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The correlation between motor proficiency and physical activity in Senior Phase learners in the Potchefstroom area

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ABSTRACT

Background: One of the risks associated with low physical activity levels is the insufficient development of motor proficiency, which in turn has an impact on participation in physical activity and sport during adolescence.

Objectives: To determine the relationship between motor proficiency and physical activity levels in adolescent Senior Phase learners in Potchefstroom, South Africa. No literature exists on the relationship between motor proficiency and physical activity levels among South African adolescents.

Method: A total of 239 13- to 14-year-old learners were assessed using the Bruininks–Oseretsky Test of Motor Proficiency 2 (BOT-2) for motor proficiency, and the *International Physical Activity Questionnaire* (IPAQ) for physical activity levels. Data analysis included descriptive statistics, Spearman correlation coefficients and effect sizes.

Results: Statistically and practically significant correlations were found between the total BOT-2 score and the physical activity levels of the total group, as well as the boys and the girls respectively. Fine motor coordination correlated with physical activity levels in the girls, while manipulation coordination correlated with the physical activity levels of the total group and the boys. The body coordination skill of jumping in place and the strength test items showed strong correlations with physical activity in all the groups.

Conclusion: The motor skills of Senior Phase learners, especially coordination and strength skills, should be developed and maintained in the Physical Education curriculum to enhance physical activity levels.

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1. Introduction

There is worldwide concern about the decrease in physical activity amongst children of school going age, together with an increase in health risks such as diabetes mellitus, cardiac risk factors and obesity (Hurter & Pienaar, 2007; Lloyd, Lubans, Plotnikoff, & Morgan, 2014; Smith et al., 2014). Low levels of physical activity correlate with a further risk, namely the insufficient development of motor proficiency (Hurter & Pienaar, 2007; Malina, 2012). Researchers agree that regular physical activity is essential to develop a child's motor skills, which include gross and perceptual motor proficiency (Gallahue & Ozmun, 2006; Harvey & Mcgill, 2007; Harvey & Reid, 2003). According to Gallahue and Cleland Donnelly (2003) the phrase "move to learn and learn to move" echoes the general approach to Physical Education with reference to the development of motor skills – therefore children must be physically active to develop new motor skills, and, conversely, with the aid of motor movement skills they can learn to move more effectively.

The negative relationship between motor development and a deficiency in physical activity can, according to Kalaja, Jaakkola, Liukkonen, and Watt (2010); Lubans, Morgan, Cliff, Barnett, and Okely (2010), and Stodden, Barett, Goodway, Foweather, and Liverpool (2010), cause a vicious cycle where insufficient physical activity levels can lead to weaker motor skills. Children with poor motor proficiency skills are more inclined to avoid physical activity because they do not possess the skills for the given activity. In this regard, Cairney, Hay, Faught, Mandigo, and Flouris (2005) refer to the long-term consequences of motor deficiencies, namely that physical inactivity goes hand-in-hand with the risk of developing chronic health problems with age.

Various studies show that deficiencies with regard to gross and perceptual motor skills in children are related to levels of physical activity (Cairney et al., 2005; Cloete, Pienaar, & Coetzee, 2006; Prinsloo & Pienaar, 2003; Skinner & Piek, 2001; Sääkslahti et al., 1999). A study by Iivonen et al. (2013) in Finland reports that gross and perceptual motor skills already have a strong correlation with physical activity by the age of four. These findings concur with a study done by Sääkslahti et al. (1999), who found that problems related to walking, running, standing long jump, jumping from side to side, throwing and catching, balancing on one leg, skipping and kicking a ball are directly related to low levels of physical activity in three-to five-year-old learners in Finland. Fisher, Reilly, and Kelly (2005) tested 394 preschool boys and girls with a mean age of four years to determine the correlation between physical activity and gross and perceptual motor skills, and found that time spent on physical activity significantly correlated with balance and ball skills. Cliff, Anthony, Okely, Smith, and Mckeen (2009) assessed the fundamental movement skills and activity levels of 46 three-to five-year-old preschool children. Manipulation skills in boys were positively associated with physical activity levels, as were locomotive skills in the girls with physical activity levels. In a detailed review study by Holfelder and Schott (2014), 23 studies were identified on the correlation between fundamental movement skills and physical activity levels in children between the ages of three and 18 years. Of the 23 studies conducted, of which 10 were in Australia, five in the USA, three in Finland and one in Greece, Belgium, Scotland, Portugal and Germany respectively, 12 showed a correlation between fundamental movement skills and organised physical activity. Strong correlations were found between moderate physical activity and object control (six studies), as well as between physical activity and locomotor skills (four studies). Stronger correlations were also found in girls than in boys (Holfelder & Schott, 2014).

In other studies in children younger than 13 years, it was found that one of the characteristics in children with poor motor skills is usually low levels of physical activity, which supports these results (Cairney et al. 2005; Cloete et al. 2006; Prinsloo & Pienaar, 2003). Harvey and Mcgill (2007) investigated the correlation between poor motor skills and physical activity in 80 three-year-old and 118 four-year-old children. The results indicated that children with weaker motor skills were less active than children with better developed motor skills. The researchers recommend that parents should be informed on the value of physical activity for the development of motor skills during early childhood.

When looking at children with Developmental Coordination Disorder (DCD), a disorder diagnosed on the basis of poor coordination skills, Cloete et al. (2006) tested a group of ten-to 12-year-old children, representing all the ethnic groups in South Africa, to determine if there is any correlation between poor levels of physical activity and DCD. The results indicated that 50% of the children classified with DCD exhibited low physical activity levels. Prinsloo and Pienaar (2003) found similar results in four-to 12-year-old farm children with DCD in the North West province of South Africa, as did Cairney et al. (2005), who tested 590 Canadian children between the ages of nine and 14 years. They found that children with DCD exhibited low self-effectiveness in relation to physical activity and participated in less organised and recreational game activities than children without the disorder.

Motor skills also exhibit a positive correlation with levels of physical activity in adolescents (Kalaja et al. 2010; Lubans et al., 2010; Stodden et al. 2010). In a national study of 446 14-year-old Finish adolescents, Jaäkkola et al. (2009) found positive correlations between locomotor, balance, and manipulative skills and physical activity levels. Physical activity in girls showed a stronger correlation with regard to static balance and skipping, while boys exhibited a stronger correlation related to dynamic balance, jumping, accurate throwing and dribbling of a ball. These results concur with the positive characteristics found by Okely, Booth, and Patterson (2001) in 13- to 15-year-old adolescents in Australia concerning six fundamental motor skills (running, vertical jumping, catching, overhand throw, forehand hit and kicking) and physical activity levels, where the levels of mastery of fundamental movement skills predicted the time spent in organised physical activity.

According to Hands, Larkin, Parker, Straker, and Perry (2009) physical activity, physical fitness and motor proficiency are health contributing constructs. This study, which analysed the correlation between aforementioned variables, included 1585 adolescents (771 girls and 814 boys) with a mean age of 14.06 years. The motor proficiency of the boys and girls

exhibited a positive correlation between physical activity and physical fitness (Hands et al., 2009), from which the researchers concluded that participation in regular physical activity leads to both better motor skills and improved physical fitness levels.

Various studies confirm that motor proficiency levels of children and adolescents show positive correlations with physical activity levels (Kalaja et al., 2010; Lubans et al., 2010; Stodden et al., 2010). It is also clear that a child's physically inactivity may lead to motor deficiencies (Bouffard, Watkinson, & Thompson, 1996). It is therefore important to provide sufficient time and resources for the development of motor skills by specialists in Physical Education in schools (Okely & Booth, 2004). However, according to recent studies (Du Toit, Van Der Merwe, & Rossouw, 2007; Van Deventer, 2009), Physical Education teaching in South Africa often does not measure up to the prescriptions of the National Curriculum, especially in the Senior Phase of high school, which leads to concerns about the level of physical activity, physical fitness and motor development of learners. No literature could be found on the correlation between motor proficiency and physical activity levels in adolescents in South Africa. Therefore the aim of this study is to investigate the correlation between the levels of physical activity and motor proficiency in a group of adolescents, thus Senior Phase learners, in an area of South Africa.

2. Material and methods

2.1. *Research design*

This study utilised a quantitative research method and made use of a one-time cross-sectional design.

2.2. *Research group*

This study forms part of a larger study, namely the PAHL study (Physical Activity and Health Longitudinal study), which is a multi-disciplinary longitudinal project that investigated various health aspects of 13- to 18-year-old learners over a period of five years. For the purposes of this study, subjects were identified by making use of random sampling based on multiple phases in the larger project, according to the guidelines of Gay and Airasian (2000), and Leedy and Ormrod (2005). The total number of subjects tested for the specific aim of this study was 239 learners (98 boys and 141 girls) between the ages of 13 and 14 years in Grade 8 and considered Senior Phase learners in South Africa. The subjects were proportionally representative of the various populations of the North West province.

2.3. *Measuring instruments*

2.3.1. *Motor proficiency*

2.3.1.1. *Bruininks–Oseretsky Test of Motor Proficiency 2 (BOT-2).* The motor proficiency of the subjects was determined by making use of the Bruininks–Oseretsky Test of Motor Proficiency 2 (BOT-2) (Bruininks & Bruininks, 2005), with permission of the authors. The BOT-2 is aimed at persons between the ages of four and 21 years and is made up of four components, namely fine motor control (fine motor precision and fine motor integration, which include drawing a line between two lines, folding paper on lines, and copying a square and a star), manipulation coordination (bi-manual dexterity and upper limb coordination, which include the transferring coins, bouncing and catching a ball, and dribbling a ball), body coordination (balance and bilateral coordination tests, which include tapping the feet and fingers, jumping in place with same sides synchronised, walking a line and balancing on one leg) and strength and agility (running speed and agility and strength, which include tests for hopping on one leg, push-ups and sit-ups). For the purposes of this study the short form version as prescribed by the authors of the measuring instrument was used. The measuring instrument is gender-as well as age-specific and has been used successfully in various studies to determine the motor proficiency of children (Duger, Bumin, Uyanik, Esra, & Kayihan, 1999; Gallahue & Ozmun, 2006; Van Niekerk, 2007; Wrotniak et al., 2006). The total score of the various sub-items was calculated, and then converted into standard scores and percentiles according to the norm tables of the BOT-2 (Bruininks & Bruininks, 2005). A score that lies between the third and 17th percentile according to the norm scale is considered below average for learners of this age, while scores between the 18th and 83rd percentiles are considered average, and scores between the 84th to 97th percentile are considered above average. The BOT-2 exhibits a validity value of $r = .80$ (Bruininks & Bruininks, 2005) and according to Kambas and Aggeloussis (2006), it is a valid test of motor proficiency in normal children.

2.3.2. *Physical activity*

2.3.2.1. *International Physical Activity Questionnaire (IPAQ).* The standardised *International Physical Activity Questionnaire* (IPAQ) was used to determine levels of physical activity (Sjöström, 2005). This questionnaire asks the participant to report on physical activity for the last seven days, as well as for a normal week in general, measured in total METS (metabolic equivalent – intensity of activity). Three levels of physical activity are distinguishable: Low (Category 0); Moderate (Category 1) and High (Category 2). The individuals in Category 0 do not meet the criteria of categories 1 and 2, and are regarded as inactive with a processed total METS of under 200. Category 1 must meet the following three criteria: three or more days of intensive activity of at least 20 min per day, or five or more days of any moderate intensity activity or walking for at least 30 min per day, or five or more days of any combination of walking at moderate intensity or intensive activity that can be processed to a total of at least 200–500 METS per week. For the high intensity category there are two criteria: high intensity activity for at least three days or seven or more days of any combination of walking, moderate intensity or high intensity activity that can be processed to a total of more than 500 METS per week (Sjöström, 2005). According to Hagströmer, Oja, and Sjöström (2005) the IPAQ questionnaire exhibits good validity for assessing levels and patterns of physical activity, as the validity quotient of $r = .30$ corresponds with that of most self-reporting validity studies.

2.4. Procedure

Permission to conduct the study was obtained from the ethics committee of the Potchefstroom campus of the North-West University (NWU–0058-01–A1). Permission was obtained from the district head of the Provincial Department of Education. The principals of the various schools were approached for permission to conduct the study, after which ethical indemnity was obtained for the study and letters of informed consent were distributed to the Grade 8-learners to be completed by themselves as well as their parents before the inception of the study. Only learners who returned consent forms signed by themselves and their parents participated in the study. The tests were conducted at the schools by the researcher and Honours students specifically trained to take down the BOT-2 and the IPAQ. In these testing conditions no potential risks for the learners were identified.

2.5. Data analysis

Descriptive statistics were used to calculate means (M), minimum and maximum values, and standard deviations (*SD*) with the aid of the Statistica for Windows software program (StatSoft, 2012). Correlations between the results of the motor proficiency tests and levels of physical activity were further analysed with the help of Spearman correlation coefficients. The practical significance of the correlations was determined by using the correlation coefficients as effect sizes (ES) according to the guidelines of Cohen (1988) and Steyn (2006) for practical significance in correlation research. In this instance, a coefficient correlation of .1 represents a small effect, .2 a medium effect and .5 a large effect (Cohen, 1988; Steyn, 2006).

3. Results and findings

The descriptive statistics related to the results of the motor proficiency tests according to the BOT-2 and physical activity levels according to the IPAQ are represented in Table 1. The mean total score of the whole group (67.5, *SD* = 5.18), as seen in Table 1, according to the categories of the BOT-2, falls on the 14th percentile for their age, while the mean total score of the boys (69.53, *SD* = 6.35) as well as the girls (67.4, *SD* = 7.67) lie on the 16th and 14th percentiles respectively. According to the guidelines for interpretation of the BOT-2, the motor proficiency of the total group of learners, as well as the boys and girls respectively, are considered below average for their age. In Table 1 the mean scores obtained by each group in each test item can further be compared to the possible maximum scores of the individual test items. From this it would appear that the tests for the fine motor control component (especially copying a star, 3.07 out of a maximum of 5, *SD* = 1.06), body coordination (especially jumping in place: 3.34 out of 5, *SD* = 1.73) and strength and agility (especially hopping on one leg, 41.50 out of 50+, *SD* = 10.5; sit-ups, 11.59 out of 36+, *SD* = 5.14; and push-ups, 13.81 out of 36+, *SD* = 5.87) contributed to the below average scores.

With regard to the activity levels of the subjects, the total group exhibited a mean value of 489.68 (*SD* = 696.7) METS per week, which according to the guidelines of IPAQ are classified as moderately active. According to the IPAQ, the boys were further classified as highly active (519.68, *SD* = 748.4) and the girls as moderately active (468.83 METS, *SD* = 660.3). Although

Table 1 – Descriptive statistics with regard to motor proficiency and physical activity levels in Senior Phase learners.

Sub-item and maximum score	Total group (*N* = 239)				Boys (*n* = 98)				Girls (*n* = 141)			
	M	*SD*	Min	Max	M	*SD*	Min	Max	M	*SD*	Min	Max
Fine motor coordination												
Drawing a line between 2 lines (0 errors)	1.36	1.75	0	9	1.45	1.31	0	7	1.23	1.67	0	9
Folding paper on lines (12 correct folds)	9.85	2.92	0	12	9.72	2.03	0	12	10.0	1.98	0	12
Copying a square (5 marks)	4.18	.92	0	5	3.96	.76	1	5	4.34	.78	0	5
Copying a star (5 marks)	3.07	1.06	0	5	2.95	1.04	0	5	3.37	.98	0	5
Manipulation coordination												
Transferring coins (20 coins)	17.18	2.47	8	20	17.24	2.65	9	20	17.15	2.44	8	20
Bouncing and catching a ball (5 catches)	4.98	.21	3	5	4.99	.10	4	5	4.96	.26	3	5
Dribbling a ball (10 dribbles)	9.04	2.01	3	10	9.06	1.89	3	10	8.96	2.09	3	10
Body coordination												
Tapping feet and fingers (10 taps)	9.88	.64	4	10	9.9	.65	4	10	9.87	.63	5	10
Jumping in place (5 jumps)	3.34	1.73	0	5	3.3	1.78	0	5	3.37	1.70	0	5
Walking on a line (6 steps)	5.53	.89	1	6	5.44	1.05	1	6	5.61	.77	3	6
One-leg balance (10 s)	9.37	1.69	2	10	9.39	1.75	2	10	9.34	1.66	3	10
Strength and agility												
One-leg hopping (≥50 hops)	41.50	10.5	12	80	42.5	11.54	12	69	40.8	9.63	16	80
Push-ups (≥36 push-ups)	13.81	5.87	0	40	16.3	6.22	2	40	12	4.93	0	30
Sit-ups (≥36 sit-ups)	11.59	5.14	0	25	13.5	4.71	2	25	10.2	5.03	0	22
BOT-2 total score	**67.50**	5.18	55	85	**69.53**	6.35	55	84	**67.40**	7.67	56	80
Physical activity (METS per week)	**489.6**	696.7	10	5116.7	**519.6**	748.4	17	5116.7	**468.8**	660.3	10	4034

Min = minimum value; Max = maximum value, M = mean value; SD = standard deviation.

the differences between the boys and girls' mean BOT-2 scores, as well as their physical activity levels were statistically significant ($p = 0.03$, $t = 2.06$ and $p = 0.04$ $t = 2.17$, respectively), the differences were of a small effect (.18 and .11, respectively).

The correlation coefficients of motor proficiency with physical activity levels of the subjects are represented in Table 2. This table shows statistically significant correlations between the total BOT-2 scores and the physical activity levels of the total group, as well as the boys and girls' groups respectively. These correlations further exhibit a practical significance of a medium effect (coefficient between .27 and .36, Table 2). In the girls' group the fine motor correlation sub-item of folding a paper on lines, as well as copying of a star, show a statistically significant correlation to physical activity levels, with practical significance of a medium effect ($r = .25$). Statistically and practically significant correlations were also found in the manipulation coordination sub-items of tapping the feet and fingers in the girls' group (small effect, $r = .17$) and the dribbling a ball in the total group and the boys' group (medium effect, $r = .21$ and .24, respectively). The sub-item where the strongest correlation was found with physical activity levels appears to be the body coordination item of jumping in place, where statistically significant correlations were found in the total group, as in the boys' and girls' groups respectively, with practical significance of a medium effect in the total group and the girls ($r = .31$ and .22, respectively), and a small effect in the boys ($r = .16$). Significant correlations with medium effect ($r = .21$ to .24) were further found between the results of the test items of push-ups (in al the groups) and sit-ups (in all the groups) and physical activity levels.

Table 2 – Correlation coefficients of motor proficiency with levels of physical activity in Senior Phase learners.

Variables	Total group ($N = 239$)	Boys ($n = 98$)	Girls ($n = 141$)
	r	*r*	*r*
Fine motor coordination			
Drawing a line between 2 lines	.002	.14	.10
Folding paper on lines	.09	.12	.25*
Copying a square	.11	.06	.12
Copying a star	.16	.11	.19*
Manipulation coordination			
Transferring coins	.02	.05	.02
Tapping feet and fingers	.05	.11	.17*
Dribbling a ball	.24*	.21*	.14
Bouncing and catching a ball	.02	.11	.02
Body coordination			
Jumping in place	.31*	.22*.	.16*
Walking on a line	.07	.03	.11
One-leg balance	.02	.07	.02
Strength and agility			
Hopping on one leg	.02	.07	.09
Push-ups	.21*	.28*	.22*
Sit-ups	.23*	.29*	.23*
Total BOT-2 score	.36*	.27*	.30*

* = Statistically significant where $p \leq 0.05$.

4. Discussion

The aim of the study was to investigate the relationship between motor proficiency and physical activity levels in Senior Phase learners. The results show correlations between physical activity levels and the total motor proficiency scores of this group of learners, as well as some fine motor test items and the test items for jumping in place, dribbling a ball, push-ups and sit-ups.

Barnett, Van Beurden, Morgan, Brooks, and Beard (2009) confirm that motor proficiency is a predictor of physical activity in adolescents. The findings by Okely et al. (2001) that fundamental movement skills are significantly associated with adolescents' participation in organised physical activity, further support the results of a national study by Jaäkkola et al. (2009) on 14-year-old Finish adolescents, where positive correlations were found between fundamental movement skills, specifically locomotor and balancing skills, and sport-based physical activity levels. Studies by Fisher et al. (2005), Iivonen et al. (2013) and Sääkslahti et al. (1999) show that fundamental motor skills (walking, running, standing long jump, agility, throwing and catching, balancing on one leg, galloping and kicking a ball) exhibit a correlation with physical activity at an early age.

The correlations found in the two fine motor sub-tests (folding paper on lines and copying a star) in the boys' group are supported by the findings of Malina (2012), as well as Markovic and Kopas-Vukasinovic (2012), and Ziviani, Poulsen, and Hansen (2009) which all show that fine motor skills correlate to physical activity. According to Malina (2012), fine motor skills together with gross- and perceptual motor skills can be related to physical activity, as gross- and perceptual motor skills form the basis of the development of fine motor skills.

The correlation between physical activity and jumping in place (same sides synchronised), which represents the body coordination component, are supported by studies where similar correlations between physical activity and coordination skills were found (Ericsson, 2011; Iivonen et al., 2013; Malina, 2012). Researchers also found that children with coordination problems were not highly physically active (Bouffard et al., 1996; Cloete et al. 2006; Prinsloo & Pienaar, 2003; Skinner & Piek, 2001). Regular physical activity thus appears to be related to the development of body coordination in children and adolescents.

The positive relationship between physical activity and the test-item of dribbling a ball, which represents the component of manipulation coordination, correlates to characteristics found in studies on manipulation skills. In this regard Barnett et al. (2009) found that object control skills, such as kicking, catching and throwing show relationships with physical activity in 928 16-year-old learners in Sydney, Australia. Sliding, galloping, throwing and catching are also significantly associated with moderate to high intensity physical activity in the study by Iivonen et al. (2013), which also agree with the results of Raudsepp and Päll (2006) with regard to overhand throwing and jumping in 133 elementary school learners in Estonia. Holfelder and Schott (2014) identified six studies that confirm that the association between object control skills and physical activity, all showing associations in this regard among children and adolescents.

The gender differences with regard to the correlations between physical activity levels and motor skills that were found in this study can possibly be attributed to the different types of physical activity that boys and girls prefer. According to Cloete et al. (2006), Pienaar and Kemp (2014), as well as Themane, Koppes, Kemper, Monyeki, and Twisk (2006), it would appear that boys often prefer playing outside while girls often play more sedentary games inside, which require fine motor skills above gross motor skills (Themane et al., 2006; Walter, 2011). The correlations found in this study between the girls with regard to the fine motor coordination skills of folding a paper and copying a star, and the boys' group with the skill of dribbling a ball, could therefore possibly be attributed to the types of physical activity they prefer. According to Hardy, O'Hara; Rogers, St George and Bauman (2014) the relationship between motor skills and physical activity in girls are related to organised physical activity, such as Physical Education or sport-specific training, while in the boys the relationship is stronger in object control skills and non-organised physical activity, such as games among boys. The correlation found in this study with regard to the manipulation coordination skill of dribbling a ball in the boys' group, is supported by the results of Hardy, Reinten-Reynolds, Espinel, Zask, and Okely (2012) on 6917 representative Australian children. These researchers found that boys in both primary and high school, who exhibit poor object control skills are more likely to be physically inactive than girls in the primary and high school, while girls with poor locomotor skills are only half as physically active as boys (Hardy et al. 2012). These findings also support the stronger correlation found in the girls' group compared to the boys in this study between the body coordination skill of jumping in place and physical activity.

Various studies further found correlations between the physical fitness component of muscle strength, as represented by the test-items of push-ups and sit-ups in the BOT-2, and physical activity levels (Bozkus, 2013; Golubović, Milutinović, & Golubović, 2014; Lennox, Pienaar, & Wilders, 2008; Pejcic, Zvan, & Krstulovic, 2004). Golubovic et al. (2014) found in 139 preschool children (6.38 years) from Serbia that there was a significant correlation between physical activity and trunk strength, measured by, among others, sit-ups. In support of this, Bozkus (2013) found a positive correlation between physical activity and knee-, back- and leg strength, measured by means of an isometric dynamometer in 20-year-old Turks. Similar results were found with regard to strength in sit-ups and push-ups by Pejcic et al. (2004) in a study on 1058 children between 11 and 12 years of age in Slovenia, and by Lennox et al. (2008) in 13- to 14-year-old children from low socio-economic backgrounds in the North West province of South Africa.

According to Ericsson (2011), well-developed fundamental motor movement skills are important in motivating learners to become more physically active, as a deficiency in these skills could lead to a lack of interest in participating in physical activity and a poor self-image as they get older. Chen and Housner (2013) and Cloete et al. (2006) support this finding by emphasising that children with low levels of motor skills often exhibit poor levels of self-confidence and are inclined to avoid physical activity. Oldemar (2012) agree that Physical Education and physical activity intervention programmes must focus on motor skills development, especially manipulation skills, as it would appear that these skills are needed to increase children's levels of physical activity. The correlations that were found in this study are an indication that motor proficiency levels in adolescents can also be a determining factor with regard to their participation in physical activity.

5. Conclusions, limitations and recommendations for future research

The main aim of Physical Education as set out by the national school curriculum for the Senior Phase according to the South African Curriculum and Assessment Policy (CAPS) (SADBE, 2011), is to promote learners' participation in physical activity. The results of this study imply that it is important that learners' motor proficiency must be well developed to meet the requirements of the Physical Education curriculum. The recommendation can therefore be made that a Physical Education teacher should pay attention to the gross- and perceptual motor skills of Senior Phase learners, especially with regard to coordination skills and strength. With this recommendation in mind, future research should also include the assessment of the competency of Physical Education teachers to address and develop the motor proficiency of Senior Phase learners, as various South African universities no longer train specialist Physical Education teachers and this could also contribute to the lack of motor development. A further recommendation is that the mastery of fundamental motor skills should be included as a specific outcome in the Senior Phase Physical Education curriculum.

The results of this study should, however, be interpreted in light of a few limitations. Firstly, the test group was selected from one area of South-Africa and the generalisability of the findings is therefore limited. Secondly, the limited ability of children and adolescents to respond to self-report questionnaires with regard to physical activity is widely recognised in literature (De Coen et al. 2014; Chen et al. 2014; Hnatiuk, Salmon, Hinkley, Okely, & Trost, 2014) and could have affected the results. However, the results of this study emphasise that motor proficiency and the mastery of fundamental movement skills have an important role to play, even in adolescent learners in the Senior Phase, with regard to current, but also future participation in physical activity.

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