South African Journal for Research in Sport, Physical Education and Recreation, 2014, 36(1): 167-182.
Suid-Afrikaanse Tydskrif vir Navorsing in Sport, Liggaamlike Opvoedkunde en Ontspanning, 2014, 36(1): 167-182.
ISBN: 0379-9069

MOTOR PROFICIENCY PROFILE OF GRADE 1 LEARNERS IN THE NORTH WEST PROVINCE OF SOUTH AFRICA: NW-CHILD STUDY

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ABSTRACT

This study aimed to establish a comprehensive profile of the motor proficiency of Grade 1 learners in the North West Province of South Africa, taking into account gender and racial differences and strengths and weaknesses. A stratified randomised sample of 816 Grade 1 learners (419 boys, 397 girls, mean age 6.84 years (±0.39), were assessed with the 'Bruininks-Oseretsky Test of Motor Proficiency-2 Short Form'. The highest percentage of the group was classified in the below average (n=383; 49.63%) and average (n=405; 48.16%), descriptive categories for motor proficiency with poorest mastery indicated in fine motor integration, fine motor precision and strength. Boys performed significantly better than girls ($p<0.05$), while significantly more White learners were classified in the average descriptive category, compared to Black learners. The motor proficiency of more than 50% of school beginners was below average while girls and Black learners experienced motor proficiency problems to a greater extent compared to boys and White learners. These shortcomings place a high percentage of school beginners at risk for developmental problems associated with inadequate motor skills and should consequently be addressed, especially during the preschool years and the initial years of the primary school phase.

Key words: Motor proficiency; School beginner; Gender; Race; Bruininks-Oseretsky Test of Motor Proficiency-2 Short Form.

INTRODUCTION

Poor motor proficiency during the early childhood years can impede various aspects of a young child's development (Pienaar, 2009; Cairney *et al*., 2010; Pienaar *et al*., 2013). Transition to formal schooling is further considered a demanding, challenging and stressful period for young children (Bart *et al*., 2007). These researchers found that good motor ability serves as a buffer to these challenges, as it is associated with better scholastic adaptation and more prosocial behaviour, while poor motor ability emerges as a vulnerability factor in the transition period to normal schooling. Researchers (Rosenbaum *et al.,* 2001; Avi-Itzhak & Obler, 2008; Westendorp *et al.,* 2011) have indicated that fine motor skills, perceptual-motor abilities and fundamental motor skills play an important role in the learning process and are consequently important skills for the school beginner to master. Pheloung (2003) reported in this regard that movement provides the foundation for the brain to integrate brain function for academic work by means of stimulation. Goddard-Blythe (2000) further indicated that 'Attention' (A), 'Balance' (B) and 'Co-ordination' (C) are the primary 'ABC' upon which all learning builds. Fredericks *et al., (*2006) are furthermore of the opinion that if these skills are

not sufficiently developed in the school beginner, the child is likely to develop specific learning problems.

In addition to these associations, researchers report that adequate motor competency during the early childhood years is also important to ensure lifelong participation in sport and physical activity (Van Beurden *et al.,* 2002). The fundamental motor skills, categorised as stability, locomotor and manipulation skills, which develop during this period, are important building blocks upon which more sport-specific and specialised skills are built (Gabbard, 2008). Furthermore, research findings show a relationship between motor proficiency and participation in physical activity (Wrotniak *et al.,* 2006; Williams *et al.,* 2008; Haga, 2009), which suggest that children with inadequate motor skills avoid participation in sport activities because they struggle to master advanced skills (Van Beurden *et al.,* 2002; Pang & Fong, 2009). Consequently, if children do not become motor proficient during the early childhood years, their participation in physical activity later in life could be hampered.

High percentages of perceptual motor problems are reported for young children. Research by Gligorovic *et al*. (2011) indicate that a significant number of typically developing young school children had perceptual motor difficulties, while Nikolic and Ilic-Stošovic (2009) report high percentages of motor skill disorders in three areas of motor development functioning, namely neuromaturation, coordination and balance in a sample of 6.5 to 11 year old children. There has been a worldwide decline in children's motor skills over the past 15 to 20 years (Kretschmer, 2001). Sanders and Kidman (1998) reveal that learners between the ages of 10 and 11 years have only fully mastered 6 of the 12 fundamental motor skills (bouncing, catching, running, hopping, leap-jumping and sliding) that were assessed.

Van Beurden *et al.* (2002) report that 21.3% of learners in Australia only exhibit near mastery and 25.7% mastery of balancing, throwing, catching, speed, hopping, kicking, sliding and jumping skills. Research in New South Wales show that no more than 35% of the learners demonstrated mastery of throwing, kicking, leaping, hopping, sliding and skipping proficiency (Okely & Booth, 2004), while Butterfield *et al*. (2012) report 80% of mastery of object control skills up to 14 years of age in some of these skills. A few studies that were conducted in South Africa also show that South African children display inadequate motor skills. Du Toit and Pienaar (2001) reveal that 25.27% to 27.47% of 6-year-olds demonstrated below average skills when balancing on one leg, while a study by Africa and Van Deventer (2005) of 7- to 9-year-old girls indicate that girls are weaker in standing long jump, running and jumping over a high object with speed, agility skills, running over and under a series of objects and cable jumping, compared to a study completed in 1976.

However, these South African studies were based on small samples of participants and examined only a few variables that do not reflect a comprehensive profile of the motor proficiency levels of South African children. In order to create a comprehensive profile of the motor proficiency of young children, it is also important to obtain knowledge about possible gender and racial differences that may exist. Gender differences are reported by researchers where boys performed better in object control skills, standing long jump, strength and running skills (Du Toit & Pienaar, 2002; Okely & Booth, 2004; Portela, 2007; Shala, 2009), while girls out performed boys in locomotor skills, balancing and bilateral integration (Van Beurden *et al.,* 2002; Okely & Booth, 2004; Portela, 2007; Hardy *et al.,* 2010). However,

results are also reported indicating no gender differences (Du Toit & Pienaar, 2002; Shala, 2009; Milanese *et al.,* 2010; Venetsanou & Kambas, 2011). Racial differences are further reported in a few studies (Pienaar *et al.,* 2007; Capute *et al*., 1985; Uys & Pienaar, 2010).

South Africa is described as a 'Rainbow Nation' which includes various ethnic groups, languages and cultures, as well as a range of socio-economic circumstances (Edginton *et al.,* 2012), which pose several challenges to child development. South African statistics further show that 72% of children living in the North West Province of South Africa grow up in poverty (Millennium Developmental Goals, 2010). Lejarrage *et al.* (2002) report that the environment in which children grow up plays a significant role in their motor development. As the early childhood years are considered the golden years for motor development, it is vital that children are provided with enough opportunities to practise and improve their motor skills during this developmental period (Hardy *et al*., 2010). Deficits with regard to motor skills in children who grow up in disadvantaged communities have been found (Goodway & Branta, 2003; Robinson & Goodway, 2009), mostly because of a lack of opportunities. A study by Pienaar *et al.* (2007) of 5- to 6-year-old South African children confirm that children from low socio-economic circumstances (SEC), display developmental deficits of up to 12 months in comparison to their chronological aged peers from higher SEC.

These findings raise concerns about the current level of motor proficiency of young school beginners in South African schools. Motor proficiency refers to the specific abilities upon which performance is built and which is measured by means of tests for running speed and agility, balance, bilateral co-ordination, strength, upper limb co-ordination, reaction speed, visual-motor control, upper limb speed and agility (Sherrill, 2004). It is evident from the above discussion that motor proficiency plays an important role in a child's cognitive, social and emotional development, life-long participation in physical activity and total well-being, and that the early childhood years are a vital developmental period in which to optimise the motor development of young children.

Bearing in mind that it is important to have adequately developed motor skills for all spheres of life, it is important to determine the strengths and weaknesses in the motor proficiency make-up of children, in order to timely treat possible difficulties. Few studies report comprehensive profiles of the motor proficiency of school beginners and most of these studies used the 'Test of Gross Motor Development (TGMD)', which only provides a profile of the locomotor and object control skills of children. South African studies that have reported statistics in this regard are not based on randomised sampling or examined only selected variables and consequently have shortcomings. Researchers, practitioners, health authorities and educators, however, need comprehensive information about the levels of motor proficiency of young children in order to develop appropriate intervention strategies and awareness in this regard.

AIM OF RESEARCH

The aim of this study was to compile a comprehensive profile of the motor proficiency of Grade 1 learners in the North- West Province of South Africa with further investigation into possible gender and racial differences, and the strengths and weaknesses in their motor proficiency profiles.

METHODOLOGY

Research group

The research formed part of the NW-CHILD (Child-Health-Integrated-Learning and Development) longitudinal study. Ethical approval was obtained for this study from the Ethics Committee of the North-West University (No. NW 00070 09 A1), as well as from the Department of Basic Education of the North-West Province. Permission was also obtained from each school principal to conduct the testing on a particular day during school hours. Grade 1 learners in the North-West Province of South Africa served as the target population and a total number of 880, Grade 1 learners were identified for the study. The participants were selected by means of a stratified randomised sample in conjunction with the Statistical Consultation Service of the North-West University.

In order to determine the sample, a list of names of all the schools in the North-West Province was obtained from the Department of Basic Education. These schools were grouped into 8 educational districts, each represented by 12 to 22 regions with approximately 20 schools (minimum 12, maximum 47) per region. From the list, regions and schools were chosen randomly with regard to population density and school status (quintile 1 – schools from poor socio-economic areas - to quintile 5 – schools from good socio-economic areas). Boys and girls in Grade 1 were then selected randomly from each of the 20 identified schools in 4 selected school districts. If numbers allowed it, 60 learners were recruited from the schools in order to obtain a minimum of 40 children per school with an even gender distribution. All the learners, whose parents provided consent for their participation in the study, were tested. The total number of Grade 1 learners whose parents provided consent for their participation in the study was 816 (419 boys and 397 girls).

Measurement instruments

Bruininks-Oseretsky Test of Motor-Proficiency (BOT-2 SF)

The *Bruininks-Oseretsky Test of Motor-Proficiency second edition (BOT-2) - Short Form* (Bruininks & Bruininks, 2005), consists of 14 items that assess the subject's motor proficiency. This norm-based measuring instrument was validated for use among 4 to 21 year old children (Bruininks & Bruininks, 2005). The BOT-2 SF assess skills in 4 composite motor areas, each containing 2 motor sub-tests, namely: fine manual control (fine motor precision and fine motor integration); manual co-ordination (manual dexterity and upper limb co-ordination); body co-ordination (bilateral co-ordination and balance); and strength and agility (running speed, agility and strength). The knee push-up option was selected in the strength section over the push-up option. Gender specific norms were used for the scoring of the data. Scores are converted to raw scores and point scores for each sub-test (fine motor precision [maximum=14], fine motor integration [maximum=10], manual dexterity [maximum=9], bilateral integration [maximum=7], balance [maximum=8], running speed and agility [maximum=10], upper limb co-ordination [maximum=12] and strength [maximum=18]). These individual point scores were converted to a short form (SF) total point score (maximum=88), a standard score, a percentile ranking and a descriptive category. The descriptive categories reported for the standard scores were: well above average (standard score $\geq$70); above average (standard score 60-69); average (standard score 41-59);

below average (standard score 31-40); and well below average (standard score <30). The BOT-2 SF has a validity of r=0.80 (Bruininks & Bruininks, 2005).

Data analyses

STATISTICA for windows (StatSoft, 2011) was used to analyse the data. Data were analysed for descriptive purposes by using means (M), maximum and minimum values and standard deviations (SD). Data were also analysed by using independent t-testing to determine gender and racial differences and the level of significance was set at $p<0.05$. Because of the small number of Coloured (n=20) and Indian (n=11) children in the sample, these children were not included in the analysis of racial differences (Table 2-4), although their data were taken into account in the analysis of the descriptive statistics (Table 1).

RESULTS

Table 1 describes the group of Grade 1 learners (N=816) with regard to age, and the number of participants grouped into each race and gender.

***TABLE 1*: NUMBER AND MEAN AGE OF LEARNERS ACCORDING TO GENDER AND RACE**

Group		N	Age M	Age SD
Gender	Boys	419	6.86	0.39
	Girls	397	6.81	0.38
Race	White	218	6.86	0.34
	Black	567	6.83	0.40
	Coloured	20	6.74	0.29
	Indian	11	7.07	0.27
	Total Group	816	6.84	0.39

N= Number of participants M = Mean; SD= Standard Deviation

Table 2 displays the percentage of learners in the group and also in each gender and race group who, according to the standard scores (SC) obtained in the BOT-2-SF, were classified into the different motor proficiency descriptive categories. A standard score (SC) of 41.11 classified the group in the average motor proficiency descriptive category which ranges from 41 to 59. On an individual level, most of the 816 learners were classified in the average (n=393; 48.16%) or below average (n=405; 49.63%) descriptive categories. Boys obtained a significantly higher mean standard score of 43.33 compared to girls (27.83; $p<0.05$). A high percentage boys were classified in the average category (n=268; 63.96%) compared to girls, where most of them were classified as below average (n=257; 64.74%). The motor proficiency of White and Black learners (SC=44.40 and SC=39.73 respectively) were significantly different ($p<0.05$), where the motor proficiency of most of the white children was classified as average (n=151; 69.27%), compared to the Black children, of which a high percentage (n=333; 58.73%) was classified as below average.

***TABLE 2*: PERCENTAGE OF LEARNERS CLASSIFIED IN DIFFERENT DESCRIPTIVE CATEGORIES FOR MOTOR PROFICIENCY**

Group	N	Standard Score	WA average ≥70 SC >98 PR	Above average 60-69 SC 84-97 PR	Average 41-59 SC 18-83 PR	Below average 31-40 SC 3-17 PR	WB average <30 SC <2 PR
Gender							
Boys	419	43.33	0	3(0.72%)	268(63.96%)	148(35.32%)	0
Girls	397	27.83	0	2(0.50%)	125(31.49%)	257(64.74%)	13(3.27%)
Race							
White	218	44.40	0	5(2.29%)	151(69.27%)	62(28.44%)	0
Black	567	39.73	0	0	221(38.98%)	333(58.73%)	13(2.29%)
Tot. Gr.	**816**	**41.11**	**0**	**5(0.61%)**	**393(48.16%)**	**405(49.63%)**	**13(1.59%)**

SC= Standard Score PR= Percentile Ranking WA= Well Above WB= Well Below

***TABLE 3*: DIFFERENCES IN MOTOR PROFICIENCY BY GENDER AND RACE**

Variables	Boys (n=419) M	Boys SD	Girls (n=397) M	Girls SD	White (n=218) M	White SD	Black (n=567) M	Black SD
Motor control								
Fine motor precision PS (14**)**	7.26	3.12	7.07	3.91	**8.97***	3.23	6.40	3.35
Fine motor integration PS (10**)**	1.96	1.85	2.09	1.93	**3.00***	2.16	1.63	1.65
Manual co-ordination								
Manual dexterity PS (9)	4.78	1.06	**5.04***	1.03	**5.26***	1.12	4.77	1.00
Bilateral co-ordination PS **(7)**	4.87	2.04	**5.20***	1.92	**5.82***	1.53	4.69	2.08
Body co-ordination								
Balance PS (8)	6.70	1.49	6.89	1.37	6.39	1.55	**7.00***	1.34
Upper limb co-ordin. PS (12**)**	**8.16***	2.43	7.59	2.67	**8.16***	2.33	7.75	2.67
Strength and agility								
Strength PS (18)	**4.84***	2.14	4.35	2.22	**5.15***	2.01	4.40	2.18
Run. speed & agility PS (10)	8.07	1.24	8.13	0.90	8.07	1.35	**8.11***	0.99
BOT-2 SF Total Point Score	47.10	7.91	47.23	8.64	**51.41***	7.42	45.40	8.05
BOT-2 SF Standard Score	**43.33***	5.72	27.83	6.37	**44.44***	6.67	39.73	5.91
BOT-2 SF Percentile rank	**38.77***	18.42	17.29	16.82	**31.68***	21.28	19.02	15.92

M= Mean SD= Standard Deviation PS= Point Score ( ) =Max. PS in brackets *p<0.05= Sign. difference

Table 3 reports the point score means obtained for each of the sub-tests, the BOT-2 SF composite total, BOT-2 SF standard scores and percentile rankings for boys and girls, and for the White and Black learners separately. Significance of differences between boys and girls and white and Black children determined by independent t-testing ($p<0.05$), are also reported in the table. Boys obtained a significantly higher standard score and percentile ranking than the girls ($p<0.05$), although the point score means of the different sub-tests indicated that only a few sub-tests differed significantly. Boys out performed girls significantly in upper limb co-ordination (M=8.16 and M=7.59) and strength (M=4.84 and M=4.35), while girls performed

significantly better than the boys in manual dexterity (M=5.04 and M=4.78) and bilateral co-ordination (M=5.20 and M=4.87).

The mean standard scores and percentile rankings of the Black and White learners also differed significantly ($p<0.05$). The White children performed significantly better in 6 of the 8 motor proficiency sub-components, while the Black children performed significantly better in balance and running speed and agility skills. The results were also analysed to determine strengths and weaknesses in the motor proficiency profiles of the learners in the different motor proficiency mastery categories.

***TABLE 4*: MEANS AND PERCENTAGE MASTERY OF EACH SUB-TEST IN DIFFERENT DESCRIPTIVECATEGORIES**

	Well-below average (n=13)			**Below average** (n=405)		
Sub-tests	**M**	**%**	**SD**	**M**	**%**	**SD**
Fine motor precision PS (14)	3.31	**23.64**	2.63	5.96	**42.57**	3.11
Fine motor integration PS (10)	0.38	**3.80**	0.51	1.67	**16.70**	1.36
Manual dexterity PS (9)	3.54	39.33	0.88	4.65	51.67	0.94
Bilateral co-ordination PS (7)	2.23	31.86	1.96	4.33	61.86	2.08
Balance PS (8)	5.92	74.00	1.93	6.55	81.88	1.53
Running speed & agility PS (10)	7.46	74.60	1.27	7.99	79.90	1.14
Upper-limb co-ordination PS (12)	3.46	28.83	1.81	6.95	57.92	2.52
Strength PS (18)	1.69	**9.39**	1.93	3.99	**22.17**	2.15
	Average (n=393)			**Above average** (n=5)		
Sub-tests	**M**	**%**	**SD**	**M**	**%**	**SD**
Fine motor precision PS (14)	8.54	**61.00**	3.38	7.80	55.71	6.06
Fine motor integration PS (10)	2.72	**27.20**	2.09	5.00	50.00	1.22
Manual dexterity PS (9)	5.18	57.56	1.05	7.20	80.00	0.84
Bilateral co-ordination PS (7)	5.82	83.14	1.48	7.00	100	0
Balance PS (8)	7.05	88.13	1.25	8.00	100	0
Running speed & agility PS (10)	8.23	82.30	1.01	9.00	90.00	0
Upper-limb co-ordination PS (12)	8.96	74.67	2.05	10.60	88.33	0.89
Strength PS (18)	5.30	**29.44**	1.96	7.80	43.33	0.84

M= Mean SD= Standard Deviation PS= Point Score ( ) = Maximum Point Scores in brackets

Table 4 indicates the mean point score values of the group in each of the 8 sub-tests of the BOT-2 SF and in each of the different descriptive categories of motor proficiency (well below average, below average, average, above average). Percentage mastery was calculated for each of these point scores from which strengths and weakness could be inferred. The percentages show that the learners, irrespective of the descriptive group that they were

categorised in, performed the poorest in strength, fine motor precision and fine motor integration skills.

DISCUSSION

This was a first study to compile a comprehensive profile of the motor proficiency of Grade 1 learners in the North-West Province of South Africa, which includes knowledge about possible gender and racial differences, as well as strengths and weaknesses in the motor proficiency make-up of the group.

The results indicated that the motor proficiency of Grade 1 learners were average although on an individual level, a high percentage of them exhibited below average (49.63%) to average (48.16%) levels of motor proficiency. These statistics raise concern since it indicates that one out of every two learners was classified into a category of motor proficiency that indicates below average motor proficiency (percentile ranking between 3 and 17, and less than -2.0 and -1.0 standard deviations below the mean). The results, however, coincide with research findings world-wide, which report decreasing trends in motor development (Kretchmer, 2001), high percentages of perceptual motor problems (Gligorovic *et al*., 2011; Pienaar *et al*., 2013), and below average to average mastery of fundamental motor skills in this age group (Van Beurden *et al.,* 2002; Okely & Booth, 2004; Hardy *et al*., 2010). Various reasons can be suggested for these disturbing results. It is reported that contemporary children are less inclined to participate in physical activity and sports activities and spend more time indoors (Williams *et al.,* 2008; Haga, 2009). Modern day technology, which includes computers and television, public transport, unsafe environments, increased crime and urbanisation, also further contribute to inactive lifestyles (Somers *et al.,* 2006; Hills *et al.,* 2007), which again limits a child's opportunities to develop motor skills and cause children to suffer from movement deficiency (Kretschmer, 2001). The rising obesity epidemic, which is associated with the lack of physical activity and poor motor skill development (Truter *et al*., 2012; Kemp & Pienaar, 2013), is considered another probable contributing factor to this deficiency.

The reduced time that is allocated to physical education and movement programmes in schools, the lack of experts delivering these programmes in schools and learning content without clear outcomes in this area could also be contributing factors (Van Deventer, 2004; Rajput & Van Deventer, 2010; Edgington *et al*., 2012). The winning-at-all-cost phenomenon in school sport also hampers motor development goals during the important developing periods. Other factors such as socio-economic circumstances, gender and racial preferences can also play a role, as was evident from our results and which is also confirmed by researchers studying the physical activity levels and patterns of South African children (McVeigh *et al*., 2004; Walter, 2011). However, variability in motor development or developmental delay, which is characteristic of children at this young age, could also be a possible contributing factor, although it will only be possible to determine such an effect by means of longitudinal research. More research focussing on the possible reasons brought to the fore in this discussion is consequently necessary for a better understanding of the possible contributing factors.

The sub-tests of the BOT-2 SF showed that the greatest deficiencies were strength, fine motor integration and precision skills, irrespective of the motor proficiency category in which the

subjects were categorised (Table 4). Steps should thus be taken to address the poor overall motor proficiency and especially the weaknesses that were identified in the motor proficiency make-up of Grade 1 learners. Adequate fine motor skills (which include fine motor integration and precision), are important for academic performance as school beginners spend more than half of their school day using fine motor activities (Tseng & Chow, 2000). Sufficient core strength and shoulder stability are furthermore key to the development of adequate fine motor skills (Gabbard, 2008), while bodily strength is an important health enhancing physical fitness component which is needed for sport participation.

The analysis of gender differences (Table 3) indicate significant differences, showing that the overall motor proficiency of boys were superior to that of the girls, and that they outperformed girls significantly in the upper limb co-ordination and strength skills sub-items. The better upper limb co-ordination of the boys could probably be ascribed to better object control skills in boys, which are reported in several studies concerning 1 to 9 year old boys (Van Beurden *et al.,* 2002; Okely & Booth, 2004; Hardy *et al.,* 2010), as the test required them to drop and catch a ball and dribble it with alternating hands. The better strength of the boys further coincides with various studies that report similar findings (Hands & Larkin, 1997; Du Toit & Pienaar, 2002; Malina, 2004; Okely & Booth 2004; Portela, 2007; Shala, 2009). Researchers furthermore reported that boys engage more in high intensity physical activity than girls (Walter, 2011), that they play outdoors more and are encouraged by parents and peers to participate in different and more extreme types of activities than girls, such as jumping and running, which could also contribute to improved strength. Girls on the other hand, generally play more indoors and are more encouraged to play gently, performing fine motor activities (Portela, 2007; Walter, 2011; Bouchard *et al.,* 2012).

Girls were on average categorised in the below average descriptive category for motor proficiency, which places a high percentage of them at a young age at risk for developmental problems associated with inadequate motor skills. However, they outperformed boys significantly in bilateral co-ordination and manual dexterity, which is supported by other research findings. Portela (2007) reports bilateral integration differences in South African learners in the Foundation Phase (Grade R to 3) and ascribed the differences to the type of activities in which girls participate such as dancing. The better manual dexterity of the girls further coincides with a study by Sigmundsson and Rostoft (2003) on 4 year old pre-schoolers, which also reported better manual dexterity in girls.

Fine motor integration, fine motor precision, balance, running speed and agility showed no differences between the genders which is contradictory to studies indicating gender differences. However, Bruininks and Bruininks (2005) report that fine motor skill differences between boys and girls decrease as they get older which substantiate our findings in this regard. Better balancing scores are reported for girls by Du Toit and Pienaar (2002), Portela (2007), Shala (2009) and Venetsanou and Kambas (2011). No gender differences were also found in running speed and agility, although the girls achieved slightly higher mean values than the boys in the current study. Milanese *et al.* (2010) report better running speed and agility in 6 to 7 year old boys based on the performance of the 30m agility test, while in the current study it was required of the subjects to hop as fast as possible on one leg for 15 seconds. As girls in our study also obtained slightly better balancing skills scores than the boys it could probably be contributed to their ability to hop faster on one leg ($p>0.05$). Girls

also play games such as 'hopscotch', which could also improve their ability to hop on one leg. Attention should consequently be paid to the improvement of the overall motor proficiency of girls, but also specifically in sub-tests that influenced the overall motor proficiency of girls and boys.

Significant motor proficiency differences were also found between White and Black learners. A higher percentage of White learners (69.27%) compared to 38.98% of the Black learners showed average motor proficiency, while a high percentage of Black learners were categorised in the below average (58.73%) motor proficiency category. White learners performed significantly better in 6 of the 8 sub-components of motor proficiency, excluding balance and running speed and agility in which the Black children outperformed them significantly. However, most of the Black learners came from low socio-economic areas (quintile 1, 2 and 3 schools, mainly due to the historical past of South Africa), and these differences between the race groups were consequently ascribed more to environmental influences than to racial differences as several studies report associations between motor skills and socio-economic circumstances (Goodway & Branta, 2003; Pienaar *et al.*, 2007; Robinson & Goodway, 2009; Uys & Pienaar, 2010; Walter, 2011). The White learners performed significantly better in fine motor precision and fine motor integration skills, which coincide with the findings of Uys and Pienaar (2010), who also reported poorer fine motor skills in children living in lower socio-economic areas.

Children living in low socio-economic areas might also possibly receive less stimulation at home with regard to fine motor skills and the day care centres and nursery schools that they attend might be under-resourced to improve fine motor skills. White learners also performed significantly better in manual dexterity and bilateral co-ordination. Portela (2007) reports no significant differences between Foundation Phase learners from independent schools and schools from low socio-economic areas in manual dexterity, although the learners in low socio-economic areas performed slightly better in bilateral co-ordination. White learners also showed better upper limb co-ordination which could possibly be ascribed to them participating in activities that can improve upper limb co-ordination such as netball, cricket and rugby. Mcveigh *et al.* (2004) also report higher physical activity levels and differences in the physical activity patterns of 9 year old White and Black South African children. Black children played traditional games, such as tag games and soccer (Walter, 2011), which might possibly contribute to improved lower limb co-ordination. However, the better upper limb co-ordination of White children contradicts the findings of Portela (2007), which indicates better upper limb co-ordination in children from low socio-economic areas. The strength of Black learners in the study could possibly be influenced negatively by malnutrition and protein deficiencies in their diets which are indicated to have an effect on the physical growth and energy levels of children from impoverished backgrounds (Henneberg *et al.*, 1998; Portela, 2007).

Attention should consequently be given to the identified weaknesses in the motor proficiency make-up of learners from different racial groups and especially those that were identified among learners growing up in disadvantaged communities (who, in the case of this study, were mainly Black learners). These include fine motor precision, fine motor integration, manual dexterity, bilateral co-ordination and upper limb co-ordination and motor proficiency in general. The better motor proficiency of the White learners, who were mainly in quintile 4

and 5 schools, could also be ascribed to them being exposed in these schools to a greater extent, to physical education and participation in sport activities during and after school.

Most of the White learners in the study also live in higher socio-economic areas where they are exposed to quality preschool programmes before entering the formal schools and that are in most cases also well-resourced with aids for the development of motor proficiency. Affluent parents can also afford to expose their children to additional stimulation programmes that can improve their motor development. Walter (2011) report that the afternoon activities of girls living in lower socio-economic areas are curtailed from a young age by compulsory domestic responsibilities and that their preferred games are sedentary, which is a concern that needs to addressed, as motor proficiency depends to a great deal on sufficient opportunities to develop these skills. These activity patterns which are embedded in cultural beliefs, place a much higher responsibility on schools to ensure that young girls whose motor development are restrained by these beliefs obtain enough opportunities to improve their motor skills during school hours.

The Black learners however, performed significantly better in balancing skills compared to White learners, which agree with other studies that reported similar results (Portela, 2007; Uys & Pienaar, 2010). The Black learners also performed significantly better in running speed and agility, which could possibly be ascribed to the fact that most of them live in low socio-economic areas where they are to a large extent, not exposed to technology and, consequently, play outdoors more (Walter, 2011). The sub-items that were used to determine the running speed and agility consist of, for example, hopping, one-leg side-jumps and two-leg side-jumps that are regularly part of traditional games that are played by children in low socio-economic areas.

This study had limitations which need to be recognised. For practical reasons such as time constraints, the BOT-2 SF had to be used rather than the complete version of the BOT-2, which limits the applicability of the use of the results in different settings, such as, for example, clinical assessment purposes. Although everything was done to optimise the testing conditions, assessments had to be performed during school hours where distractions from other children could have influenced the results. However, the strength of the study is the large randomised and representative sample that increased the generalizability of the results. The results will also serve as the baseline measurements of the on-going NW-child longitudinal study which investigate various factors influencing child development. A follow-up objective of this study is to track the motor proficiency of the subjects over time, and then to establish from a developmental systems approach, whether the motor proficiency of the group during baseline was the result of developmental delays or of poor motor functioning.

CONCLUSIONS

This study showed that the motor proficiency of more than 50% of Grade 1 learners in the North-West Province of South Africa put these learners at risk of developing various problems that are associated with inadequate motor proficiency. Strength, fine motor integration and fine motor precision showed the greatest deficits in the motor proficiency makeup of the group, thus attention should especially be devoted to the improvement of these

skills. The overall motor proficiency of boys was significantly better than that of girls and a very high percentage of girls exhibited below average motor proficiency. Consequently, special attention should be paid to the motor proficiency of girls in general, with specific attention to their upper limb co-ordination and strength, while the development of the manual dexterity and bilateral co-ordination of boys should also receive special attention. A large group of the Black learners (58.73%) furthermore exhibited below average motor proficiency and attention should consequently be devoted to the improvement of their motor proficiency, especially with regard to fine motor precision, fine motor integration, manual dexterity, bilateral co-ordination, upper limb co-ordination and strength. More research is recommended regarding problems associated with poor SES, cultural beliefs and responsibilities in order to provide a better understanding of these influences on development, but also of racial differences as these differences were clouded by environmental influences in this study.

Inadequate motor proficiency can impact negatively on the health, academic progress and sport participation of young children and, therefore, require accountability from different stakeholders and on various levels in order to address the problem significantly. On a government level, the Department of Basic Education should place more emphasis on the importance of motor development of young children as a key learning area, especially in the earlier grades, because of the important role that motor development plays in a young child's overall development. They could use the statistics of this study to create more awareness among educators of the current disturbing situation and to develop strategies to address the problem, especially among educators who teach in lower SES areas where the problem is even bigger. Educators should also be empowered more by receiving in service training to optimally develop motor skills in learners, while under-resourced schools should be better equipped with age appropriate aids and equipment to improve motor development. As the preschool years is a vital motor skill developmental period, health care workers should also be endowed with knowledge that they can disseminate in communities among mothers of young children and to caregivers not only to create more awareness about the importance of providing young children with opportunities to develop motorically, but also about the health risks involved in inadequate motor development, such as obesity and diabetes.

Improvement of children's motor development is a modifiable risk factor which can be addressed significantly if professionals in this field are involved in the delivery of this content area. Thus, on a school governance level, headmasters should ensure that experts, such as trained Life Orientation or Physical Education teachers or Kinderkineticists be appointed within schools, not only to develop the basic motor proficiency of young children, but also to provide remedial help where deficiencies are identified. It is, however, also important that these appointed experts should be held accountable for outcomes that have to be obtained regarding the development of age appropriate motor proficiency skills of children. The outcomes of any sport and motor development programmes that are presented to young children, especially as part of the school curriculum, should also be revisited and adjusted to make sure that these programmes will improve the motor proficiency foundation of all children, whatever their abilities, gender, race or culture, in order to ensure that physical activity becomes meaningful for all.

Acknowledgements

This work is based upon research supported by the National Research Foundation of South Africa (NRF), the National Lottery Distribution Fund and the Focus area of PhASRec which are greatly acknowledged for their contributions. The authors also wish to express their gratitude to the students, research and administration teams and the schools and learners who participated in the study. *Disclaimer*: Any opinion, findings and conclusions or recommendations expressed in this material are the opinion of the author(s) and, therefore, the NRF does not accept any liability in this regard.

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(Subject Editor: Dr Monique de Milander)