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Chapter 7

Teachers' perceptions of children's sport learning capacity associated with their fundamental movement skill development.

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ABSTRACT

The intrapersonal mechanism that drives and explains individual differences in motor development is still a relatively underexplored area of research. In this study, we set out to determine whether in teachers' perceptions, higher sport-learning capacity (SLC) is associated with the level of fundamental movement skills, and the changes therein over 24 weeks in 7-year-olds. We assessed 170 children from eight primary schools in the Netherlands twice (T1, T2) in 24 weeks, using a tool to assess their FMS in applied settings (Platvoet, Elferink-Gemser, & Visscher, 2018). The schools' eight PE teachers used a digital questionnaire to score their perceptions of children's SLC (Platvoet, Elferink-Gemser, Baker, & Visscher, 2015). Based on their SLC, each child was then placed in the low ($n = 33$), average ($n = 107$), or high SLC-group ($n = 30$). We used a MANOVA to examine group differences, with the four subtests as dependent variables. The results revealed that regardless of SLC-group, children improved their FMS over 24 weeks ($F(4,163) = 10.22$, $p < .05$, Wilks Lamba = 0.800). An interaction effect was found for FMS assessment and SLCgroup ($F(8,326) = 2.23$, $p < 0,05$, Wilks Lamba = 0.899). The children in the average and high groups improved more on the moving sideways subtest than those in the low group ($p < .05$). The MANOVA showed a main effect for SLC-group ($F(4,163) = 4.69$, $p < .05$, Wilks Lamba = 0.804). The average and high groups outperformed the low group on the measurements for walking backwards and moving sideways ($p < .05$). The high group also outperformed the low group on jumping sideways at both measurements, while the average group only achieved this at T1. The high group scored better on jumping sideways than the average group at T1 ($p < .05$). No differences in proficiency were found between the three groups on the hand-eye coordination assessment ($p > .05$). In sum, we found an association between children's SLC and level of FMS and changes therein; this was especially pronounced in children with a lower SLC, who had a lower proficiency and improved less on the subtest moving sideways.

Keywords: Motor development, early childhood, proficiency, intrapersonal capacity, physical literacy

INTRODUCTION

Well-developed fundamental movement skills (FMS) are a prerequisite for long-term involvement in physical activity, and even for becoming an elite athlete (e.g., Haugen & Johansen, 2018; Logan, Ross, Chee, Stodden, & Robinson, 2017; Lloyd, Saunders, Bremer, & Tremblay, 2014). FMS are composed of locomotor skills (e.g., walking, hopping), balance / stability skills (e.g., balancing, turning), and object control skills (e.g., throwing, catching). Newell's constraints model states that movement skills arise from the interaction between a task (e.g., goals rules, equipment), the environment (e.g., accommodation, group dynamics), and individual related factors (e.g., body composition, motivation, tenacity) (Newell, 1986). During early childhood (i.e., from the ages 6–8), a critical stage in which children develop and improve rapidly in FMS performance, it has been reported that the extent to which children acquire FMS competency differs (Burns, Fu, Hannon, & Brusseau, 2017). Whereas many studies (e.g., Goldfield, Harvey, Grattan, & Adamo, 2012; Jones et al., 2011; Morgan et al., 2013; Roach & Keats, 2018) focused on environmental factors (e.g., supportive physical and social environment, amount of physical education and physical activity), we focus on individual related factors; i.e. children's sport learning capacity (SLC) as possible indicators of FMS performance development. A well-developed balance is assumed to be a prerequisite for postural control which is critical to perform more complex skills like hopping, throwing, and kicking (Clark, 2007). It is assumed that balance / stability skills develop in the initial stage, whereas locomotor and object control skills develop faster at later stages of the fundamental movement phase (Goodway, Gallahue, & Ozmun, 2013). An objective assessment of children's proficiency in FMS provides practitioners with an opportunity to better understand children's performance level and to meet their developmental demands. Practical tools that are available to measure FMS in applied settings cover the broad performance spectrum of FMS proficiency as well as the individual components (Platvoet, Elferink-Gemser, & Visscher, 2018). The interaction between the three constraints, i.e. task, environment, and individual, determine the developmental pattern of movement in a specific motor skill task (Newell, 1986). Age is positively related to children's FMS proficiency (Ahnert, Schneider, & Bos, 2009; Fransen et al., 2014; Vandorpe et al., 2011). However, this does not mean that children 'naturally' acquire FMS proficiency (Barnett et al., 2016; Logan et al., 2017). Those aged under ten who spent many hours in a wide range of activities showed the highest levels of FMS proficiency when aged between ten and twelve (Fransen et al., 2012). Most often, the children's parents determine whether they participate in a number of sports, and how children experience the outcomes of sport participation (Harwood, Knight, Thrower, & Berrow, 2018). This explains the importance of the environment for children's FMS developmental paths as it strongly influences their opportunities and may explain differences between children's FMS performance (Clark & Metcalfe, 2002; Stodden et al., 2008). In addition, children's FMS do not improve without specific instructions, even when offered opportunities to play freely with appropriate equipment (Goodway et al., 2013; Roach & Keats, 2018). Individual differences may be explained by psycho-cognitive performance development capacities to 'get most out of practice'. Regardless of background and gender, motivational characteristics strongly predict primary school children's' achievement (Hornstra, Van der Veen, Peetsma, & Volman, 2013). This relates strongly to the concept of physical literacy. Physical literacy means that an individual has the motivation, confidence, physical competence, knowledge, and understanding to value and take responsibility for maintaining purposeful physical activity throughout the life course (Whitehead, 2013). Gulbin, Oldenziel, Weissensteiner, and Gagné (2010) and Gu, Chen, and Zhang (2019) stated that physical education (PE) teachers might be able to identify and develop these capacities thanks to their educational background and the developmental nature of education (Gu et al., 2019; Gulbin et al., 2010). In PE teachers' perceptions, children aged 6–8 with sport potential are mainly characterized by their capacity for and attitude to work (e.g., work hard, get the best out of themselves) and their SLC (e.g., pick up clues fast, want to improve themselves) (Platvoet, Elferink-Gemser, Baker, & Visscher, 2015). Sport coaches who, regardless of the type of sport, also found these capacities at a young age most important (Platvoet et al., 2018), confirmed this finding. The relevance of sport potential indicators related to children's capacity for psycho-cognitive performance development capacities is in line with findings from other studies (Abbott & Collins, 2004; MacNamara, Button, & Collins, 2010). At a young age, it is especially important to focus on the capacity to develop, instead of the performance itself, although both are considered as being important in children's movement development (Abbott & Collins, 2004). As most children, when young, enjoy moving and playing, children's initial work attitude should be fair. Their SLC is particularly thought to be associated with FMS, and this may explain differences in movement skill development. The items underlying this capacity are a combination of psychological (e.g., likes to work hard), cognitive (e.g., pick up clues fast), and motor (e.g., good coordination between upper and lower body) skills (Platvoet et al., 2015). Although there is significant attention to the development of FMS in young children, the intrapersonal mechanism that drives and explains individual differences in development is still a relatively underexplored area in research. The main aim of this study is to determine whether in teachers' perceptions, higher SLC is associated with the level of fundamental movement skills (FMS), and the changes therein over 24 weeks in 7-year-olds. We hypothesize that children who score high in PE teachers' perceptions on SLC have a better FMS proficiency and develop their FMS more than those with lower scores.

METHOD

Ethical statement

This study procedure was approved by the ethical advisory committee at the Faculty of Health of the HAN University of Applied Sciences (reference number EACO 17.12/89). All parents were informed by the schools prior to the assessments and were asked to communicate with the school in case they did not want their child(ren) to participate. We recorded all data anonymously in a secured dataset.

Participants

We recruited participating PE teachers and children at eight regular primary schools in the Netherlands. Based on rural and urbanized areas, we made a selection in four different provinces to obtain a representative sample. A total of eight PE teachers and 170 children (all aged 7 at first measurement, 78 boys and 92 girls) participated. All children participated in the regular two-week 45- min PE classes. Most of the children were in their PE classes for over a year. Participating PE teachers had a bachelor's degree in PE and worked at least three days a week at a primary school. They all used the Handbook of Physical Education in primary education (Mooij & Van Berkel, 2012) to determine the content of their PE classes.

Measures

We measured teacher's perceptions of the children's SLC in November with a digital questionnaire. The teachers were not informed about the children's FMS proficiency. We assessed children's fundamental movement skills (FMS) within 24 weeks with two measurements (T0, T1). The FMS were assessed during regular PE classes, in October and April.

Sport potential questionnaire. We used the Scale for Identification of Sport Potential (SISP) (Platvoet et al., 2015) to measure the PE teachers' perceptions of each child's SLC. The original SISP consists of 27 items divided over six capacities, i.e. work attitude, sport learning, motor coordination, creativity, interpersonal, and intellectual capacities. The reliability and internal validity of the SISP were confirmed, where Cronbach's α for SLC was 0.87 and the ICC was 0.90 (Platvoet et al., 2015); Table 1 presents the 9 SLC items. These items express children's capacity to learn skills that are related to FMS proficiency and or sport skills. In a pilot-study, we determined the SLC intra-rater reliability by a PE teacher who scored the nine items for 51 children, twice within 8 days. The ICC was 0.75, which is considered acceptable (Litwin, 1995). The participating teachers reported their perceptions of each child's SLC online on a five-point Likert scale (1 = strongly disagree to 5 = agree very much) on each of the 9 items. Each item's score was summed to create one SLC score between 9 (lowest possible score) and 45 (highest possible score) per child. Before filling in their SLC perceptions', the teachers taught and observed the children for at least 10 weeks twice a week during the regular PE classes.

Fundamental movement skill assessment. We assessed the FMS of the children in week 0 and in week 24. The assessment supervisors were PE students who were well-trained by university researchers to guarantee standard use of the assessment protocol. In addition, each assessment session was supervised by recently graduated PE students familiarized with the assessment protocols. We used a recently developed tool to assess children's FMS in applied settings (Platvoet, Elferink-Gemser, & Visscher, 2018). The assessment battery includes four subtests i.e., Korperkoördinationstest für Kinder (KTK) Walking Backwards (WB); KTK moving sideways (MS); KTK jumping sideways (JS) and a hand-eye coordination assessment (EHC). For a detailed description of the subtests, we refer to Kiphard and Schilling (2007), Kiphard and Schilling (1974) and Faber, Oosterveld, and Nijhuis-Van der Sanden (2014). Platvoet, Elferink-Gemser, and Visscher (2018) found that, on average, 7-year-olds (n = 265) scored 34 ± 12.6 on WB, 38 ± 7.6 on MS, 49 ± 14.5 on JS, and 7 ± 6.2 on EHC. Boys outperformed girls on the EHC subtest; girls scored better at the WB subtest.

Data analysis

The SLC scores ranged from 9 to 45 with a median score of 32.00 and a mean of 31.34 ± 6.73; data were normally distributed with acceptable skewness and kurtosis values. This was expected as in this study typically developing 7-years-old of regular primary schools participated. On most capacities or skills typically developing children score average, some score low, and some score high. Therefore, to determine whether children with higher levels of SLC have a higher FMS proficiency and improve their FMS at a faster rate, we created a large group with children with an average score, a small group with children with a low score, and a small group with children with high SLC scores (i.e., average, low, high). The average group (~68%; 107 children, 62 girls), consisted of children with a score between 26 and 36 ('neutral'- 'agree'), the low group (~16%; 33 children 13 girls) were those children with a score between 9 and 25 ('strongly disagree'- 'neutral'), and the high group (~16%; 30 children, 17 girls) scored between 37 and 45 ('agree'- 'strongly agree'). We calculated descriptive statistics for the boys and girls in each group separately for each of the four FMS subtests at T0 and T1. We used a repeated measures analysis of variance to examine group differences, with the four subtests as dependent variables and sex as covariate. A first analysis revealed no sex * sport learning capacity interaction effects on the dependent variables, as such, sex was excluded from this analysis. In the within-subjects analysis, a measurement effect shows differences between scores on both measurements. An interaction effect between group and measurement reveals differences between the three groups that change as a function of time. In the between subject's analysis, the group effect shows differences in average scores at T0 and T1 between the three SLC groups. We calculated effect sizes (Cohen's d) to interpret the development in scores from T0 - T1 per SLC-group and for boys and girls. Additionally, effect sizes were also calculated to interpret the difference in average development between the low and average group, the low and high group, and the average and high group with $0.20 \leq d \leq 0.49$ indicating a small effect, $0.50 \leq d \leq 0.79$ a medium effect, and $0.80 \geq$ a large effect (Cohen, 1992). Significance level was set at $p < .05$. All data were analyzed using SPSS version 24.

Table 1. The nine sport learning capacities (SLC) items.

Item
1. Likes to learn new movements
2. Has strong perseverance
3. Moves fluently
4. Has well developed coordination between lower and upper body
5. Likes to work hard
6. Is able to customize to changing situations
7. Quickly pick up clues
8. Is constantly looking for new challenges
9. Often chooses difficult exercises

RESULTS

Proficiency

The mean scores and standard deviations at T0 and T1 and the average development over 24 weeks for each SLC-group and for boys and girls are presented in Table 2 and Fig. 1. The repeated measurements MANOVA showed a significant main effect for SLC-group ($F(4,163) = 4.69$, $p < .05$, Wilks' Lambda = 0.804), indicating that, on average, the low, average, and high group scored differently at T0 and T1. At the WB subtest ($F(1,169) = 10.01$, $p < .05$) and the MS subtest ($F(1,169) = 16.34$, $p < .05$), the average and high SLC-group outscored the low group for both measurements. At the JS subtest, the high group outperformed the low group on both measurements, the average group only at T1, $F(1,169) = 18.37$, $p < .05$. At the JS subtest at T1, the high group also outperformed the average group. The univariate analysis did not reveal any differences between the three SLC-groups on the hand-eye coordination assessment ($p > .05$) (Fig. 1).

Table 2. Descriptive statistics for FMS and development from T0 to T1 in 7-year-old children (n=170) divided in three SLC-groups for the four subtests: walking backwards (WB), jumping sideways (JS), moving sideways (MS), and hand-eye coordination (EHC).

			Proficiency scores				Development from T0 –> T1						
	Sport Learning Capacity Group		T0 M ± SD	T1 M± SD	Cohen's d	M ± SD		Low vs average		Low vs high		Average vs high	
								d	95% CI	*d*	95% CI	d	95% CI
Walking Backwards	Low	Overall	24.67 ± 12.14	31.37 ± 10.84	-0.54	6.70 ± 2.71	Overall	0.14	[-16.90 ,-4.97]	0.04	[-23.82, -8.87]	-0.09	[-11.09, 0.27]
		Boys	25.65 ± 11.19	30.24 ± 8.62	-0.36	4.59 ± 3.95	Boys	-0.04		-0.05		-0.01	
		Girls	23.38 ± 13.64	32.85 ± 13.04	-0.76	9.46 ± 1.25	Girls	0.35		0.17		-0.17	
	Average	Overall	34.89 ± 12.52	40.16 ± 10.16	-0.43	5.27 ±2.02							
		Boys	30.62 ± 11.55	35.62 ± 10.59	-0.45	5.00 ± 0.89							
		Girls	37.98 ± 12.36	43.45 ± 9.92	-0.45	5.46 ± 1.79							
	High	Overall	37.67 ± 11.40	43.91 ± 12.46	-0.48	6.24 ± 4.39							
		Boys	35.94 ± 10.91	41.06 ± 13.19	-0.41	5.13 ± 4.07							
		Girls	39.29 ± 11.94	46.59 ± 12.04	-0.55	7.29 ± 4.64							
Jumping sideways	Low	Overall	35.97 ± 10.92	45.93 ± 8.22	-0.84	9.97 ± 2.62	Overall	0.19	[-16.51, -5.89]	-0.21	[-26.94, -3.63]	-0.37	[-14.14, -4.07]
		Boys	38.71 ± 10.88	45.59 ± 7.55	-0.59	6.88 ± 2.53	Boys	-0.19		-0.91		-0.72	
		Girls	32.38 ± 10.30	46.38 ± 7.63	-1.18	14.00 ± 3.23	Girls	0.67		0.72		-0.01	
	Average	Overall	45.86 ± 11.51	54.22 ± 8.97	-0.74	8.36 ± 1.03							
		Boys	45.56 ± 13.04	54.00 ± 8.72	-0.68	8.44 ± 1.62							
		Girls	46.08 ± 10.36	54.39 ± 9.22	-0.79	8.31 ± 0.67							
	High	Overall	48.79 ± 9.83	60.73 ± 10.20	-1.05	11.93 ± 2.67							
		Boys	46.19 ± 7.05	61.88 ± 11.25	-1.39	15.69 ± 4.32							
		Girls	51.24 ± 11.56	59.65 ± 7.88	-0.74	8.41 ± 1.25							

Moving sideways	Low	Overall	32.23 ± 7.48	34.20 ± 8.85	-0.24	1.97 ± 5.64	*Overall	-0.55	[-10.01, -3.86]	-0.84	[-14.74, -7.03]	-0.30	[-6.88, -1.02]
		Boys	33.06 ± 7.73	34.53 ± 9.79	-0.17	1.47 ± 6.14	Boys	-0.63		-1.16		-0.65	
		Girls	31.15 ± 7.30	33.77 ± 7.82	-0.35	2.61 ± 5.07	Girls	-0.47		-1.17		-0.47	
	Average	Overall	35.77 ± 6.46	41.10 ± 6.78	-0.81	5.34 ± 6.52							
		Boys	36.80 ± 6.32	41.78 ± 6.84	-0.76	4.98 ± 4.92							
		Girls	35.02 ± 6.50	40.61 ± 6.75	-0.84	5.60 ± 7.50							
	High	Overall	36.06 ± 5.08	43.45 ± 7.55	-1.15	7.39 ± 7.11							
		Boys	36.44 ± 4.78	42.56 ± 8.29	-0.90	8.58 ± 5.11							
		Girls	35.71 ± 4.34	44.29 ± 6.93	-1.48	8.59 ± 5.11							
Hand-eye coordination	Low	Overall	5.50 ± 5.13	7.73 ± 5.23	-0.43	2.23 ± 3.89	Overall	-0.28	[-7.34, -1.80]	-0.47	[-10.09, -3.15]	-0.09	[-4.69, 0.59]
		Boys	6.53 ± 5.76	9.24 ± 5.95	-0.46	2.71 ± 4.25	Boys	-0.26		-0.50		-0.28	
		Girls	4.15 ± 4.00	5.77 ± 4.38	-0.39	1.61 ± 3.43	Girls	-0.38		-0.63		-0.09	
	Average	Overall	7.16 ± 5.89	10.67 ± 6.12	-0.58	3.60 ± 5.47							
		Boys	7.71 ± 6.27	11.71 ± 6.57	-0.62	4.00 ± 5.67							
		Girls	6.76 ± 5.62	10.06 ± 5.72	-0.58	3.31 ± 5.27							
	High	Overall	9.30 ± 5.70	13.33 ± 5.64	-0.71	4.03 ± 3.84							
		Boys	11.38 ± 6.36	15.75 ± 5.22	-0.75	6.13 ± 8.75							
		Girls	7.35 ± 4.34	11.06 ± 4.78	-0.81	3.71 ± 3.24							

Note 1. The univariate analyses revealed that from T0 through T1, children developed their proficiency on all subtests except on hand-eye coordination. An interaction effect was found for measurement x group. *Children in the average and high SLC-group developed faster than the children in the low group on the MS subtest from T0 through T1 ($p < 0.05$).
Note 2. The thresholds for the effect's sizes were $0.20 \leq d \leq 0.49$ indicating a small effect, $0.50 \leq d \leq 0.79$ a medium effect, and $0.80 \geq$ a large effect (Cohen, 1992).
Note 3. Confidence intervals for the differences between the groups are only given for the overall score as no sex * sport learning capacity group interaction effects was observed

Development

The children improved their FMS over 24 weeks ($F(4,163) = 10.22$, $p < .05$, Wilks' Lambda = 0.800); post-hoc analysis shows that children improved their scores on all subtests, except on the hand-eye coordination assessment. An interaction effect was found for measurement and SLC-group, $F(8,326) = 2.23$, $P < .05$, Wilks' Lambda = 0.899, indicating that the groups differ in their FMS development over time. On the MS subtest, children in the average and high group showed greater improvement, on average, than those in the low group, $F(4, 163) = 5.38$, $p < .05$, $d = -0.55$ and $d = -0.84$ respectively.

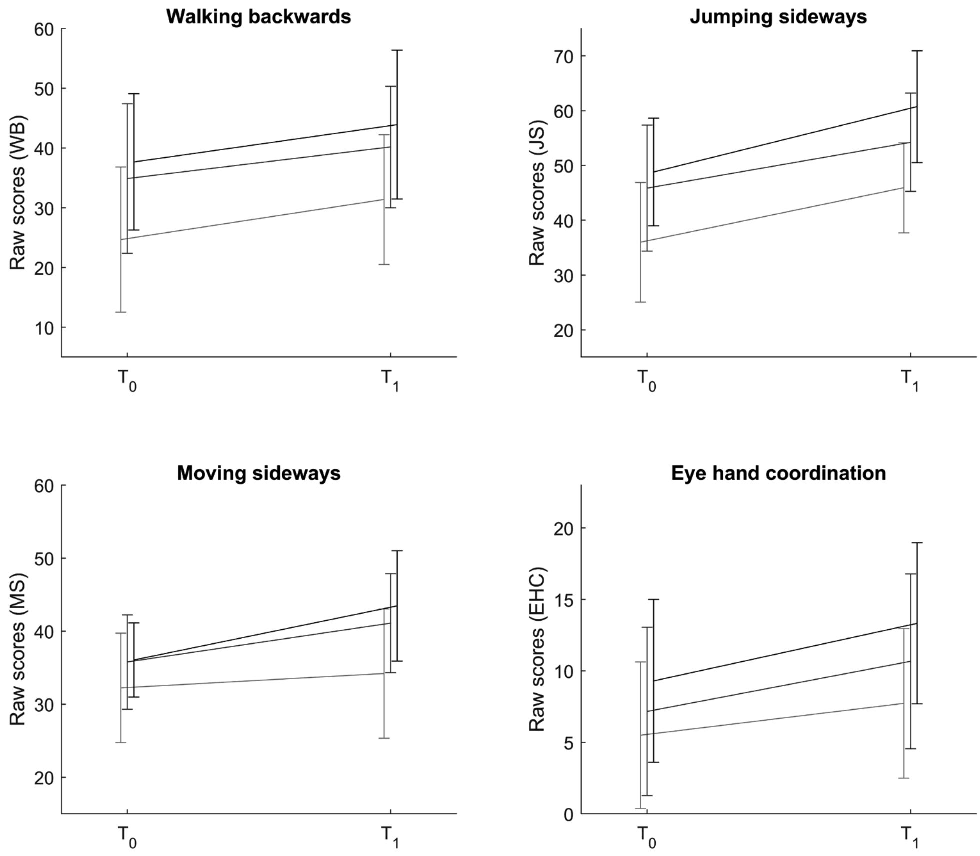

Figure 1. Development of FMS from T0 to T1 of 7-year-old children on the four subtests: walking backwards (WB), jumping sideways (JS), moving sideways (MS), and hand-eye coordination (EHC). The solid dark line is the high SLC-group, grey line is the average SLC-group, and the light grey line is the low SLC-group.

DISCUSSION

Our main aim was to determine whether, in teachers' perceptions, higher sport learning capacity (SLC) is associated with the level of fundamental movement skills, and the changes therein over 24 weeks in 7-year-olds. Regardless of their SLC, our results show that 7-year-old children improved their FMS over 24 weeks. Subsequently, those with an average and high SLC improved more than those with a low SLC, although only on one of the four subtests. The results also showed that a higher SLC score is associated with a higher FMS proficiency. This is, to our knowledge, the first study on the association between SLC and young children's FMS proficiency and change therein over 24 weeks. Some of the items (e.g., much perseverance, like to work hard) underlying this capacity are related to motivational characteristics (Platvoet et al., 2015). Previous studies have shown that these characteristics predicted children's results in primary school achievement (Hornstra et al., 2013). Our findings on SLC are also in line with the effective learning strategies reported by Jonker, Elferink-Gemser, and Visscher (2010) who showed that young adolescents with higher sport levels, get more out of the opportunities offered them. In addition, Clark and Metcalfe (2002) and Stodden et al. (2008) stated that environmental opportunities can explain differences between children's FMS. In our study, the circumstances known to influence children's development (e.g., amount of quality PE, school environment, involvement in organized sports) (Goldfield et al., 2012; Roach & Keats, 2018; Stodden et al., 2008) were similar for all participating children. Thus, it appears that SLC can explain differences in proficiency and development between young children too. Still, it is important to note that in this study we did not measure children's activities between both FMS assessments. In the light of transfer of learning (Schmidt & Young, 1987), it would be valuable to understand the influence of the activities practiced in and beyond the PE classes on the results at the FMS assessments. Children with better FMS proficiency tend to be more active (Goodway & Rudisill, 1997; Stodden et al., 2008). As children develop their FMS in a diverse range of settings it might be that the children in the average and high SLC-group of the current study were 'just' more active both in and out school. So, to which extend the higher FMS proficiency and quicker FMS development of children in the average and high group is a result of a higher SLC in PE classes has to be determined in future research. On the MS subtest, the average and high groups improved more quickly than the low SLC-group. The effect sizes revealed that the effect of sport learning capacity on children's development is large in the high group (−0.84) versus moderate in the average group ($d = -0.55$), =suggesting that a higher SLC could result in more improvement within a particular time interval.

Differences between the groups in FMS development may be explained by the age and complexity of the movement. Moving sideways is a subtest in which children have to both use and coordinate their upper (arms) and lower (legs) body, which is one of the items underlying the SLC. Children start to improve this skill from early childhood, and it needs more time, effort, and persistence, i.e. higher SLC, to develop to a high proficiency (Getchell & Whitall, 2003). Locomotor and balance/ stability skills are more directly controlled by the body. Children practice these skills from the day they try to stand and walk, in daily activities, and children develop these skills more in the 'initial' or 'elementary' stage (Goodway et al., 2013). Although we found no significant differences on the subtest hand-eye coordination, the effects sizes show small to moderate effects between the groups. The results at T0 show that children's proficiency on the hand-eye coordination subtest is limited. Object control is probably the most complex FMS component and requires a more 'mature' stage of development (Goodway et al., 2013). In this task, children must coordinate their actions to the dynamics of a moving ball, which implies an increased contribution of the perception of ball trajectory and the integration of this information in the ongoing action. Further research should determine whether differences in SLC could explain differences in FMS development and proficiency, from earlier phases in development, and over a longer time. This study has several practical implications. First, sport professionals working with young children should be aware of the importance of SLC for FMS proficiency. The items that underlie this capacity express skills like goal-directed learning, perseverance, and motivation to learn, which in several studies in talent identification and talent development have been shown to be highly relevant as determinants of potential (Baker & Wattie, 2018). SLC expresses items related to Dweck's growth mindset theory in which she states that this type of mindset can be learned (Dweck, 2006). It is highly relevant to study 1) how and to which extent children could improve their SLC and 2) whether this improvement results in a better development of FMS proficiency. Second, in only 24 weeks, the differences in FMS proficiency between the low SLC-group and the other two groups increased on the MS subtest. Although children in the low group might need more time to develop their skills, their lower SLC score is a reason for concern. Following the developmental skill-learning gap hypothesis (Wall, 2004), larger differences with their peers in FMS proficiency will make it more difficult for them to participate in movement activities. A lower proficiency, and as a result possibly a lower self-perceived competence, can influence their intrinsic motivation to become more active and play sports (Deci & Ryan, 1985; Haugen & Johansen, 2018; Stodden et al., 2008). Third, previous studies show that FMS proficiency becomes better with age (Ahnert et al., 2009; Vandorpe et al., 2011; Fransen et al., 2014;). Our study supports this, showing that already in 24 weeks, children can significantly develop their FMS performance. Therefore, we suggest that in younger age groups, FMS benchmarks should cover a narrower age span than one year. Some limitations need to be addressed as well. First, it is possible that the FMS proficiency results in a self-fulfilling prophecy, i.e. that those who perform better are, in teachers' perceptions, also those who work harder and learn more. Observations of children's behavior may add to teachers' perceptions and improve understanding. Secondly, we do not know whether the 24-week development period is representative for improvement over a longer period. Children's motor skills development is not a linear process and it might be that some children just need more time to develop their skills. The rate of children's development is influenced by both environmental and biological factors (Malina, Bouchard, & Bar-Or, 2004). As such, the development in FMS proficiency over a longer period associated to SLC is an opportunity for further research. Thirdly, we did not control for the pedagogical and motivational climate that teachers created in their classes which may have influenced children's' development (Jaakola, Wang, Soini, & Liukkonen, 2015; Nicholls, 1989). However, we selected well-educated teachers with a bachelor's degree in physical education, and several years' experience teaching PE. In addition, they all used the same handbook for PE to determine the content of their classes and worked with most of the children for over a year. Fourth, we found on three of the four subtests no differences between the three SLC groups on development in FMS proficiency. This might be explained by a ceiling effect, i.e. those with a high proficiency probably scored at T0 near to or maximum scores for their age group which makes improvement difficult. To conclude, in this first study on the association between SLC and FMS development we show that 1) children with an average and high SLC improved their FMS proficiency faster in 24 weeks than those with a low capacity on the subtest moving sideways, and 2) children's FMS proficiency is associated with their SLC. Those children with, in teachers' perceptions, relatively low scores on these capacities showed lower FMS proficiency levels. Future research should determine how and to what extent children can develop their SLC, and whether this results in an improved development of children's FMS skills in early childhood.

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