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MOTOR SKILLS OBSERVATIONS AND GRADES IN PHYSICAL EDUCATION: EVALUATION OF MUGI OBSERVATION CHECKLISTS

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ABSTRACT

The aim was to study the relationship between motor skills and grades in the subject Physical Education and Health (PEH) in Swedish schools as well as to develop and evaluate checklists for motor skills observations of students in different school years. The checklists *Motor Development as Ground for Learning* (Motorisk Utveckling som Grund för Inlärning, or MUGI) were tested during a period of nine years. Motor skills observations of balance and coordination were carried out at two Swedish compulsory schools and included all pupils in years 1, 2, 3 (n=265) and 9 (n=245). The MUGI observation checklists were found to provide evidence of validity and reliability by explorative factor analyses and tests of reliability with Cronbach´s alpha. Significant correlations were found between students' grades in PEH in year 9 and the motor skills that were measured in years 2, 3 and 9, respectively. The MUGI checklists can be used in school to collect information when planning motor training in PE and for individual programmes of motor skills remediation.

Keywords: Grading criteria, Motor skills development, Motor skills training, MUGI model, Physical Education

INTRODUCTION

It is well known that physical activity is important for a healthy lifestyle, and several studies, including the European Youth Heart Study, report increased obesity and cardiovascular disease risk factors in children who are physically inactive (Andersen et al., 2006). Researchers conclude that a great number of children do not get enough physical activity to attain optimal health (Dencker, 2007; Westerståhl, Barnekow-Bergkvist, Hedberg, & Jansson, 2003).

Another issue that is poorly documented is whether the risk of deficiencies in children's motor skills is increasing as their physical activity decreases in both their leisure time and during their time at school. Nordic researchers have shown that there is a need for useful screening instruments and repeated examinations of pupils' motor skills status in order to make comparisons and study changes over time (Ericsson, 2007; Pless, 2001; Thorsteinsdottir, 1999).

Fundamental motor skills may be an important factor in motivating children to be physically active and to take part in social physical play. Some children with impaired coordination may not become involved in social physical play at all; consequently, they are at risk of becoming isolated and solitary on the school playground. Researchers have shown that school-aged children diagnosed with Developmental Coordination Disorder (DCD) spend less time in formal and informal team play (Smyth & Anderson, 2000). Researchers who found low motor skills levels across Australia claimed that more children and young people would play sport and take part in other physical activities if they had better motor skills (Brown, Walkley, & Holland, 2004).

Studies have shown that some children are not participating in sport or partaking in exercise because they have not established basic coordination skills while at school. A national evaluation of *Physical Education and Health* (PEH), a subject in Swedish schools, revealed that 10 percent of the pupils felt bad and clumsy during the physical education lessons and that 7 percent of the girls did not reach the declared goals of PEH (Eriksson et al., 2003). The lack of development of fundamental motor skills in early years can lead to a disinterest in physical activities, a lack of fitness, low self-esteem and health problems as children grow older (Brown et al., 2004). In the Swedish Bunkeflo project, significant correlations were found between motor skills and two components of self-esteem: friendship/sports efficacy and attention/learning efficacy (Ericsson & Karlsson, 2011).

Children with poor fitness and insufficiently developed motor skills often end up in a downward spiral leading to decreasing physical activity: they are physically passive during their leisure time and do not participate in any sports activities, and those who are most in need of motor skills training get the least practice. These children have poor motor skills because they do not participate in physical activities, and because they have poor motor skills they do not participate in physical activities; as a result, their motor skills further decline. This sees them trapped in a downward spiral of declining motor skills, fitness and motivation to take part in physical activity.

However, engagement in organised team sport does not necessarily increase physical self-worth and exercise habits from a lifelong perspective (Hofstetter, Sallis, & Hovell, 1990). One of the criticisms of teaching approaches that are directive and focus on the execution of skill is that they can actually discourage the less skilled from participation by highlighting what they cannot do in front of their peers and their teacher (Light & Fawns, 2003).

Engström (2005) found that attitudes to the school subject PE and, especially, grades in the subject were highly associated with later physical activity habits. Of those students who achieved the highest grade, 60 percent were physically active 33 years later, whereas less than 20 percent of those with the lowest grade were active sports practitioners at 47 years of age. In a study concerning low motivation in PEH (Åström, 2009), pupils revealed feeling incompetent and perceiving themselves as not being able to perform tasks set out by the teacher or not being able to perform the tasks good enough in relation to their classmates. According to teachers, some reasons for pupils who do not participate in PEH can be that pupils find it embarrassing to show their skills and/or body to others, uncertainty, poor self-esteem, lack of interest, or that those who play truant from other subjects also play truant from PEH (Franzén, 2009; Larsson, 2003).

School physical education thus seems to be one logical and practical point for intervening in the damaging cycle described above. When planning intervention programmes to increase motivation to be physically active, early school interventions to improve fundamental motor skills may be successful starting points. In this work, there is a need for useful screening instruments to help teachers decide which pupils are in need of specific support in their motor skills development.

Goals and Grading Criteria in PEH

According to the Swedish curriculum, basic motor skills are a significant constituent of the declared goals of PEH (Skolverket, 2011). The pupils are supposed to develop their physical, psychological and social abilities as well as a positive self-efficacy regarding their physical competence. One of the basic goals of PEH is that pupils develop an all-round competence in physical activities so that they should be able to participate in different activities on their own terms.

How teachers evaluate and grade their pupils significantly influences how the pupils understand what knowledge is important to learn in a school subject. It also influences pupils´ self-esteem and how they value their abilities (Nyström, 2004). Moreover, when pupils are asked what they think would give them a high grade in PEH, the answers vary from cooperation, social competence and doing their best to having a fighting spirit and a positive attitude. Motor skills are seldom mentioned, although many pupils acknowledge that physical condition, strength, technique or having good sport results are key skills (Redelius, 2009). Most of the pupils look upon the assessment as a form of sport competition (Larsson, 2009). There has been some criticism regarding the forms and contents of PEH, which sometimes seem to be the same as in sport federations. Ball games and other team sports are frequently on the schedule (Carli, 2004; Eriksson et al., 2003; Skolverket).

However, when teachers are interviewed about what the pupils are supposed to learn in the subject, they rarely mention motor skills as a goal for pupils to improve. Among teachers' grading criteria are sports results, social abilities, helpfulness and having a positive attitude (Redelius, 2007). There seems to be a large amount of confusion concerning teachers' perspectives on the subject's goals, important knowledge to achieve in the subject and which grading criteria to use in the subject. Further, teachers also value boys' achievements higher than girls'; PEH is the only school subject where girls have significantly lower grades than boys.

Since several grading criteria in PEH include different forms of motor skills — balance, precision, speed, motor control and mobility — it is interesting to find out whether fundamental motor skills are important in PEH and to what extent pupils' motor skills can be related to their grades in PEH during year 9.

Research Questions

One of the aims of this study was to analyse the relationship between motor skills and grades in PEH. How important are motor skills in terms of grades in PEH? Another aim was to develop and evaluate checklists for motor skills observations in different school years. The following questions were examined:

- What relationships can be found between fundamental motor skills and grades in PEH in year 9?
- Will the MUGI observation checklists fulfil the criteria of validity and reliability for measuring motor skills in school pupils?

METHOD

All pupils in three school years at two compulsory schools in a middle class area in Sweden were observed in years 1, 2, 3, and 9. The pupils' parents were informed and gave their written consent; only two pupils declined participation in the study. In total, 263 of 265 pupils agreed to participate, of which 49 percent were boys and 51 percent were girls. At the follow-up, 18 pupils had moved out of the region, leaving 245 pupils in the study in year 9. The study was approved by the Ethics Committee of Lund University and conducted according to the Declaration of Helsinki.

The education programme *Motor Development as Ground for Learning (MUGI)* [in Swedish: Motorisk Utveckling som Grund för Inlärning] was used. The MUGI model was developed in Lund in the early 1980s, as collaboration between PEH teachers and the School Health Service (Ericsson, 1987). It includes motor skills observations of all pupils at school start, information to teachers and parents and offers of extra motor skills training. An evaluation of the MUGI model showed that the motor training had positive effects on children's motor control, perception and ability to remember details (Ericsson & Lindström, 1987).

In order to study the development of motor skills in relation to PEH, motor skills observations with the MUGI observation checklist (Appendix A) were conducted by the school nurse and by the children's teachers every year for the first three school years as well as in year 9, one month before the pupils left compulsory school.

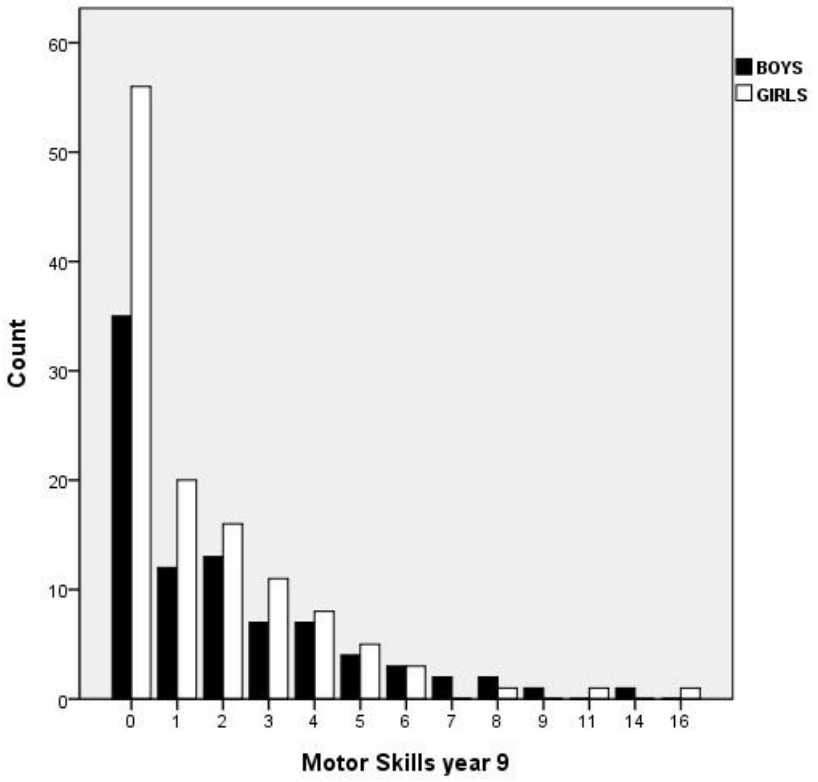

Figure 1. Distribution of motor skills among boys and girls in school year 9 according to the adjusted MUGI motor observation checklist.

The checklist consists of nine gross motor items measuring two components of motor skills: *balance/bilateral coordination* (e.g., hopping and balancing on one leg) and *hand-eye coordination* (e.g., throwing, bouncing and catching a ball) (Ericsson, 1998; 2003; 2008a). The principles for the MUGI motor observation checklist can be summarised as giving early indications of pupils in need of extra support in motor skills development. Groups of students are observed for periods of 30-40 minutes. There no clear test situations, and there are no measurement of strength, speed or maximal exertion. There are no fixed instructions to be given to the children, and the tasks are relatively easy to observe and evaluate. Each task can result in a score from 0 to 2 points: 0 for *no problem*, 1 for a *small deficit* and 2 for a *major deficit*.

To avoid the risk of children with good motor skills being judged as having motor deficiencies because they temporarily lost their balance or otherwise happened to be unsuccessful in one or two exercises that they normally would be able to do, the borderline for good motor skills has been set at 2 points. The concept of *good motor skills* thus indicates a mastery of body movements that corresponds to 0-2 total points on the MUGI observation checklist. *Small motor skills deficiencies* correspond to 3-9 total points, and a score of 10-32 points corresponds to *major motor skills deficiencies*. The reason for setting the limit at 10 points for major motor skills deficiencies is that both the initial data collected in years 1 and 2 (Ericsson, 2003) as well as the observations in year 9 (Figure 1) showed a notable reduction in the number of pupils who had 10 points as compared to those who had 9 points. The scale can, as in most observation instruments, be viewed as being arbitrary; nevertheless, it offers an opportunity to study and compare pupils with good motor skills and, respectively, the extent of pupils with motor skills deficiencies.

Validity and Reliability

The MUGI checklist (Appendix A) has been validated and tested for reliability in school years 1 and 2, as reported in earlier publications (Ericsson, 2003; 2008b). In an explorative factor analysis (n=245), nine items with factor weights between 0.56 and 0.80 were separated into two components: balance/bilateral coordination and hand-eye coordination. Internal consistency, estimated with Cronbach's alpha, was 0.76 (balance/bilateral coordination), 0.65 (hand-eye coordination) and 0.80 in total. Inter-rater reliability, studied with three independent raters, was 0.75 and test-retest 0.78 using Spearman's rank correlation (Gustafsson, 2008). The checklist was found to fulfil the criteria as an assessment tool for motor skills and to be reliable enough for comparing groups of pupils in early school years. However, to better fit the year 9 students, the original checklist was somewhat adjusted. The purpose is now to validate the adjusted checklist so that it can be used on older students. In three of the nine items, some minor changes were made: *item 2* was changed to bouncing a ball, not only five consecutive times, but also simultaneously moving forward and alternatively changing hands without stopping for three minutes. In *item 9a*, a skipping-rope was used instead of a hula hoop, and the pupils were asked to skip forward 15 meters, skip on the spot 10 consecutive times and then return skipping to the starting point. Three

hurdles, each 50 cm high, were used in *item 9c* for the pupils to run and jump over consecutively.

Table 1. Rotated Component Matrix of tasks school year 9, Extraction Method: Principal Component Analysis

	Component	
MUGI items	1	2
1-Throw and catch a large ball		,788
2-Bounce a large ball		,759
3-Skip in diagonal pattern	,845	
4-Hop on one leg	,554	
6-Walk with toes pointing out	,629	
7-Alternating ”ski hop”	,771	
9-Obstacle course		,687

An exploratory factor analysis (EFA) was carried out on motor skill items in year 9 (Table 1). A rotated component matrix was used, and the extraction method was a principal component analysis. The same two components as in years 1 and 2 were found: component 1 measuring *balance/bilateral coordination* (items 3, 4, 6 and 7) and component 2 measuring *hand-eye coordination* (items 1, 2 and 9). Items 5 and 8 were excluded from further analyses since they loaded in more than one component. The remaining seven items all had factor loadings between 0.55 and 0.85, meaning they are relevant to measure the two components of pupils' motor skills in year 9. A test of reliability with Cronbach´s alpha gave the value 0.55, which can be considered acceptable for comparing groups, taking into account the number of items being even fewer than initially.

Collected data have been analysed in the programme Statistical Package for the Social Sciences (SPSS). As most of the instruments of measurement used in the study gave data on ordinal scales and the collected data were mostly not normally distributed, nonparametric tests (Kruskal-Wallis and Mann-Whitney U test) were used to study the differences in motor skills and grades in PEH between groups. To examine the correlations, the Spearman rank correlations were used. An alpha level of 0.05 was used for all statistical tests.

The sample in the study was not randomised, but comprises all pupils in three school years at two compulsory schools. Baseline data concerning motor skills and attention, which have been reported in previous publications (Ericsson, 2003; 2008a), were found to be consistent with other findings (e.g., Gjesing, 1997, Henderson & Sugden, 1992; Kadesjö & Gillberg, 1999). Thus, the results from this study may be generalised to other similar populations.

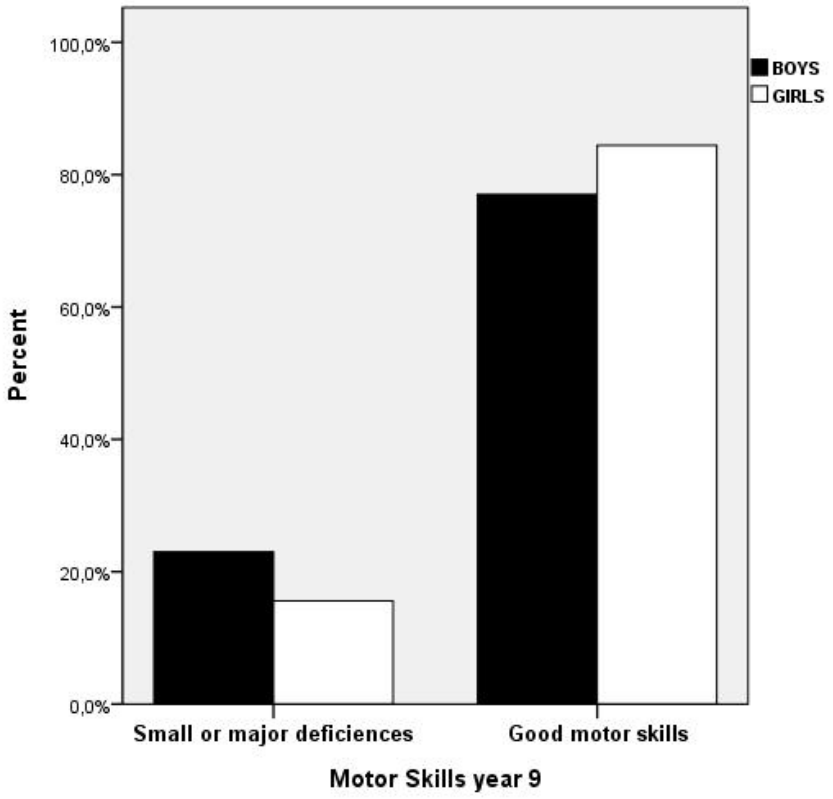

Figure 2. Motor skills among boys and girls in school year 9 according to the adjusted MUGI motor observation checklist.

RESULT

The baseline data concerning motor skills showed that 51 percent of the pupils in years 1 and 2 had good motor skills, 37 percent had small deficits and 12 percent had major motor deficits.

As mentioned earlier, these results are consistent with other findings. In year 9, 73 percent had good motor skills, 26 percent had small deficits and 1 percent had major deficits (Figure 2).

Grades in Physical Education and Health

In year 9, the breakdown of grades in PEH was as follows: 20 percent of the examined pupils received a G (Pass), 30 percent received a VG (Pass with distinction), 48 percent received an MVG (Pass with special distinction), and 2 percent of the pupils did not reach PEH's declared goals (i.e., they did not receive a grade in PEH). Further, boys had significantly higher grades in PEH than girls.

Correlations between Motor Skills and Grades in PEH

Significant correlations were found between grades in PEH in year 9 and motor skills tested in years 2, 3 and 9. The correlations are rather low but seem to become stronger the older the pupils become (Table 2). In year 9, about 9 percent of the variation in grades in PEH can be explained by the pupils' motor skills.

Pupils with good motor skills in year 9 had significantly higher grades than pupils with deficient motor skills. The results showed that among pupils with good motor skills, there were also many (68 percent) with MVG, the highest grade possible in PEH.

A large amount (40 percent) of pupils who had deficient motor skills received either the lowest grade or no grade at all. The results from motor skill observations carried out in years 1, 2 and 3 showed that 43 percent, 50 percent and 50 percent (respectively) of pupils who then had major motor skills deficits received the lowest grade in PEH in year 9, and 59 percent of pupils who had good motor skills during their early school years received the highest grade.

Table 2. Correlations (significant in bold) according to Spearman's rho between motor skills and grades in Physical Education and Health school year 9 (n=245)

Motor skills	Correlations with grades in PEH school year 9
School year 1	-,122
	Sig. ,073
School year 2	-,148*
	Sig. ,028
School year 3	-,248**
	Sig. ,000
School year 9	-,266**
	Sig. ,000

*. Correlation is significant at the 0.05 level (2-tailed).
**. Correlation is significant at the 0.01 level (2-tailed).

CONCLUSION

The finding that 27% of the pupils in school year nine still have small or major deficits indicate that motor skill deficits do not disappear by themselves and that the school's two lessons of PEH per week are not sufficient to stimulate improvements in motor skills for these pupils. These results are in line with other studies (Cantell, 1998; Cratty, 1997; Kadesjö & Gillberg, 1999; SEF, 2000), which confirm that without any remediation programme many children with deficits in motor skills will retain these problems for many years.

The reliability tests and the results from the factor analyses of the items on the MUGI observation checklists gave values at an acceptable level of validity and reliability for measuring motor skills in school years 1, 2, 3 and 9. The checklists could thus be used in school to collect information when planning motor training in PE and for individual programmes of motor skills remediation.

The results in this study indicate the possibility to predict grades in PEH from motor skills observations. Motor skills functioning is one of several important components in the grading criteria, and the results show that there are significant correlations between motor skills in years 2, 3 and 9 and grades in PEH school year 9. The results also show significant differences in grades

in PEH between pupils with good motor skills and pupils with deficient motor skills.

The results from motor skill observations showed that many of the pupils who had major motor skills deficiencies in school years 1, 2 and 3 received the lowest grade in PEH in year 9, whereas 59 percent of pupils who had good motor skills the early school years received the highest grade. Hence, the results support that motor skills observations at school start could be a useful pedagogic instrument to predict some achievements and results in PEH in year 9.

To combat declining physical activity levels, there is a need for more knowledge regarding motor development in children. The link between motor competence, physical health and psychological health needs to be examined further. Early discovery provides an opportunity for early intervention, which could be important when it comes to avoiding discouraging pupils whose fitness is poor. Moreover, measuring the motor skills of children from an early age allows for comparisons to be made and changes to be studied over time, as pointed out by Thorsteinsdottir (1999) and Pless (2001). However, there is a lack of widespread screening which can be used to determine which children are in need of specific support in their motor skills development.

The MUGI observation checklists used in this and other studies have high relevance regarding the schools' responsibility to ensure that children develop and automatise fundamental motor skills. They include exercises that measure static and dynamic balance capability, bilateral coordination, and hand-eye coordination, all of which are significant indicators of motor skills development and capability. The reported results of factor analyses and reliability tests show that the MUGI observation checklists fulfill the measurement instrument requirements at an acceptable level of validity and reliability. Since they have also proven to function well as an educational tool, they could also be recommended as screening instruments in PE programmes.

Teachers might need education in observing and stimulating children's motor development and in motivating pupils to have a healthy, lasting appreciation of physical activity. The MUGI observation checklists give an indication of which children may need additional and adapted gross motor skills stimulation.

The purpose of motor skill observations of children at school start is to make early identification of deficiencies in motor control possible so that remedial pedagogical programs can be implemented before the motor deficiencies become a problem to the children. Research has shown that childhood engagement in organised team sports does not create a sense of

physical efficacy and that habits of exercise carry over to adulthood (Hofstetter et al., 1990). Therefore, schools have an essential role in promoting health through the adoption of physically active lifestyles. However, many of the activities in physical education are devoted to ball games and team sports rather than to the development of motor skills and recreational activities that can promote lifelong fitness (Carli, 2004; Eriksson et al., 2003).

The content and grading criteria in PEH also seem to favour boys over girls when it comes to achievements and grades in the subject; PEH is still the only subject in Sweden where girls have significantly lower grades than boys.

The form and content of PEH may be questioned, and this calls for a reorienting towards motor skills and physical fitness activities that can be practised regardless of time and place and which are transferable to adulthood. Coeducational PEH classes may be questioned, in line with Carli (2004) and Moreno, Gimeno, Lacárcel and Pérez (2007), because it makes physical development and knowledge in motor skills salient to everybody, which could contribute to an uncomfortable situation for many pupils. Directive teaching approaches that focus on the execution of skills may be questioned since they can discourage the less skilled from participation by highlighting what they cannot do in front of their peers (Light & Fawns, 2003). This seems to be especially true among girls.

The results indicate that, when planning intervention programs to increase motivation and physical self-esteem through physical activity, school interventions should focus on improving fundamental motor skills. The MUGI checklists can be useful as pedagogical instruments for PE teachers and could be used in schools' regular PE programmes to evaluate pupils' motor skills and, additionally, in later school years as a component in grading.

When the focus of grading is on quality evaluations of motor skills rather than on measurements of sports performances, pupils are more likely to compare their results to their own previous results rather than to judge themselves compared to others (Larsson, 2009). This may motivate students to participate in PE, most likely resulting in an increase in their kinesthetic knowledge as well as in their grades in the subject.

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Appendix 1. **MUGI OBSERVATION CHECKLIST**

The MUGI observation checklist is intended for the use of school nurses, PE teachers, trained sports coaches/teachers, and special needs teachers, under the supervision of a trained PE teacher.

Introduction and warm-up: Individual play with a large ball.

	MUGI task	Minor difficulty, insecurity, uncertainty	Major difficulty
1	Throw and catch a large ball 5 consecutive times		
2	right Bounce large ball 5 consecutive times		
	left		
3	Skip in diagonal pattern forward 15 m		
4	right Hop in one leg 2x7 m		
	left		
5	right Stand on one leg 10 sec.		
	left		
6	Walk with toes pointing out 2x7 m Without big involuntary movements		
7	Alternating “ski hop” Rhythmically, 15 times		
8	Imitate body movements and positions game: “Simon says do this; do that!”		
a	“Warm your knees” In diagonal pattern		
b	Opposite arm and leg lifted to the side		
c	Right hand on left ear and left hand on left hip		
9	Obstacle course		
a	Jump with hula hoop, Moving with running steps		
b	“Broad jump over a ditch” 1 m		
c	“High jump over a magic rope” 40 cm		

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