South African Journal for Research in Sport, Physical Education and Recreation, 2013, 35(1): 1-10.
Suid-Afrikaanse Tydskrif vir Navorsing in Sport, Liggaamlike Opvoedkunde en Ontspanning, 2013, 35(1): 1-10.
ISBN: 0379-9069

RELIABILITY OF THE TEEN RISK SCREEN: A MOVEMENT SKILL SCREENING CHECKLIST FOR TEACHERS

Eileen K. AFRICA* & Martin KIDD**
**Department of Sport Science, Stellenbosch University, Stellenbosch, Republic of South Africa*
***Centre for Statistical Consultation, Department of Statistics and Actuarial Sciences, Stellenbosch University, Stellenbosch, Republic of South Africa*

ABSTRACT

The importance of fundamental movement skills (FMS) are often taken for granted. It is expected that these movement skills will be adequate to get children through their school career, however, some children struggle. Teachers play an important role, as they are able to observe children in the classroom, as well as in a Physical Education setting. This study aims to provide an easy-to-administer, reliable screening checklist to determine children's FMS. The study sample consisted of 125 girls and seven classroom teachers from a selected school in Stellenbosch, South Africa. The checklist consisted of seven subscales. Cronbach alpha values, confirmatory factor analysis (CFA), partial least squares (PLS) path analyses, Spearman correlations and agreement intra-class correlations (ICC) were calculated. The results indicated that the data supported the reliability of the checklist. Most of the mentioned statistical models fitted the data well. All the scales except one, confirmed an acceptable fit and reliability coefficients reached acceptable values. There is a scarcity of research in this area. Future quality research is vital using validated screening checklists in conjunction with validated movement skill assessment tools.

Key words: Fundamental motor skills; Screening tool; Children; Teachers.

INTRODUCTION

Research involving human growth and motor development has been of insightful importance to researchers and teachers for many years (Gallahue, 1983). During the growing years, children continuously engage in activities involving moving around, handling objects, watching and exploring movement. Pre-adolescence is not only marked by rapid physical change, children also need to perform a repertoire of movement skills during their daily functioning, and developing functional independence is a prerequisite (Sugden & Sugden, 1990; Utley *et al*., 2010).

Fundamental motor skills are seen as building blocks for complex movement patterns. It is imperative that children are exposed to movement skills in various contexts prior to and during the pre-adolescence phase of development (Utley *et al*., 2010). The importance of fundamental movement skills is often taken for granted, as it is seen as a normal part of human development (Cools *et al*., 2008; Auxter *et al*., 2010). Larkin and Rose (2005) perceive movement skills as the groundwork of human performance. It is expected that these movement skills will be adequate to get through the school career with ease, however, some children struggle with some motor skills and are regarded as clumsy or physically awkward (Hay *et al*., 2004). According to Hay *et al*. (2004), these children are faced with a multitude of complications, which up till now have hardly ever received attention.

Over the past three decades, the world has created extremely young technology wizards who engage in sedentary lifestyles (Sanders, 2002). Children with advanced fundamental motor skills are more likely to engage in physical activity, since motor proficiency is inversely related to sedentary lifestyles (Wrotniak *et al*., 2006; Ericsson, 2008; Williams *et al*., 2008; Cliff *et al*., 2009; D'Hondt *et al*., 2011). Developing movement skills is the key line of attack to enhance children's current and future physical activity levels (Morgan *et al*., 2010). According to Barnett *et al.* (2010), proof regarding the significance of motor skill proficiency in physical activity participation has increased over the last decade. It is thus important to understand fundamental movement skill development to identify problems in order to offer remedial intervention (Piek & Edwards, 1997; Brantner *et al*., 2009). Assessment encompasses a multiplicity of ways to gather information (Auxter *et al.*, 2010). Although the assessment of children's movement skills has noticeably escalated (Netelenbos, 2005), there is a scarcity of research studies in this area (Ward *et al*., 2010). Consequently, future quality research is vital, using validated screening checklists in conjunction with validated movement skill assessment tools (Cliff *et al*., 2009). There are quite a few standardised assessment tools out there, but it is often time consuming, needs qualified professionals, expensive test equipment and adequate space, and children need to be tested individually (Netelenbos, 2005; Schoemaker *et al.*, 2008). Hardly any assessments are administered in schools, because a quick and reliable screening tool that can be used on every child is not available (Ericsson, 2008).

Schools and teachers are increasingly seen as the hub to promote the health and well-being of youth both in the classroom and on the playground (Larkin & Rose, 2005). Schools are the perfect place to receive guidance and support, as most children gather there five days a week. Teachers are interested in the children that they interact with and possess a wealth of information about their development most of the time. Teachers are most likely to be the first to notice that a child struggles with motor skills (Junaid, 2002). They are also supposed to employ an array of techniques to support children in their development (Utley *et al*., 2010). By employing new strategies and using new innovations, teachers can provide better learning opportunities.

This study therefore aims to provide a self-designed, easy-to-administer screening checklist to determine children's fundamental movement skills in a South African school setting. A more fundamental reason for administering the screening checklist in a school setting by Life Orientation (LO) teachers is that screening instruments are usually administered in laboratory settings and usually consists of tasks that are rarely observed in a Physical Education lesson. Researchers often ignore this (Bodnarchuk & Eaton, 2004; Netelenbos, 2005).

PROBLEM STATEMENT

The main problem was to develop a screening tool that is easy for teachers to use in a school setting to identify learners experiencing movement difficulties. The aim of the research was to construct a teen risk screen that will be thorough, but not daunting, which include multiple items related to fundamental movement skills that enables teachers to identify learners at high risk for movement difficulties.

METHODOLOGY

Participants

The sample consisted of girls (N=125) with a mean age of 12.12 (SD=1.1) years and teachers (N=7) from a selected primary school in the Stellenbosch region, Western Province, South Africa. The teachers were involved and committed to Life Orientation and specifically the Learning Outcome, Physical Development and Movement and/or Physical Education. Inclusion criteria were as follows: The teachers must have been involved in Life Orientation and had to give consent to participate in the study.

Measures

The teachers were trained by the researcher's assistant to administer a 26-item, self-designed motor skills screening checklist (Teen Risk Screen [TRS]), while the children were performing physical activities during a Physical Education lesson. The assistant who trained the teachers was also actively involved in all the measurement processes, thus in effect all the measurements can be viewed as being assessed by the same person. The aim was not to look at inter-rater reliability.

***TABLE 1*: MOTOR SKILLS**

PS-AM	**PS-DM**	**LS-SS**	**LS-C**	**MS-SA**	**MS-MP**	**MS-GP**
Sitting	Body Rolling	Walking	Galloping	Throwing	Carrying	Catching
Standing	Starting #	Running	Sliding	Striking	Dribbling	
Bending	Stopping	Leaping	Skipping	Kicking		
Stretching	Dodging	Jumping				
Twisting	Balancing	Hopping				
Turning						
Swinging						

\# Starting / take-off

PS-AM = Posture & Stability (Axial Movement);
PS-DM = Posture & Stability (Dynamic Movement);
LS-SS = Locomotor Skills (Single Skills);
LS-C = Locomotor Skills (Combinations);
MS-SA = Manipulative Skills (Sending Away);
MS-MP = Manipulative Skills (Maintaining Possession)

There are three fundamental skill categories namely, stability, locomotor and manipulative skills (Wickstrom, 1983). The TRS consisted of seven subscales, namely, posture and stability (axial movement) [PS-AM]; postural stability (dynamic movement) [PS-DM]; locomotor skills (single skills) [LS-SS]; locomotor skills (combinations) [LS-C];

manipulative skills (sending away) [MS-SA]; manipulative skills (maintaining possession) [MS-MP] and manipulative skills (gaining possession) [MS-GP]. The items under each subscale ranged from two to seven items (Table 1).

Each item was rated on a 3-point Likert-type scale (0 = cannot perform skill according to guidelines; 1 = can perform skill but not according to guidelines; 2 = can perform skill). By adding the scores for each item of each skill, a total score can be calculated. The lower the score is, the poorer the motor skill performance. The TRS can be administered to a group of children in a relatively short period of time. A trained administrator can administer the test to a group of 20 children in 30 to 40 minutes.

A reliable instrument is one that is consistent over time, thus it is necessary to ensure that the checklist is valid and reliable. The reliability of the checklist was determined by the test-retest method. An interval of two weeks was used before the second test period. Validity is the extent to which an instrument appears to be measuring what it is supposed to measure (Baumgartner *et al.*, 2002). The type of validity that was addressed in the development of the TRS was content validity, meaning to what extent the instrument will cover the content it intends to cover. The researcher ensured content validity by consulting with four colleagues in the field of Sport Science, as well as trained Physical Education teachers.

Procedure

Informed consent was obtained from the teachers and the principal of the school involved. The teachers attended an information session about the TRS and were educated and skilled to use the checklist. Each teacher received an information booklet in which every motor skill was described in detail. The teachers completed the TRS for each learner during the Physical Education class, while observing them doing a variety of physical activities, for example games and dances.

Statistical analysis

Firstly, Cronbach alpha values were calculated for each of the motor skills to investigate the reliability of items in measuring each of the skills. It is important to note that for the scale, Manipulative skills (gaining possession) [MS-GP], there was only 1 item; therefore it was not included in the statistical analysis. The reliability was then further and more rigorously investigated through confirmatory factor analysis (CFA). Finally partial least squares (PLS) path analyses were conducted that simultaneously evaluated the reliability of the motor skills together with testing the relationship between the first and second measurements. For specific evaluation of test-retest reliability, Pearson correlations as well as agreement intra-class correlations (ICC 2.1) were calculated.

RESULTS

Cronbach's alpha analysis

Table 2 presents the calculated Cronbach alpha values and average inter-item correlations for all the scales. A threshold of alpha>0.7 was used as guideline for acceptable reliability.
The results of Test 1 indicated that the screening checklist showed acceptable reliability values ($\alpha \geq 0.70$) in all but 1 of the cases. Scales that might have a problem ($\alpha \leq 0.70$) were

Locomotor Skills – Combinations [LS-C], Manipulative Skills – Sending Away [MS-SA] and Manipulative Skills – Maintaining Possession [MS-MP]. These scales still showed alpha values >0.6. All average inter-item correlations were positive (>0.4) indicating positive correlations structures for all the scales.

***TABLE 2*: CRONBACH'S ALPHA VALUES FOR SIX SCALES AND TWO TIME POINTS**

	Cronbach's Alpha		**Average inter-item correlation**	
Scales	**Test 1**	**Test 2**	**Test 1**	**Test 2**
PS-AM	0.93	0.86	0.66	0.48
PS-DM	0.89	0.86	0.64	0.56
LS-SS	0.89	0.90	0.66	0.68
LS-C	0.67	0.56	0.42	0.32
MS-SA	0.71	0.45	0.45	0.23
MS-MP	0.62	0.60	0.45	0.43

PS-AM = Posture & Stability (Axial Movement);
PS-DM = Posture & Stability (Dynamic Movement);
LS-SS = Locomotor Skills (Single Skills);
LS-C = Locomotor Skills (Combinations);
MS-SA = Manipulative Skills (Sending Away);
MS-MP = Manipulative Skills (Maintaining Possession)

For Test 2, the reliability indices were generally lower than for Test 1, with LS-C, MS-SA and MS-MP presenting lower than acceptable alpha values. MS-MP scores were also lower than the guideline but still on a 0.6 threshold.

Confirmatory factor analysis (CFA)

Due to the sample size not being large enough, separate confirmatory factor analyses (CFA) was fitted for each motor scale, except for LS-C, MS-SA and MS-MP which were combined into 1 model (Table 3). The latter 3 were combined due to the few items measuring each of the scales. The factor analysis (CFA) results were evaluated in 2 steps. Firstly the goodness-of-fit was investigated by reporting root mean square error of approximation (RMSEA) and the adjusted goodness of fit index (AGFI). Guidelines used were RMSEA<0.05 and AGFI>0.95. The second step (if acceptable goodness-of-fit was achieved) was to investigate construct reliability (CR) and variance extracted (VE). Guidelines here were CR>0.7 and VE>0.5.

For the PS-AM and PS-DM Test 1 scales, the CFA results showed marginal fit statistics with the RMSEA just outside the prescribed boundaries, but the AGFA indices were acceptable. Construct reliability and variance extracted indicated acceptable reliability. However, for Test 2, the fit statistics were well below acceptable. The LS-SS scale gave marginally acceptable RMSEA (Test 1 and 2) and acceptable AGFI, CR and VE (Test 1 and 2). The 3-scale CFA model gave acceptable results for all indices at both time points with perhaps the VE of MS-SA at time Test 2 being slightly lower (VE=0.43).

***TABLE 3*: CONFIRMATORY FACTOR ANALYSIS-FIT STATISTICS**

Model	Test	RMSEA (p-value)**	AGFI	Scales	Construct reliability	Variance extracted
1	1	**0.10 (0.03)**	1.00	PS-AM	0.98	0.85
	2	**0.13 (<0.01)**	0.97		Not reported*	Not reported*
2	1	**0.12 (0.05)**	0.99	PS-DM	0.95	0.80
	2	**0.16 (<0.01)**	0.98		Not reported*	Not reported*
3	1	0.10 (0.13)	1.00	LS-SS	0.97	0.86
	2	0.06 (0.34)	1.00		0.97	0.97
4	1	0.008 (0.74)	0.99	LS-C	0.79	0.57
				MS-SA	0.85	0.65
				MS-P	0.76	0.62
	2	0.05 (0.35)	0.93	LS-C	0.74	0.51
				MS-SA	0.68	0.43
				MS-P	0.79	0.65

*Not reported due to lack of fit
**p-value for test of close fit (RMSEA ≤0.05)

Partial Least Squares path model

The PLS path model simultaneously tested the reliability of the scales (outer model), as well as the relationship between Test 1 and Test 2 (inner model), which provided information on test-retest reliability. Figure 1 shows the layout of this model.

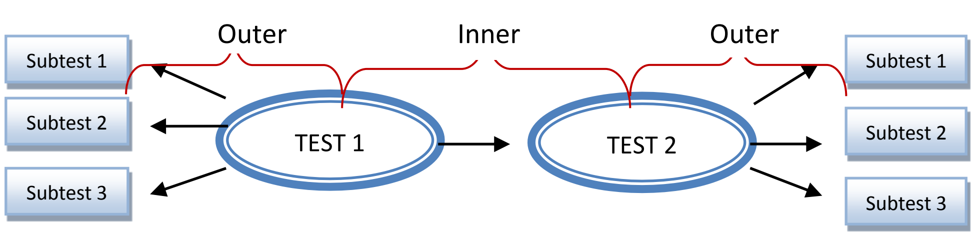

***FIGURE 1*: GENERIC LAYOUT OF PARTIAL LEAST SQUARES PATH MODEL**

***TABLE 4*: PARTIAL LEAST SQUARES PATH MODEL RESULTS**

Scales	Composite reliability Test 1	Composite reliability Test 2	R^2 Test 1-Test 2	Variance extracted Test 1	Variance extracted Test 2
PS-AM	0.94	0.88	0.34	0.75	0.59
PS-DM	0.92	0.90	0.48	0.71	0.64
LS-SS	0.93	0.93	0.81	0.72	0.74
LS-C	0.82	0.78	0.58	0.61	0.54
MS-SA	0.84	0.73	0.20	0.63	0.48
MS-MP	0.84	0.83	0.35	0.72	0.71

From the results in Table 4, it can be concluded that the composite reliability of all the scales was acceptable (≥0.7). Variance extracted results were similar to the CFA results with all the scales showing VE>0.5 except MS-SA, which were slightly lower (as was the case for CFA). The last column in Table 4 shows the amount of variance of Test 2, explained by Test 1. This can be seen as a measure of test-retest reliability. The LS-SS scale showed the best relationship between test-retest (81%) with the others in varying degrees lower than that. MS-SA gave the lowest R^2 (20%).

Test-retest reliability

***TABLE 5*: RESULTS FOR TEST-RETEST RELIABILITY**

Test 1 & 2 Scales	Pearson correlation	ICC agreement 95% (CI)	Mean ± SD Test 1	Mean ± SD Test 2
PS-AM	0.59	0.51 (0.32, 0.65)	6.9 ± 2.6	7.8 ± 2.1
PS-DM	0.69	0.63 (0.46, 0.75)	10.3 ± 3.4	11.5 ± 2.4
LS-SS	0.88	0.86 (0.76, 0.91)	7.0 ± 2.5	7.5 ± 2.3
LS-C	0.76	0.74 (0.65, 0.82)	4.3 ± 1.5	4.5 ± 1.3
MS-SA	0.43	0.34 (0.13, 0.51)	4.5 ± 1.3	5.2 ± 0.9
MS-MP	0.58	0.56 (0.42, 0.67)	2.9 ± 0.1	3.1 ± 0.9
MS-GP*	0.56	Kappa=0.36(0.21-0.53)		

*Kappa coefficient of conformance is reported here because this scale consists of only one item with Likert outcomes 0.1 and 2. Polychoric correlation is reported which is more suitable for this 3-point Likert scale. No means are reported.

The results (Table 5) revealed significant (p<0.01) positive correlations between Test 1 and Test 2. Correlations were relatively high (≥0.7) for all the scales, except for MS-SA (r=0.44) and MS-MP (r=0.59). The ICC values showed a similar pattern with MS-SA lowest (ICC=0.34) and LS-SS highest (ICC=0.86). Repeated measures ANOVA was conducted to test for mean differences between Test 1 and Test 2 and were found to be significant (p<0.01) in all cases. The averages of Test 2 were always higher. The same trend was seen for MS-GP with a significantly higher proportion of 3's reported in the Test 2 (results not shown). This could be because of a learning/practice or maturation effect. The teachers as the observers could have been more used to administering and understanding the Teen Risk Screen. They were also potentially less nervous during the second testing. The second time around the learners could have had a better understanding of what was expected of them. The children could have become accustomed to the second round of testing, because the excitement of the novelty of the activities diminishes. The children potentially competed against one another, thus performing better.

CONCLUSION

Early testing for problems with fundamental motor skills will ensure adolescents have the capabilities and foundation to grow into adults successfully. As children spend a significant part of the day at school, utilising teachers as testers/observers within the school environment, will ensure that the child acts as intuitively as possible. The results of this study indicated that Posture and Stability - Axial Movement [PS-AM], Posture and Stability - Dynamic Movement [PS-DM] and Locomotor Skills - Single Skills [LS-SS] showed acceptable reliability on all three counts (Cronbach's alpha, CFA and PLS) except for Test 2, where the Confirmatory Factor Analysis [CFA] did not fit for PS-AM and PS-DM. For Locomotor Skills - Combinations [LS-C], Manipulative Skills - Sending Away [MS-SA] and Manipulative Skills - Maintaining Possession [MS-MP] the alphas were generally lower, but acceptable according to the CFA and PLS.

The CFA results did indicate possible problems with PS-AM and PS-DM, and further research should be done on larger samples to investigate possible underlying sub dimensions. However, none of the other statistical procedures (Cronbach alpha & PLS) indicated problems with these scales. Exploratory factor analyses were not done because the aim was to specifically test the current proposed latent structure. It would be useful to conduct such analyses in follow-up studies on larger samples.

The unfortunate reality is that limited data and tests were available to use as a base for determining the reliability coefficient and thus instilling confidence in the Teen Risk Screen. Due to observations from the test process, it is envisioned that more testing and changes to composition of some of the scales in the TRS are required. However, the information gathered can provide valuable addition to measures that teachers use to identify learners with movement difficulties.

Several challenges were met while developing the Teen Risk Screen [TRS]. The teachers that participated in this study were not representative of all teachers involved in Physical Education. When used as a screening tool, it has to be used in juxtaposition with a standardised motor test or clinical assessments.

Acknowledgement

The study was funded by THUTHUKA (NRF). The views expressed here do not necessarily represent those of the funding organisation. The authors would like to acknowledge the assistants for the data collection.

REFERENCES

AUXTER, D.; PYFER, J.; ZITTEL, L. & ROTH, K. (2010). *Principles and methods of adapted physical education and recreation*. New York, NY: McGraw-Hill.

BARNETT, L.M.; VAN BEURDEN, E.; MORGAN, P.J.; BROOKS, L.O. & BEARD, J.R. (2010). Gender differences in motor skill proficiency from childhood to adolescence: A longitudinal study. *Research Quarterly for Exercise and Sport,* 81(2): 162-170.

BAUMGARTNER, T.; STRONG, C. & HENSLEY, L. (2002). *Conducting and reading research in health and human performance*. New York, NY: McGraw-Hill.

BODNARCHUK, J.L. & EATON, W. (2004). Can parent reports be trusted? Validity of daily checklists of gross motor milestone attainment. *Applied Developmental Psychology*, 25: 481–490.

BRANTNER, S.; PIEK J.P. & SMITH, L.M. (2009). Evaluation of the validity of the MAND in assessing motor impairment in young children. *Rehabilitation Psychology*, 54(4): 413-421.

CLIFF, D.P.; OKELY, A.D; SMITH L.M. & McKEEN, K. (2009). Relationship between fundamental motor skills and objectively measured physical activity in preschool children. *Paediatric Exercise Science,* 21: 436-449.

COOLS, W.; DE MARTELAER, K.; SAMAEY, C. & ANDRIES C. (2008). Movement skill assessment of typically developing preschool children: A review of seven movement skill assessment tools. *Journal of Science and Medicine,* 8: 154-168.

ERICSSON, I. (2008). To measure and improve motor skills in practice. *International Journal of Paediatric Obesity*, 3(S1): 21-27.

D'HONDT, E.; DEFORCHE, B.; VAEYENS, R.; VANDORPE, B.; VANDENDRIESSCHE, J.; PION, J.; PHILIPPAERTS, R.; DE BOURDEAUDHUIJ, I. & LENOIR, M. (2011). Gross motor coordination in relation to weight status and age in 5- to 12-year-old boys and girls: A cross-sectional study. *International Journal of Paediatric Obesity,* 6(2-2): e556-e564.

GALLAHUE, D.L. (1983). Assessing motor development in young children. *Studies in Educational Evaluation*, 8: 247-252.

JUNAID, K.; HARRIS, S.; FULMER, A. & CARSWELL, A. (2002). Teachers' use of the M-ABC checklist to identify children with motor difficulties. *Paediatric Physical Therapy,* 12: 158-163.

HAY, J.A.; HAWES, R. & FAUGHT, B.E. (2004). Evaluation of a screening instrument for developmental coordination disorder. *Journal of Adolescent Health,* 34: 308-313.

LARKIN, D. & ROSE, E. (2005). Assessment of developmental coordination disorder. In D.A. Sugden & M.E. Chambers (Eds.), C*hildren with developmental coordination disorder* (135-154). London: Whurr Publishers.

MORGAN, P.; MCINTYRE, F.; HANDS, B.; CLIFF, D.; BARNETT, J.; WALKLEY, J. & OKELY, T. (2010). How important is motor skill proficiency to physical activity participation? *Journal of Science and Medicine in Sport*, 12: e1-e232.

NETELENBOS, J.B. (2005). Teachers' ratings of gross motor skills suffer from low concurrent validity. *Human Movement Science*, 24: 116-137.

PIEK, J.P. & EDWARDS, K. (1997). The identification of children with developmental coordination disorder by class and physical education teachers. *British Journal of Educational Psychology,* 67: 55-67.

SANDERS, S. (2002). "The importance of developing fundamental motor skills". November. [http://www.pbs.org/teachers/earlychildhood/articles/motorskills.html]. Retrieved on 8 November 2011.

SCHOEMAKER, M.M.; FLAPPER, B.C.T.; REINDERS-MESSELINK, H.A. & DE KLOET, A. (2008). Validity of the motor observation questionnaire for teachers as a screening instrument for children at risk for developmental coordination disorder. *Human Movement Science*, 27(2): 190-199.

SUGDEN, D. & SUDGEN, L. (1990). The assessment of movement skill problems in 7- and 9-year-old children. *British Journal of Educational Psychology*, 61: 329-345.

UTLEY, A.; NASR, M. & ASTILL, S. (2010). The use of sound during exercise to assist development for children with and without movement difficulties. *Disability and Rehabilitation,* 31(18): 1495-1500.

WARD, D.S.; VAUGHN, A.; McWILLIAMS, C. & HALES, D. (2010). Interventions for increasing physical activity at child care. *Medicine and Science in Sports and Exercise*, 42(3): 526-534.

WICKSTROM, R.L. (1983). *Fundamental motor patterns.* Philadelphia, PA: Lea & Febiger.

WILLIAMS, G.H.; PFEIFFER, K.A.; O'NEILL, J.R.; DOWDA, M.; MCIVER, K.L.; BROWN, W.H. & PATE, R.R. (2008). Motor skill performance and physical activity in preschool children. *Obesity*, 16(6): 1421-1426.

WROTNIAK, B.H.; EPSTEIN, L.H.; DORN, J.M.; JONES, K.E. & KONDILIS, V.A. (2006). The relationship between motor proficiency and physical activity in children. *Paediatrics,* 118: e1758-e1765.

Dr. Eileen K. AFRICA: Department of Sport Science, Stellenbosch University, Private Bag X1, Matieland 7602, Stellenbosch, Republic of South Africa. Tel.: +27 (0) 21 808 4591, Fax.: +27 (0) 21 808 4817, E-mail: africa@sun.ac.za

(Subject Editor: Dr. Karen Welman)