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FUNDAMENTAL MOVEMENT SKILL PROFICIENCY OF SOUTH AFRICAN GIRLS FROM A LOWER SOCIO-ECONOMIC COMMUNITY

Samantha A. KAHTS[1], Rosa DU RANDT[1], Danie J.L. VENTER[2]
[1] *Department of Human Movement Science, School of Lifestyle Sciences, Faculty of Health Sciences, Nelson Mandela University, Port Elizabeth, Rep. of South Africa*
[2] *Unit of Statistical Consultation, Nelson Mandela University, Port Elizabeth, Rep. of South Africa*

ABSTRACT

Poor fundamental movement skills (FMS) proficiency can contribute to a decrease in participation in energy-expending recreational and sporting endeavours. Against the backdrop of the increasing obesity epidemic, ensuring that these foundational motor skills are established in childhood is justified. The purpose of this study was to evaluate the status of FMS proficiency of 191 girls aged nine- to 12-years-old from a lower socio-economic community within Port Elizabeth, South Africa. A descriptive study design employing convenience sampling and quantitative assessment techniques was utilised. The FMS assessed were running for speed, standing long jump, throwing and catching. The Component Approach (CA) and Test of Gross Motor Development 2 (TGMD-2) qualitative motion analysis tools were used. The CA findings revealed that only the catch was performed proficiently whereas the TGMD-2 indicated that the catch and run for speed were performed proficiently when comparing age groups. Only catch had a small statistical and practical significant difference in FMS scores between nine- and ten-year-olds. These findings highlight the need for FMS interventions at an early age in girls from lower socio-economic status communities. The different results observed for the CA and TGMD-2 as implemented in this study highlight possible limitations in FMS qualitative motion analysis tools.

***Keywords*:** Fundamental movement skills; Movement proficiency; Girls; Component Approach Qualitative Motion Analysis; Test of Gross Motor Development 2; Lower socio-economic status.

INTRODUCTION

There is a growing body of evidence supporting the relationship between children possessing proficient Fundamental Movement Skills (FMS) and increased Physical Activity (PA) levels (Stodden *et al.*, 2008). With energy deficits due to decreased PA levels resulting in cardiac and metabolic disorders in South African children and youths (Rossouw *et al.*, 2012) and research emphasising the health benefits associated with proficient FMS (Lubans *et al.*, 2010), identifying the status and developing FMS seems warranted (Goodway *et al.*, 2014).

With physical education (PE) being present in the school curriculum and childhood being the optimal period for FMS-based training (Graham *et al.*, 2012), developing FMS proficiency in a sheltered Primary School environment is justified (Lonsdale *et al.*, 2013). However, with the use of non-specialist PE teachers to implement PE at South African schools (Van Deventer, 2009), FMS proficiency levels in children may be below par. In addition, the incidence of gender sporting stereotypes in South Africa may also unfavourably affect the acquisition of certain FMS, especially in females (Shehu, 2010). Furthermore research indicates that females can be negatively affected by maturational changes in their bodies between the ages of ten- to 14-years-old, decreasing the amount of PA participated in (Todd *et al.*, 2015) and hence exposure to an array of FMS. Finally, and when specifically referring to the lower Socio-Economic Status (SES) communities of the Eastern Cape province of South Africa, the presence of poor or lack of recreational and sporting infrastructure, lack of water and electricity at schools (Department of Basic Education, 2011; Veriava, 2012) and the high unemployment and low education levels of community members (Makiwane & Dan, 2010), FMS proficiency of children may be negatively affected.

The constraints-led approach (Renshaw *et al.*, 2010) and Bronfenbrenner's bio-ecological model (Nobre *et al*., 2014) of motor learning support the notion that the motor development of an individual is affected by the environmental surroundings and social context in which motor tasks take place. The aforementioned literature suggests that children from lower SES communities would be negatively affected in this regard. The present study was consequently initiated to establish whether this hypothesis was true in the South African context. The specific aim of this study was therefore to describe and compare FMS proficiency of nine- to 12-year-old girls from a lower SES community in Port Elizabeth and their associated PA and maturational status.

LITERATURE REVIEW

Fundamental movement skills (FMS)

A child who can proficiently perform FMS possesses the ability to utilise the most efficient bodily movements while performing locomotor, non-locomotor and object control skills such as running, jumping, catching, throwing, balancing, and kicking, to name but a few (Graham *et al.*, 2012). The importance of mastering these foundational skills in early childhood has been established in systematic review literature findings and demonstrates the health benefits that include increased cardiovascular fitness and PA levels and the maintenance of a healthy Body Mass Index (BMI) (Lubans *et al.*, 2010). According to the hour glass model of motor development of Gallahue and Ozmun, FMS should be mastered by the age of seven (Gallahue *et al*., 2012).

Research conducted on South African children indicate that the mastery of FMS is not necessarily being achieved by the age of seven years old. In the study of Pienaar *et al*. (2015) on 826 children aged nine- to ten-years-old from the lower and higher SES areas within the North West Province, it was found that of the object control skills investigated, 23% of participants were below average when tested with the Test of Gross Motor Development 2 (TGMD-2). Additionally, males and children from higher SES areas tended to perform better. Van Niekerk *et al*. (2015) studied 239 adolescents aged 13- to 14-years-old from a higher SES area within the North West Province using the Bruininks-Oseretsky Test of Motor Proficiency 2 (BOT-2) quantitative movement analysis tool together with the Fundamental Movement

Pattern Assessment Instrument (FMPAI). The findings revealed that the FMS assessed within the youth sample were performed below the expected level, necessitating intervention. It was furthermore found that males performed better than females.

The study of Pienaar *et al*. (2016) on 72 children six years of age from higher SES area within the North West Province indicated that throwing and body coordination skills were performed poorly when using the BOT-2. A difference in male and female performance was furthermore noted with concluding recommendations that targeted interventions for both sexes are required. Finally, Pienaar and Kemp (2014) investigated 816 children aged six- to seven-years-old from lower and higher SES areas within the North West Province using the BOT-2 and reported that one out of two learners assessed were placed into a below average motor proficiency level. It was highlighted that white girls and black learners performed poorly in comparison to boys and white learners.

A similarity noted regarding the concluding comments of various studies was that children and youth are not performing all FMS at a mastery level as would be expected of children or youth of their age and that targeted FMS interventions are needed. What should also be noted in the South African studies on the status of FMS proficiency, is that many of these studies were conducted in the North West Province, highlighting the need for research in other provinces. Furthermore, the cited studies employ mainly the BOT-2 or MABC-2 protocols, which focus on the quantitative movement outcomes (which are also known as product scores and refer to, for example how far a child has jumped) of motor skills versus the qualitative outcomes (which are also known as process scores and refer to the quality of the movement mechanics of the jump, for example). Consequently the literature highlights the need for research focusing on the latter movement analysis tools by including the TGMD-2 or alternative qualitative motion analysis tools. Most studies indicated gender differences in motor proficiency, with females performing poorer in certain motor skills when compared to males. The studies highlight that children from lower SES areas (on average) do not perform FMS as proficiently as their higher SES peers, justifying the need to focus research on children or youth from lower SES areas.

The low proficiency scores noted in children could, according to Bronfenbrenner's bio-ecological model, be due to the environment, which comprises of the micro-, meso-, exo- and macro-systems (Nobre *et al*., 2014; Uehara *et al*., 2014). As stated by the latter authors, the micro-system is the immediate environment in which the developing individual resides and participates in motor learning activities. Examples of the immediate environment could include the school environment and the presence or absence of sport infrastructure, access to PE equipment and/or the interactions with PE teachers. The meso-system consists of the interaction between micro-systems and how each influences the other and the developing individual. For example, the interaction between a parent and school staff members and/or the interaction between the parent, school staff and sport club would form the meso-system which affects the motor development of an individual. The exo-system consists of the environment that the developing individual does not directly interact with but which indirectly effects their development. Examples include, characteristics of a neighbourhood, a parent's workplace and/or the policies and procedures of the Department of Education or Sport and there influence on FMS development. Lastly, the macro-system is the overarching environmental influence, which consists of the effect that history, poverty, culture and politics have on motor learning.

Furthermore, the constraints-led approach supports the notion that the environmental situation together with individual and task constraints can limit or promote motor development (Renshaw *et al.*, 2010). Consequently, FMS development should be considered within the environmental context where motor development is taking place. With literature highlighting that lower SES females may be at risk and with the limited research being conducted specifically in the Eastern Cape of South Africa, discussing the literature findings with regard to this context is warranted.

South African physical education and sport participation

Based on the mentioned findings reported by Nobre *et al.* (2014) and Uehara *et al.* (2014), the micro-system is the immediate environment in which the developing individual resides and participates in motor learning activities. Hence, the participation in PE and/or sport at school can be considered as the immediate environment in which motor learning takes place. Within the South African context PE is poorly implemented due to the presence of non-specialist PE teachers, its non-examinable status within the curriculum and consequently the low priority provided when compared to other subjects, lack of support from key stakeholders in the school and community, and budgetary constraints (Frantz, 2008; Van Deventer, 2009; Draper *et al.*, 2014). These sentiments extend to sport participation in lower SES areas with unqualified coaches (Mchunu & Le Roux, 2010), thus limiting the quality of FMS development during PA endeavours at school. The systematic review of Dudley *et al.* (2011) on children between five- to 18-years-old on the effect of PE and school sport on PA, movement skills and enjoyment of PE, it was emphasised that for programmes to be successful, on-going professional development of teachers is essential for the best PA intervention results.

Lower socio-economic status

Poverty forms part of the macro-system and it can affect the micro-, meso- and exo-system interactions. Within the context of this study, schools residing in lower SES communities such as the one under investigation in the present study, tend to experience barriers to the implementation of PE or sport more severely than schools in higher SES communities. This can be due to high poverty rates, poor education levels of the community, lack of access to adequate food and drinking water, and large teacher to learner ratios within class settings (Phurutse, 2005; Department of Basic Education, 2011; Veriava, 2012). These sentiments are supported by the difficulty experienced by researchers to adequately implement PA and health interventions in lower SES schools given the barriers to implementation, which include "a lack of parental involvement, time and available resources, poor physical environments at schools and socio-economic considerations" (De Villiers *et al.*, 2015:online). Parental influences on FMS development of children has been researched and shown to positively or negatively influence motor skill attainment (Cools *et al.*, 2011). Consequently, with a lack of parental support in lower SES communities, FMS development may be hampered.

The poor socio-economic considerations highlighted by De Villiers *et al.* (2015) that include a lack of money in general by community members to even buy healthy food, the prospect of community members being able to support FMS development at home or at schools is unlikely. Within the Eastern Cape, the impact of such an environment may be amplified by the state of poverty, which is supported by the comments of researchers, such as Makiwane and Dan (2010:online) that indicate "extraordinary measures by the government and all development partners are required in order to break the shackles of structural poverty and their consequences among the population of the province". The research in the North West Province of South Africa found that children from lower SES areas tended to possess poorer FMS when compared to their higher SES peers (Pienaar *et al.*, 2015). Whether or not these findings extend to the Eastern Province warrants further investigation.

Gender

According to the constraints-led approach and Bronfenbrenner's bioecological model, gender is an associated personal constraint that affects motor learning (Renshaw *et al.*, 2010; Nobre *et al*., 2014). Studies have indicated that gender cultural norms can affect the motor skill acquisition of individuals, with females being more negatively affected (Spessato *et al.*, 2013). South African cultural norms within the macro-system, such as gender stereotyping have been shown to affect the micro-, meso- and exo-system (Shehu, 2010). Although the South African government has made an effort to eradicate gender inequalities by promoting female sport, gender stereotyping persist (WASSA, 2011; Philip, 2013). Being female and the possible negative effect thereof on FMS development has been illustrated in South African studies by Pienaar and Kemp (2014) and Pienaar *et al.* (2015). These results extend to international research findings as well (Hardy *et al.*, 2012; Spessato *et al.*, 2013; Barnett *et al.*, 2016). In addition to research indicating the effect gender stereotyping may have on FMS development in females, Uehara *et al*. (2014) highlight that biological factors, such as the onset of menarche in females, should also be considered when evaluating motor skill development. Research by Todd *et al.* (2015) emphasises the possible negative effects the onset of menarche can have on developing the PA levels of adolescent female.

PURPOSE OF THE RESEARCH

With the literature highlighting the need for additional research on the FMS of females in other geographic areas, other than in the North West Province, for example in the Eastern Cape, the aim of this study was to describe and compare FMS proficiency of nine- to 12-year-old girls from a lower SES community in Port Elizabeth and their associated PA and maturational status.

METHODOLOGY

Research design

A descriptive cross-sectional study design, employing a quantitative approach, was utilised to meet the aim of this study.

Sample

Convenience sampling, as described by Gravetter and Forzano (2009), was used to select the schools and participants from the population under investigation. To be included in the sample, girls needed to be free from disability, from a school with a Quintile Three or lower status (see Collingridge, 2013) in Port Elizabeth, between nine- and 12-years-old and in grades 4 to 7.

Of the original sample of 250, 59 girls did not complete all the tests and measurements, as they were absent on day 1 or 2 of data collection. Consequently, data from a total of 191 participants were accounted for in the statistical analysis. The sample consisted of 38 nine-year-olds (20%), 53 ten-year-olds (28%), 54 eleven-year-olds (28%) and 46 twelve-year-olds (24%).

Ethical considerations

To ensure adherence to ethical conduct, ethics clearance for the study was granted by the official Ethics Committee of the Nelson Mandela Metropolitan University. The allocated ethics number is H10 HEA HMS 007. Additionally, the Eastern Cape Department of Education, the principal of each school and parents or legal guardians provided informed consent. Participants were requested to provide assent.

Fundamental movement skills assessment

Qualitative (process score) information was obtained from the FMS assessed. Each FMS process score was assessed through setting up a Sony DCR-SR58E digital video recorder at each station with specified and consistently applied camera dimensions, setup and implementation procedures. Dartfish video analysis software was employed to allow for a frame-by-frame analysis (Dartfish, 2015). The corresponding video footage of the best out of three trials FMS product scores for the 40-m run for speed (seconds) (Australian Sports Commission, 1995), standing long jump (centimetres) (Kirby, 1991), throw for distance (metres) (Australian Sports Commission, 1995) and catch (Henderson *et al.*, 2007) test protocols were assessed with the Component Approach (CA) (Horita, 2008) and Test of Gross Motor Development 2 (TGMD-2) (Ulrich, 2000) qualitative motion analysis tools.

For the TGMD-2 analysis aspect of the study, the qualitative assessment guidelines were employed to retrieve the process scores of the FMS under investigation. The TGMD-2 is a criterion based analysis tool that can be used to assess six locomotor and six object control FMS (Ulrich, 2000). The FMS assessed each have three or more performance criteria deemed critical to the success of the movement. For each performance criteria assessed, a score of either 0 or 1 is awarded. Zero is given if the criteria do not present and a score of one is awarded if the criteria do present during the movement. The TGMD-2 has been found to be reliable and valid (Payne & Isaacs, 2012).

The CA is based on the premise that movement transpires in a predictable manner from an initial to elementary and eventual mature movement pattern (McLester & Pierre, 2008). Consequently, when analysing FMS with the CA, a process score of 1, 2 or 3 was awarded to represent the fact that the participant performed the component body part at an initial, elementary or mature stage or phase of proficiency, respectively. For a participant to achieve mastery in the CA, a total score equal to 80% of the maximum possible for the particular FMS needed to be attained (O'Connor, 2000). For example in the run for speed, nine component body parts were assessed. Hence a total score of 27 could be awarded. If the participant achieved a score of 21.6 or above, the participant would have been deemed as having achieved mastery level.

For the standing long jump a score of 24 out of 30, for the throw a score of 14.4 out of 18 and for the catch a score of 9.6 out of 12 would be deemed achieving mastery. The component body parts assessed when using the CA for the run for speed were: arm swing, shoulder position, elbow angle, arm and leg opposition, foot and flight action, recovery hip and knee flexion and knee extension, based on the criteria presented by Horita (2008). The component body parts assessed in the standing long jump were: preparatory crouch, take-off arm action, knee and hip extension, take-off trunk action, flight and leg flight action, landing leg and arm action and balance when landing, based on Horita (2008).

The component body parts assessed in the throw for distance were: preparatory arm swing, contralateral leg movement, trunk rotation, angle of release, co-ordination of body and ball follow-through, adapted from Wickstrom (1983), Roberton and Halverson (1984) and Roberton and Konczak (2001). Lastly, the component body parts assessed in the catch were: preparatory arm action, reception arm action and hand and body action when catching the ball, following McGlenaghan and Gallahue (1978), Wickstrom (1983), Williams (1983) and Roberton and Halverson (1984).

To ensure the reliability of the FMS assessed, firstly the frame-by-frame analysis using Dartfish software was employed. Secondly, the percentage-agreement was calculated to identify the degree of consensus between the researcher and an independent analyst who is a human movement science specialist. The percentage-agreement was found to be above 70% for the CA and TGMD-2 assessments conducted, which is considered acceptable (Stemler, 2004).

Demographic and biographical questionnaire

In order to gain insight into the contextual setting of the selected population group, a questionnaire was used to gather relevant information. The name, surname, date of birth and age, menarche age, school, grade and home language of the participants were captured. In addition, the extent of time each participant spent partaking in extra-mural activities and playing ball games, riding a bicycle, swimming and/or running around during and after school on week days. If participants did not understand what was required of them, the teacher would repeat the question in their home language.

Statistical analysis

Microsoft Excel® V15 and Statistica® 12 were used to facilitate descriptive and inferential statistical analyses. To identify whether statistical significant differences presented between age groups with regard to mean values, ANOVA and, where applicable, the Scheffé post hoc test was employed. Statistical significance was set at $p<0.05$. If the Scheffé test indicated a statistically significant difference, Cohen's d statistic was calculated to determine the practical significance (effect size) of the applicable difference according to the following guidelines: $d<0.20$ not significant; $0.20\leq d<0.50$ small; $0.50\leq d<0.80$ medium; $d\geq 0.80$ large (Pace, 2012). Chi² (χ^2) tests were used to identify whether statistical significant differences presented between age groups when participants were categorised according to their movement scores. If statistical significance was identified in a Chi² test then Cramer's V statistic was calculated to determine the practical significance of the differences according to guidelines that varied according to the size of the relevant table (Abott & McKinney, 2013).

Table 1. FMS SCORES FOR CA AND TGMD-2 AND DIFFERENCES

Measure	**Stats.**	**9yrs** (n=38)	**10yrs** (n=53)	**11yrs** (n=54)	**12yrs** (n=46)	**Total** (n=191)	**F***	**p**	**χ^2 ****	**p**
Run CA	M±SD	19.55±1.64	19.42±1.87	19.20±1.68	19.37±1.60	19.37±1.70	0.329	0.805		
	Proficient	8%	8%	6%	9%	7%			0.40	0.941
Run TGMD	M±SD	3.58±0.55	3.53±0.58	3.37±0.52	3.46±0.55	3.48±0.55	1.289	0.280		
	Proficient	97%	96%	98%	98%	97%			0.44	0.932
Throw CA	M±SD	12.34±1.68	12.28±1.49	12.59±1.63	11.93±1.62	12.30±1.61	1.410	0.241		
	Proficient	13%	6%	7%	4%	7%			2.72	0.437
Throw TGMD	M±SD	2.00±0.87	2.06 ±0.79	1.94±0.79	1.80±0.75	1.95±0.80	0.877	0.454		
	Proficient	21%	25%	13%	9%	17%			5.50	0.139
Jump CA	M±SD	21.18±2.08	21.79±1.92	21.54±1.99	21.63±1.89	21.56±1.96	0.734	0.533		
	Proficient	18%	15%	13%	17%	16%			0.63	0.889
Jump TGMD	M±SD	1.79±0.78	1.89±0.64	1.91±0.81	2.00±0.76	1.90±0.74	0.560	0.642		
	Proficient	16%	15%	24%	20%	19%			1.70	0.637
Catch CA	M±SD	10.74±2.08	11.75±0.78	11.44±1.19	11.28±1.60	11.35±1.46	3.862	0.010		
	Proficient	76%	96%	89%	89%	88%			8.67	0.034
Catch TGMD	M±SD	2.53±0.89	2.92±0.33	2.76±0.61	2.76±0.67	2.76±0.64	2.901	0.036		
	Proficient	79%	98%	91%	91%	91%			9.58	0.023

FMS=Fundamental Movement Skill; CA=Component Approach; TGMD=Test of Gross Motor Development 2; Stats.=Statistics; M=Mean; SD=Standard Deviation
*ANOVA for means; ** Chi-square test for proficiency percentage

RESULTS

Table 1 presents the descriptive and inferential statistics for the CA and TGMD-2 scores. In terms of the CA and TGMD-2 scores it should be noted that only the catch was performed proficiently and improved significantly, both statistically and practically (small to medium practical significance), as children aged between the ages nine and ten years.

The run for speed, jump for distance and throw for distance scores did not meet the 80% proficiency cut-offs of 21.6, 24.0 and 14.4 whereas the catch was closest to the highest score of 12 that could be awarded. Of interest, the run for speed CA and TGMD-2 scores differed with the former indicating between 6% and 9% and the latter indicating between 96% and 98% mastery. The frequency distribution of the percentage of learners participating in four after-school physical activities as per the questionnaire each participant completed, is presented in Table 2.

***Table 2*. PERCENTAGE PARTICIPANTS TAKING PART IN FOUR SPECIFIC PHYSICAL ACTIVITIES ON WEEKDAYS FOR AGE GROUPS**

Physical activity		9 years (n=31)	10 years (n=50)	11 years (n=48)	12 years (n=38)	Total (N=167)
Run	n	19	17	27	21	84
	%	61.3	34.0	56.3	55.3	50.30
	#Stats.	χ2(df=3)=2.67; p=0.446				
Ball games	n	15	23	26	20	84
	%	48.4	46.0	54.2	52.6	50.30
	#Stats.	χ^2(df=3)=3.14; p=0.370				
Bicycling	n	5	3	2	6	16
	%	16.1	6.0	4.2	15.8	9.58
	#Stats.	χ2(df=3, n=20*)=2.00; p=0.572				
Swimming	n	0	2	3	3	8
	%	0.0	4.0	6.3	7.9	4.79
	#Stats.	χ^2(df=3, n=20*)=1.20; p=0.753				

* Constant added to each of the four cells to increase expected frequencies for Chi²-test to required minimum of 5.
#Stats.=Inferential statistics χ^2=Chi-Square df=Degrees of freedom p=Significance

As can be noted from Table 2, the PA of participants consisted mostly of running (50.30%) and ball games (50.30%) from the selection of running, ball games, cycling (9.58%) and swimming (4.79%) options on week days. What is additionally interesting is that no statistical or practical significant differences were noted between the activity levels of nine- to-12-year-olds. In terms of extra-mural sport, a 67% participation rate was noted with the most popular sport being netball (41%), followed by athletics (22%), soccer (7%), ballet/dancing (5%), hockey (4%), basketball (1%), cricket (1%), gymnastics (1%), tennis (1%), volleyball (1%) and swimming (0%).

Table 3 represents the number of participants who had commenced menarche. It is clear that a total of 10% of participants indicated that menarche had commenced with most being in the 12-year-old group.

***Table* 3. PERCENTAGE OF PARTICIPANTS COMMENCED MENARCHE**

Age group	Answered YES	%	Answered NO	%	Total
9 years	0	0%	32	100%	32
10 years	1	2%	49	98%	50
11 years	4	8%	45	92%	49
12 years	12	31%	27	69%	39
Total group	17	10%	153	90%	170

DISCUSSION

National and international FMS research comparisons

From what could be ascertained from research literature, there are limited South African studies investigating the FMS proficiency status of children aged nine- to 12-years-old. Studies conducted by Pienaar and Kemp (2014), Pienaar *et al.* (2015), Van Niekerk *et al.* (2015) and Pienaar *et al.* (2016) seemed to focus either on children before the age of ten or after the age of 13 years. Consequently, direct comparisons are difficult. Of these studies, only Pienaar *et al.* (2015) employed the TGMD-2 on a sample of white and black lower and higher SES nine- to ten-year-olds whilst evaluating object control skills. What was noted in the sample of black lower SES female participants is that only 8.8% (n=250) were placed into an above average or superior category for the FMS assessed.

Even though overall the scores of participants were poor, 76.8% and 96.3% of the participants performed the throw for distance and catch proficiently respectively. The catch scores align with the present study with 90% on average performing the catch correctly but this is not the case with the throw for distance with nearly 83% of participants in the present study performing none-proficiently. These results could be explained by the fact that the Eastern Cape (as compared to the North West Province) is one of the poorest provinces in South Africa, hence possibly more negatively affecting the amount of exposure females acquire to an array of FMS in PE and in sport activities.

Of the international literature reviewed, the age range focus was between three- and 18-years-old (Hardy *et al.*, 2012; Spessato *et al.,* 2013), making exact comparisons problematic. Hardy *et al.* (2012) noted that 98.3% of the 12-year-old females had low competency in all seven FMS assessed (which included the throw for distance, catch, run for speed, vertical jump, kick, slide, gallop and leap) when using the Get Skilled Get Active qualitative motion analysis toolkit. Although comparisons are difficult, the primary similarity noted between the aforementioned studies and the present study is that children and youth are not performing all FMS proficiently at the expected age of seven years, consequently necessitating intervention.

Micro-system and task constraint: Implementation of physical education and physical activity

The dynamic systems theory indicates that for FMS proficiency to transpire, practice is required (Bakhtiar, 2013). Furthermore Renshaw *et al.* (2010) highlights that the task constraint is one of the most important considerations in motor development given the direct influence a PE teacher has over the manipulation thereof. Within the present study, only the catch was performed proficiently. When reviewing the PA results of the participants, only 50.3% of the learners participated in ball games and running. Also, the most common extra-mural activities participated in are netball and athletics. Although it is expected that all grades should have equal exposure to PA endeavours at school, what can be noted for the nine- to- 12-year-old girls is that no statistical or practically significant changes appear in their PA participation with aging. Hence, it would seem that most participants are equally underexposed.

These sentiments on the lack of exposure, variability and specificity of training in PE are substantiated by Draper *et al.* (2014), in which the PA levels and PE participation statuses within South African school children were examined. It was found that, although PE has been identified as one of the seven best investment potentials to increase PA in the general population, the ability of the South African school system to implement PE scored a 'D', which according to the *Healthy active kids South Africa report card*, equates to "behaviours and environments, programs or policies that are insufficient to adequately promote health and prevent chronic disease, which may be due, in part, to a lack of reach or adoption and impact" (Sports Science Institute of South Africa, 2010:2).

Micro-system and task constraint: Assessment tool

The assessment criteria of a motor skill could be thought of as the gold standard PE teachers will aim to achieve during PE lessons. As task constraints are considered as rules, equipment used and tasks implemented to develop a motor skill, the assessment tool used can be thought of as a task constraint if limitation in the assessment exist (Renshaw *et al.*, 2010). As can be noted in the results for this study, a discrepancy between the CA and TGMD-2 approaches emerged with opposite extremes of the continuum being indicated in terms of the run for speed abilities of the participants. More specifically, according to the CA, 93% of the participants were non-proficient in the run for speed on average, whereas when using the TGMD-2, 97% of participants were proficient.

The CA run for speed measurement assesses nine component body parts, while the TGMD-2 assesses only four component body parts. The CA ranks participants into an initial, elementary and mature movement pattern, whereas the TGMD-2 is a criterion-based assessment protocol. Finally, the CA additionally employs more objective cut-offs (angles measured via a Dartfish analysis) (Dartfish, 2015). Based on these observations, it would appear that the CA is more stringent when compared to the TGMD-2. The lack of consistency in the FMS assessment protocols is a concern that has been highlighted by Stodden *et al*. (2008), who stated that movement criterion assessments based on expert performances are overly simplistic and do not encompass the motor development spectrum, hence obscuring results. Logan *et al*. (2016:1) indicated that "sensitivity to detect advanced skill level is lowest for TGMD-2 and highest for developmental sequences" for the standing long jump, throw for distance and hop. Consequently further analysis into the validity and reliability of assessment tools seems justified.

Micro-, meso-, exo- and macro-system and individual constraint: Gender stereotyping

In this study, an additional explanation for the observed results could be the sport culture, which is a macro-system constraint, possibly influencing the females under investigation. As noted in the findings and when factoring in both the CA and the TGMD-2 results, only the catch was performed proficiently by most participants. When reviewing the questionnaire results of the participants under investigation, netball and ball skills were the most commonly participated in physical activities. The FMS and questionnaire results additionally highlight that throwing a cricket ball for distance, jumping for distance or running for speed with adequate form are possibly not included in this study among the PA repertoire. Within the South African context, gender stereotyping is often cited as a barrier to the acquisition of motor skills (Philip, 2013). Walter (2011) found that the cultural expectations of African girls at home was a possible cause of decreased PA habits, as girls are expected to do house chores, whereas boys are free to play. Maturational effects and the onset of menarche in the participants under investigation could have contributed additionally to poor FMS proficiency scores due to physical and psychosocial changes (Todd *et al.*, 2015). However, only 10% of participants in this study had indicated that menarche had commenced and hence further analysis of the role menarche plays in FMS participation and PA is necessitated.

Micro-, meso-, exo- and macro-system constraint: Lower socio-economic status

An additional exo-system variable is the fact that the participants of this study reside in a lower SES community with the presence of high poverty rates (a macro-system variable) as indicated by Makiwane and Dan (2010). Research on the relationship between FMS and SES is controversial, with mostly non-significant findings presenting (Okely & Booth, 2004; Aailzadeh *et al.*, 2014). However within the Eastern Cape province, the high poverty, poor community education, high crime rates (Makiwane & Dan, 2010) and poor sporting and recreational infrastructure in playgrounds and in schools (Bogopa, 2013) may be too extreme, resulting in poor FMS.

LIMITATIONS

The small sample size and descriptive cross-sectional study design, together with the employment of convenience sampling, limits the generalisability of the findings. In addition, the use of a PA questionnaire instead of direct measurement with pedometers (or other more objective tools) possibly limited the reliability and validity of the data gathered in this respect. Although limitations do exist within the present research, employing the CA and the TGMD-2 approach added to the strength of the analysis of this study. Ensuring that percentage-agreement was conducted for each FMS and including a theoretical framework to explain the results of the findings ensured a more holistic overview of the possible parameters affecting the FMS.

CONCLUSION AND RECOMMENDATIONS

In conclusion, the participants in the present study are in need of FMS interventions that include taking into account environmental variables within the micro-, meso-, exo- and macro-systems. It is recommended that the present study be replicated on a larger representative South African sample that includes different ethnic, gender and SES groups and a larger repertoire of FMS. Finally, the different results observed for the CA and TGMD-2 as implemented in this study reveal possible limitations in FMS qualitative motion analysis tools.

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Corresponding author: Dr Samantha Kahts; **Email:** Samantha.kahts2@nmmu.ac.za

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