



Contents lists available at ScienceDirect

Journal of Science and Medicine in Sport

journal homepage: www.elsevier.com/locate/jsams



Original research

The reliability and validity of an authentic motor skill assessment tool for early adolescent girls in an Australian school setting

Natalie Lander^{a,*}, Philip J. Morgan^b, Jo Salmon^c, Samuel W. Logan^d, Lisa M. Barnett^a

^a Deakin University, School of Health and Social Development, Australia

^b Newcastle University, PRC in Physical Activity and Nutrition, Faculty of Education and Arts, Australia

^c Deakin University, Institute for Physical Activity and Nutrition Research, Australia

^d Oregon State University, Social Mobility Lab and PlayTech Workshop, School of Biological and Population Health Sciences, USA

ARTICLE INFO

Article history:

Received 10 August 2016
Received in revised form 21 October 2016
Accepted 9 November 2016
Available online xxx

Keywords:

Movement components
Assessment
Physical education
Adolescents

ABSTRACT

Objectives: Proficiency in fundamental movement skills (FMS) is positively correlated with cardiorespiratory fitness, healthy weight status, and physical activity. Many instruments have been developed to assess FMS in children. It is important to accurately measure FMS competency in adolescent populations, particularly in girls, who are less proficient than boys. Yet these tests have not been validated or tested for reliability among girls in this age group.

Design: The current study tested the concurrent validity and reliability of two FMS assessment instruments; the newly developed Canadian Agility and Movement Skill Assessment (CAMSA), against the Victorian FMS Assessment from Australia, among a sample of early adolescent girls.

Methods: In total, 34 Year 7 females (mean age 12.6 years) from Australia were tested and retested on each instrument in a school setting.

Results: Test-retest reliability was excellent for the overall CAMSA score (ICC = 0.91) and for the isolated time and skill score components (time: ICC = 0.80; skill: ICC = 0.85). Test-retest reliability of the Victorian FMS Assessment was also good (ICC = 0.79). There was no evidence of proportional bias in either assessment. There was evidence of strong concurrent validity ($r_s = 0.68, p < 0.05$).

Conclusions: Both instruments were found to be reliable and valid. However, compared to the Victorian FMS instrument, the CAMSA has the advantage of both process and product assessment, less time needed to administer and higher authenticity, and so may be an attractive alternative to the more traditional forms of FMS assessment, for use with early adolescent girls, in school settings.

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1. Introduction

Fundamental movement skills (FMS) have been described as the building blocks of physical activity, typically classified into object control skills (e.g., catching), locomotor skills (e.g., running) and stability skills (e.g., balancing).^{1,2} Developing proficiency in these skills has important health implications for young people,³ in terms of increased physical activity⁴ and cardiorespiratory fitness,⁵ and obesity prevention.⁶ Yet less than 50% of Australian Year 6 students have mastered the run, jump, kick, and throw.⁷ This finding is indicative of a worldwide trend of lower FMS proficiency.^{8,9,10} Low FMS proficiency often persists into adolescence and beyond,^{11,12} and furthermore, globally, girls exhibit especially low levels of

object control proficiency, which is of great concern, as proficiency in object control skills is positively associated with future PA levels.¹³

Most children are developmentally able to master FMS by the end of Grade 4.¹ Therefore, primary school physical education (PE) should provide the ideal environment to assess, teach, and improve these skills. However, many students, especially girls, pass through primary school PE, and the early developmental stages, commonly known as the 'golden stage of development' without mastering the critical threshold of FMS necessary for successful participation in PA and the sports-based curriculum typical of secondary school PE.^{1,7} Furthermore, research suggests that skill deficits in girls often remain unidentified in high school PE programs.¹⁴ Subsequently, remediation instruction may be rare, and opportunities to improve may be limited.¹⁴

Accurate identification of skill deficiency is a critical step in the cyclic process of skill improvement. Assessment allows

* Corresponding author.

E-mail address: nlander@deakin.edu.au (N. Lander).

teachers to identify student needs and subsequently accommodate for individual skill learning, by providing specific feedback, targeted instruction and developmentally appropriate tasks.¹⁵ Valid and reliable assessment provides purpose and meaning to instruction and enables effective program delivery to advance student learning.¹⁵ Assessment of FMS has been researched extensively in childhood.¹⁵ Therefore, the assessment criteria and protocols are developed specifically for younger age groups.^{16,17} Despite the low levels of FMS proficiency in older children and adolescents, and even adults, there is a lack of appropriate FMS assessment available.^{12,15,16} Indeed, in a recent review of five motor skill assessment instruments, none emerged as capable of consistently determining adolescents or young adults, as novice or expert performers of FMS.¹⁵ As the quality of primary school Physical Education (PE) programs varies, and FMS instruction is often poor,^{18,19} many students reach adolescence without mastering FMS, which can have lifelong consequences in terms of physical inactivity. Therefore, there is a need for a valid and reliable FMS assessment appropriate for adolescents, especially girls.

Many instruments are not ideal for use in 'real world' settings such as in schools, despite recommendations that FMS should be assessed in schools by PE teachers.^{18,19} Assessment protocols have complex criteria, often require students to be tested one at a time, and can take 20–60 min per child.²⁰ Furthermore, existing instruments (e.g., TGMD-2²) often focus on isolated skill performance, in closed or controlled environments, and subsequently are not reflective, nor do they assess the complex series of skills involved in play, sport and physical activity.²¹ Furthermore, PE teachers are faced with numerous barriers including: high student numbers per class; limited class time and a lack of preparation time; and assessment not being engaging nor fun for students.¹⁴ Due to these barriers, many teachers resort to using levels of participation, attitude, appropriate clothing and attendance as criteria for assessing students, rather than movement skill based criteria to assess, monitor and advance student learning.¹⁴

The Canadian Agility and Movement Skill Assessment (CAMSA) was recently developed, as part of the Canadian Assessment of Physical Literacy (CAPL).²² The CAMSA was designed to more authentically measure the 'real world' skills required for sport and physical activity, such as linking several skills together in succession, and transitioning from one skill to another efficiently (e.g., catching then throwing while on the move).^{21,22} The feasibility, validity and reliability of the CAMSA has been demonstrated for Canadian children (8–12 years)²¹ and feasibility has also been established in an Australian school setting.¹⁹ The aim of the current study was to investigate the test-retest reliability and concurrent validity of the CAMSA when administered by teachers in an Australian school setting, against a commonly used FMS assessment instrument in Victorian schools, the Victorian FMS Assessment.²³

2. Methods

A convenience sample of female Year 7 students ($n = 34$, mean age 12.6 years) from an independent girls' school in Melbourne, Australia, participated. Students were eligible if they were in Year 7, and could actively participate in a Physical Education class. All students who were invited, agreed to take part with their parents or legal guardians consent. The research was approved by Deakin University Human Ethics (HEAG) in August 2015.

The CAMSA requires students to cover a distance of 20 m of an agility and movement course, completing seven different movement skills in succession, namely: two-footed jump, side slide, catch, throw, skip, hop, and kick.²¹ Therefore, skills cannot be added or omitted from the course. As the study aim was to test the CAMSA

against the Victorian FMS Assessment, skills measured by the latter instrument were matched to the CAMSA.

The Victorian FMS Assessment was selected as a benchmark for concurrent validity for the following reasons: (i) the reliability and validity for all skills used in this study from the Victorian FMS Assessment have been established ($ICC > 0.7$)²³; (ii) it was designed for use by Australian teachers, and is the most common source of FMS assessment used in Victorian school¹⁴; (iii) the skills align to those required in the Year 7 PE curriculum; (iv) the instrument has been used in FMS research in school settings, in children of similar age^{24,25}; (v) the skills selected closely align with those in the CAMSA.

Six skills from the Victorian FMS Assessment were selected. Four skills were identical in both assessments (i.e., overhand throw, catch, kick, and jump) (Supplementary Table 1). As the Victorian FMS Assessment does not include the skip, hop or side slide, two additional locomotor skills from the Victorian FMS Assessment instrument (i.e., dodge and the leap) were selected, as they comprise similar movement patterns to the aforementioned CAMSA locomotor skills (i.e., skip, hop and side slide). The 'dodge' was also included as it broadly measures agility (i.e., the ability to change the direction of the body in an efficient and effective manner).²¹

The CAMSA requires students to complete the seven different movement skills as fast and well as possible.²¹ Performances of the CAMSA are evaluated using the aggregate of time taken to complete the course, and the quality of skill performance (process-oriented assessment e.g., 'Transfers weight and rotates body', and product-oriented assessment e.g., 'ball hits the target'). Time required to complete the course is recorded, and then converted to a predefined point score (range 1–14), the faster the course completion, the higher the score (Supplementary Table 2). The quality of each skill is scored as either performed (score of '1') or not (score of '0') across 14 reference criteria (Supplementary Table 3). The total score is calculated as the sum of the skill and the time scores, total score range 1–28, per single trial (Supplementary Table 4).²³

In contrast to the CAMSA, the Victorian FMS instrument assesses individual skills in isolation, and has several more behavioral components per skill than the CAMSA (Supplementary Table 1). The assessment and administration protocol has been described in detail elsewhere,²³ however, in brief, behavioral components of each skill are scored '1' if the component was demonstrated and '0' if it was not demonstrated. The correctly performed components are summed to create a total score per trial, with a higher score indicating greater proficiency. In the current study the total skill score range for the Victorian FMS Assessment was 0–33, per trial (Supplementary Table 1).

All 34 students performed both assessments in Test 1, and all were retested in both assessment instruments seven days later (Test 2), using the same location, equipment, protocol, and staffing conditions as Test 1. For the purpose of this study, the administration protocol for both instruments aligned with the CAMSA. Specifically, the facilitators provided clear verbal instructions, and two practical demonstrations of each assessment. Each participant was then given two practice trials, followed by two consecutive test trials. When performing the CAMSA, the students were instructed to perform the movement course as fast *and* as well as possible.²¹ When performing skills in the Victorian FMS Assessment they were instructed to perform with maximum effort, which produces the most advanced movement pattern of ballistic skills.²⁶

All student test trials were video recorded and later analysed. All footage was observed and coded by the lead author, who had prior training and experience in administering and analysing both the CAMSA,¹⁹ and the Victorian FMS Assessment instrument as well as with other motor skill assessments.²⁸ The two test trials, per assessment instrument, were combined to provide an overall score for Test 1, and the same procedure repeated for Test 2. Thus,

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