ‘two-hand strike’ and ‘one-hand forehand strike’. Their highest perceptions were in ‘run’, ‘kick’, ‘hop’ and ‘overhand throw’ (Table 2).

Considering sex differences, boys had higher perceptions than girls (p<0001) in perceptions of OC skills. When using the Mann–Whitney U test to ascertain skill-by-skill sex-related differences, some differences in patterns of associations were found. The girls had higher perceptions than boys in 'slide' (p = .002). Boys had higher perceptions than girls in 'two-hand strike' (p = .001), 'kick' (p = .002), 'underhand throw' (p = .010) and 'overhand throw' (p = .027) (Table 2).

Age was negatively associated with the children’s PMC. The younger the children, the more competently they evaluated themselves. However, age differences were only significant for the perception of LM skills. The five-year-old children (n = 167) perceived themselves as more competent in LM skills than the 6-year-old (n = 249; p = .034) and 7-year-old (n = 56; p = .028) children.

In the final model 2 of perceptions of LM skills, the children’s age (younger), BMI (higher), actual LM skills (higher) and less access to electronic devices explained 5.7% of the variance in perceptions of LM skills. In the final model 2 regarding perceptions of OC skills, the children’s age (younger), actual OC skills (higher), participation in organised sport activities (higher) and lower parent mean educational level explained 7.5% of their perception of OC skills (Table 3).

Discussion

The purpose of the study was to investigate the perception of LM and OC skills in 5 to 7-year-old children in a socioecological context. This is the first study to investigate such a wide range of factors in a geographically representative sample and the first to examine young Finnish children’s PMC.

There were several important findings. First, as expected in this young age group, perceptions of LM and OC skills were high. Second, some child and family factors were associated with the children’s PMC, supporting the socioecological model. Interestingly, the associations varied between specific factors and types of PMC. Most strongly associated with PMC were age and actual MC. In addition, higher BMI and less access to electronic devices were associated with higher perceptions of LM skills. Higher perceptions of OC skills were associated with lower parent mean education level and higher participation in organized sport activities (OSA). However, the explained variance was only 5.7% of the LM skill perceptions and 7.5% of OC skill perceptions. This is in line with a number of recent studies that have tried to comprehend children's PMC but in which the majority of variance remains unexplained.[30,31] Although the current study included a comprehensive range of possible child, family and environmental predictors of PMC, much remains unknown. However, one of the suggestions for future research is to take into account the fact that more variance in PMC can be explained in the perception of OC skills with sex differences and as a function of age.[30,31]

The level of perception of LM and OC skills was generally high, which supports previous investigations.[3,11,32] Only one study has reported low perceptions of physical competence in children.[8] Past and current investigations have shown that young children have naturally inflated PMC, which Harter (1999) noted was due to their more limited ability to evaluate their mastery.[6,9] According to Stodden et al. (2008), this inflated feeling of competence works in favour of young children, as it has the propensity to motivate and excite them to be more physically active. This positive spiral of engagement can lead to increased PA and subsequently, enhanced mastery of MC, supporting health-related fitness and healthy body composition and, hopefully, strengthening relationships between these factors as a function of time.[4]

Similar to our findings, Slykerman et al. (2016), Estevan et al. (2018) and Afthentopoulou et al. (2018) found that boys outperform girls in evaluations of their OC skills but not in their evaluations of LM skills. In this study, as seen in Table 1, boys had higher actual OC skills, so the difference in perception might reflect their actual skills. Furthermore, according to Blatchford and colleagues (2003), boys tend to prefer engaging in OC skills, especially in games, while Slykerman et al. (2016) suggested that girls prefer PA types that do not require OC skills. However, other similar studies reported associations with sex differences only for total PMC and did not separate perceptions of LM skills from those of OC skills. Among those studies, some reported higher total PMC in boys,[18,33] in girls[32] as well as a lack of sex differences.[11] Due to these equivocal findings, future research should separate perceptions of LM from OC skills in order to better identify sex differences.

The present results showed that BMI was positively associated with perceptions of LM skills, but not with perceptions of OC skills. This is in contrast to previous findings that leaner children had higher PMC at the age of 4–7 years[37] and over 8 years of age.[38] Based on the present results, higher BMI may reflect muscle strength in addition to (over)weight and (in)activity. In fact, muscle strength may bring along greater peer support, admiration and acceptance, which could explain higher PMC in children with higher BMI. Furthermore, in the study by Spessato et al. (2013), 15% of children were classified as obese, while in our study, only 3.4% of children were so classified. The difference in the proportion of obese children might partly explain the results, as the number of overweight children (19%) was similar in these two studies. To conclude, further research is recommended to understand the aforementioned relationship in under- and over-eight-year-old children.

Another significant child-related factor associated with PMC evaluations was the process measure (TGMD-3), though not the product measure (KTK). Previously, Duncan et al. (2018) found an association between perceived and actual MC, measured with both process and product type of measures, in 4–7-year-old children, whereas True et al. (2017) did not find any associations. Additionally, studies with aligned process measures of perceived and actual OC skills have found associations in boys,[39] or in both sexes,[3,19] but not in LM skills. One possible explanation for these differences is that in True et al.'s (2017) study, the assessment tools were non-aligned; in other words, there was no match between actual and perceived MC, unlike in the other abovementioned studies. Secondly, it is evident that OC skills are more distinctive, so children tend to evaluate their OC skills more in line with their actual OC skills than they do their LM skills. Brian and colleagues (2018) questioned whether this result reflects the fact that children learn OC skills in specific contexts with accurate instructions and are therefore more aware about their actual OC skills. However, in order to be able to understand whether young children manage to distinguish different parts of self-perception, aligned measures of PMC and actual MC need to be used.[40] Even though Brian and colleagues (2018) state that, as children get older, the association between actual and perception of MC increases, based on our results and the existing literature, it seems that even in young children, an association can be found if aligned assessment tools are used.

Participation in organised sport activities (OSA) was significantly associated with perceptions of OC skills. In addition, there were sex differences in perceptions of OC skills, as boys had higher perceptions than girls did. Moreover, boys had higher perceptions in regards to ‘two-hand strike’, ‘kick’, ‘underhand throw’ and ‘overhand throw’. According to Masci et al. (2018) girls underestimate themselves, while boys tend to overestimate their abilities in OC skills. However, a recent systematic review confirmed that boys do outperform girls in their actual OC skills.[17] Therefore, boys might have higher evaluations of their OC skills. For boys, ball games are a typical way to gather to play together, which concurrently enhances boys’ development in OC skills.[36] Due to boys’ natural tendency to practice, engage and develop OC skills, it is recommended that early educators especially encourage girls to play ball games, while giving them positive and constructive feedback. Good OC skills are crucial for children, as they are known to predict higher PA behaviour and fitness in both sexes later on in adolescence.[7]

Finally, children with less access to electronic devices had higher perceptions in LM skills. Only a handful of studies have investigated the relationship between electronic devices and skills. In 2012, Barnett et al. found that children's (ages 3–6 years) time spent in sedentary electronic game use had a negative association with children's locomotor skill (p = .06). Interestingly in our study, boys had greater access to electronic devices (Table 1), and girls had higher perceptions of LM skills, on average. Conversely, the younger children in this study had higher PMC, though they might have had more limitations regarding the use of electronic devices. We assume that the aforementioned sex and age differences in PMC may confound the association between perception of LM skills and use of electronic devices. It would, therefore, be beneficial for future research to examine this association, taking into consideration possible sex differences and parental patterns in limiting children's electronic device use.

Lastly, one family factor (i.e. parent mean educational level) was negatively associated with OC skill evaluations. Thus, the surprising result of the present study was that a higher educational level did not predict higher evaluations in OC skills. On the one hand, this may reflect differences in cognitive maturation supported by parents. While it has been shown that the perceptions become more realistic with age,[6] in highly educated families, parents may help a child's self-perceptions to mature earlier. On the other hand, today's parents spend less time with their children than earlier generations did.[41] It thus may be that even though highly educated parents are aware of the benefits of PA, they may struggle to find the time to support what is necessary, especially during the development of OC skills (throwing or kicking back). In fact, according to Trost et al. (2003), to build children’s confidence levels in PA, parents’ time and supportive behaviours are more important than a positive attitude or the parents’ own PA behaviour. However, as there was a high level of education and income in the participating families, as more than half of the families were highly educated (polytechnic or university), and around three-quarters of the families had an income level over 40,000 euros per year, the generalisability of the results can be questioned. We encourage future research to further explore this relationship and to consider mothers and fathers separately.

One of the study's strengths is the geographically wide sample of children. Second, the study assessed a range of PMC child and environmental covariates based on a socioecological model. Third, the study examined sex and age differences in perceptions of LM and OC skills separately. Additionally, the association between perceived and actual MC was investigated with more than one assessment tool, and at least one of the measurement tools was matched with the PMC assessment tool.

However, some study limitations should be noted. Although the *Skilled Kids* – study included a large number of children and families, due to the short data collection period in each childcare location, missing data could not be avoided. Concerning the assessment tools, the questions from AHEMD-SR[28] have been validated for ages up to 42 months while the study participants in this article were older. During the data collection, as young children tire quickly, a range of practical approaches can be beneficial to sustain interest and good attention towards assessments. As such, we preferred assessment times when the children were most alert, and we arranged measurements over two days per child (PMSC and KTK on the first day and TGMD-3 on the second day) so as to avoid lack of attention in assessment compliance. However, occasionally, a child was unwell or absent from the childcare centre. The recovery of the missing data was challenging, as the participants and childcare centres involved were busy and were distributed around Finland. However, the families were provided a later opportunity to return incomplete questionnaires.

Perspectives

The current study suggests that as young children have naturally high perceptions of MC, they should be encouraged to be physically active in order to sustain and improve their motor skills. Even though a range of potential correlates of perceptions of MC were examined, the majority of the perceptions of MC variance remained unexplained. Nonetheless, based on the results, we recommend that girls need to be provided with opportunities to practice their OC skills, which would likely improve their OC perceptions. Finally, our recommendation is to use aligned perception and actual MC assessment tools to better understand the association between perceived and actual motor skills in young children.

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Table 1

Child, family and environmental factors: descriptive data.

Child factors	**N**	**Mean (SD)**	**Min**	**Max**	**Mean (SD) girls**	**Mean (SD) boys**	**Sex differences *p*-value**
Age (years)	472	6.22 (0.63)	5.00	7.75	6.23 (0.64)	6.22 (0.62)	0.838
BMI SDS (%)	470	0.17 (1.02)	-4.55	3.13	0.19 (1.11)	0.14 (0.93)	0.566
- Significantly underweight	4	0.9			1.8	0	
- Underweight	15	3.2			3.1	3.3	
- Normal weight	347	73.8			76.0	71.8	
- Overweight	88	18.7			15.6	21.6	
- Obesity	16	3.4			3.5	3.3	
Height (cm)	470	119.51 (6.37)	102.10	137.30	118.91 (6.26)	120.05 (6.42)	0.054
Weight (kg)	471	23.39 (4.19)	15.10	41.60	23.38 (4.59)	23.41 (3.79)	0.941
Child's independent walking (%)	433	100					0.642
- at 7-10 months	94	21.7			22.4	21.1	
- at 11-12 months	189	43.7			43.8	43.5	
- at 13-21 months	150	34.6			33.8	35.4	
Sedentary behavior (mins / day)	463	89.22 (49.94)	15	405	88.42 (48.05)	89.97 (51.72)	0.739
TGMD-3 locomotor skills (0-46p.)	443	30.58 (6.30)	9	43	32.00 (5.64)	29.24 (6.59)	**0.000*****
TGMD-3 object control skills (0-54p.)	450	28.90 (7.97)	8	50	26.18 (6.76)	31.43 (8.19)	**0.000*****
TGMD-3 total score (0-100p.)	441	59.49 (11.94)	18	88	58.27 (10.62)	60.62 (12.98)	**0.039***
KTK	433	103.75 (33.84)	6	193	105.85 (32.69)	101.84 (34.82)	0.219
Time spent outdoors (%)	469	100					**0.014***

- Less than 1 h/day	39	8.3			11.2	5.7	
- Approximately 1 h/day	231	49.3			48.2	50.2	
- 1 to 2 h/day	199	42.4			40.6	44.1	
Participation in organized sport activities (mins/week)	445	62.04 (74.20)	0	361.00	59.05 (68.74)	64.80 (78.93)	0.415
Access to electronic devices (%)	460	100					**0.042***
- Not at use	276	60.0			62.4	57.7	
- 1	104	22.6			22.6	22.6	
- 2 or more	80	17.4			15.0	19.7	
Family factors							
Parent mean education level[1] (%)	468	100					0.828
- Comprehensive school	6	1.3			0.5	2.0	
- High school / vocational school	174	37.1			39.4	35.1	
- Polytechnic	176	37.6			37.6	37.6	
- University	112	24.0			22.5	25.3	
Income level (%)	424	100					0.514
- under 39 999 euros / year	105	24.6			28.5	21.1	
- 40 000 – 69 999 euros / year	148	34.9			32.9	36.9	
- 70 000 – 99 999 euros / year	109	25.8			22.2	29.0	
- over 100 000 euros / year	62	14.7			16.4	13.0	
Respondent's physical activity frequency (%)	466	100					0.788
- Not at all (0)	15	3.2			1.8	4.5	
- Randomly few times a month	51	10.9			10.4	11.0	

- Approximately once a week	70	15.0			17.7	12.2	
- 2-3 times a week	207	44.4			46.6	43.2	
- Over 4 times a week	123	26.5			23.5	29.1	
Respondent's sedentary behavior (%)	448	100					**0.050***
- Do not know	79	17.7			17.5	17.8	
- 3 h / day or less	121	27.0			24.9	29.0	
- 3.1-6 h / day	126	28.1			21.7	34.2	
- Over 6 h / day	122	27.2			35.9	19.0	
Environmental factors							
Access to sport facilities (%)	429	100					0.120
- Rarely	4	0.9			1.0	0.9	
- Occasionally	255	59.4			62.4	56.7	
- Weekly	168	39.2			36.1	42.0	
- Daily	2	0.5			0.5	0.4	

Values are reported as mean (standard deviation) scores or percentages (%).

[1] Values were rounded to the nearest whole number.

*Statistically significant difference between girls and boys at the level of $p < 0.05$.

Table 2

Children's perception of LM skills and OC skills (n=472).

		Not that good		Sort of good		Pretty good		Really good	
		(n)	%	(n)	%	(n)	%	(n)	%
Perception of LM skills	**All**	**6**	**1.3**	**93**	**19.7**	**294**	**62.3**	**79**	**16.7**
	Girls	**1**	**0.4**	**41**	**18.2**	**144**	**64.0**	**39**	**17.4**
	Boys	**5**	**2.0**	**52**	**21.1**	**150**	**60.7**	**40**	**16.2**
Run	All	7	1.5	17	3.6	118	25.0	330	69.9
	Girls	4	1.8	7	3.1	60	26.7	154	68.4
	Boys	3	1.2	10	4.0	58	23.5	176	71.3
Gallop	All	32	6.8	78	16.5	143	30.3	219	46.4
	Girls	12	5.3	35	15.6	65	28.9	113	50.2
	Boys	20	8.1	43	17.4	78	31.6	106	42.9
Hop	All	22	4.7	39	8.3	118	25.0	293	62.0
	Girls	11	4.9	17	7.6	60	26.7	137	60.8
	Boys	11	4.5	22	8.9	58	23.5	156	63.1
Skip	All	49	10.4	84	17.8	120	25.4	219	46.4
	Girls	21	9.3	34	15.1	57	25.3	113	50.3
	Boys	28	11.3	50	20.2	63	25.5	106	43.0
Horizontal jump	All	30	6.4	57	12.1	136	28.8	249	52.7
	Girls	14	6.2	32	14.2	62	27.6	117	52.0
	Boys	16	6.5	25	10.1	74	30.0	132	53.4
Slide*	All	28	5.9	54	11.4	95	20.1	295	62.6
	Girls	10	4.4	20	8.9	37	16.4	158	70.3
	Boys	18	7.3	34	13.8	58	23.5	137	55.4
Perception of OC skills*	**All**	**14**	**3.0**	**150**	**31.8**	**244**	**51.7**	**64**	**13.6**
	Girls	**9**	**4.0**	**83**	**36.9**	**103**	**45.8**	**30**	**13.3**
	Boys	**5**	**2.0**	**67**	**27.1**	**141**	**57.1**	**34**	**13.8**
Two-hand strike*	All	115	24.4	144	30.5	70	14.8	143	30.3
	Girls	67	29.8	71	31.6	33	14.7	54	23.9
	Boys	48	19.4	73	29.6	37	15.0	89	36.0
One-hand strike	All	72	15.3	110	23.3	114	24.2	176	37.2

	Girls	38	16.9	56	24.9	56	24.9	75	33.3
	Boys	34	13.8	54	21.9	58	23.5	101	40.8
Dribble	All	36	7.6	62	13.1	108	22.9	266	56.4
	Girls	16	7.1	32	14.2	53	23.6	124	55.1
	Boys	20	8.1	30	12.1	55	22.3	142	57.5
Catch	All	28	5.9	45	9.5	115	24.4	284	60.2
	Girls	8	3.6	26	11.6	60	26.7	131	58.1
	Boys	20	8.1	19	7.7	55	22.3	153	61.9
Kick*	All	12	2.5	30	6.4	85	18.0	345	73.1
	Girls	8	3.6	16	7.1	54	24.0	147	65.3
	Boys	4	1.6	14	5.7	31	12.6	198	80.1
Underhand throw*	All	43	9.1	87	18.4	123	26.1	219	46.4
	Girls	24	10.7	50	22.2	59	26.2	92	40.9
	Boys	19	7.7	37	15.0	64	25.9	127	51.4
Overhand throw*	All	19	4.0	52	11.0	107	22.7	294	62.3
	Girls	9	4.0	28	12.4	65	28.9	123	54.7
	Boys	10	4.0	24	9.7	42	17.0	171	69.3

* Statistically significant difference between girls and boys. The level of significance $p < 0.05$.

Table 3

Child, family and environmental factors associated with children’s perception of LM and OC skills.

Variables	**Perception of LM skills**					**Perception of OC skills**				
	Base model 1 (*n* =243) R^2 =.086			Final model 2 (*n* =437) R^2 =.057		Base model 1 (*n* =241) R^2 =.106			Final model 2 (*n* =421) R^2 =.075	
	Standardized *B*	*P*	*RE	Standardized *B*	*P*	Standardized *B*	*P*	*RE	Standardized *B*	*P*
Child factors										
Age (months)	-.169	**.027**		-.152	**.002**	-.165	**.029**		-.181	**.001**
Sex (1 = girls, 2 = boys)	-.139	**.035**	8.			-.065	.350	5.		
BMI SDS	.171	**.008**		.112	**.017**	.132	**.046**	10.		
Independent walking age	-.027	.684	3.			-.103	.126	8.		
Sedentary behavior	-.012	.851	1.			.009	.883	2.		
TGMD-3 -actual skill	.138	.073		.150	**.002**	.265	**.002**		.218	**.000**
KTK -motor coordination	.031	.727	2.			-.031	.719	4.		
Time spent outdoors	-.111	.099	9.			-.009	.897	1.		
Participation in organized sport activities	-.021	.760	4.			.098	.152		.119	**.017**
Access to electronic devices	-.100	.117		-.137	**.004**	-.078	.224	6.		
Family factors										
Parent mean education level	-.103	.150	6.			-.166	**.020**		-.130	**.007**
Respondent’s physical activity	-.053	.418	5.			-.078	.224	7.		
Respondent’s sedentary behavior	.106	.128	7.			.082	.241	9.		
Environmental factors										
Access to sport facilities	.164	**.019**	10.			.021	.767	3.		

Statistically significant values are shown in bold.

* RE= Removal order in which explaining variable was deleted from base model (1). In the final model (2) only statistically significant factors explaining PMC were left.