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Expert recommendations for the design of a teacher-oriented movement assessment tool for children aged 4-7 years: a Delphi study

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ABSTRACT

The aim of this study was to establish the content of a teacher-oriented movement assessment tool (MAT) for children aged 4–7 years. A three-round Delphi poll with an international panel of forty-six academics and practitioners was conducted. Consensus was reached on a selection and number of fundamental movement skills to be assessed with four stability (one foot balance, walk forwards along a line, front support, and sideways roll), five object control (two handed catch, underarm throw, overarm throw, kicking a ball, dribbling a ball with hands), and five locomotor (run, hop, horizontal jump, side-stepping, and skipping). A developmental stage approach and process-oriented scoring were deemed most suitable. These findings present the requisite elements to develop a teacher-oriented MAT for children aged 4–7 years. This framework would provide teachers the opportunity to effectively assess children's FMS and subsequently intervene to improve movement competence.

KEYWORDS

Physical Education; fundamental movement skills; measurement; primary teachers; consensus

Introduction

Fundamental movement skills (FMS) (i.e. fundamental motor skills; Logan et al., 2018) are learnt movement patterns composed of locomotor skills such as running and jumping, object control skills such as throwing and catching, and stability skills such as a one leg balance (Goodway et al., 2019). Active participation and learning of FMS lead to the development of movement competence in children, which is positively related to increased physical activity and health-related fitness (Stodden et al., 2008; Holfelder & Schott, 2014; Robinson et al., 2015; Xin et al., 2020). Moreover, developing movement competence in childhood underpins and enables successful participation in a variety of physical activities and sports later in life (Barnett et al., 2016).

International guidelines and curricula for quality physical education (PE) in primary (elementary) schools highlight the importance of young children developing competence in a broad range of FMS (Australian Curriculum Assessment and Reporting Authority, 2015; Department for Education, 2013; European Physical Education Association, 2017; Society of Health and Physical Educators America, 2013; United Nations Educational, Scientifc and Culture Organisation, 2015). Primary schools provide an ideal setting for children to acquire and develop FMS (Morgan et al., 2013) and it has been recommended that primary school teachers be more involved in the assessment of children's FMS to enable children reach key movement milestones (Morley et al., 2015).

There are a range of existing FMS assessment tools for use with young children (Bardid et al., 2019; Burton & Miller, 1998; Cools et al., 2008; Hulteen et al., 2020; Scheuer, Herrmann et al., 2019). However, these were typically developed for health professionals or researchers to assess movement deficiencies and there are questions around the feasibility and acceptability for their use by primary school teachers (Bardid et al., 2019; Eddy et al., 2020). In recent years, there has been an emergence of FMS assessments for use in school settings, such as the Canadian Agility and Movement Skills Assessment (CAMSA; Longmuir et al., 2015) and the Motorische Basiskompetenzen (MOBAK; Herrmann et al., 2015). However, the CAMSA has not been validated for use with children under eight years old, while the MOBAK is designed for use by specialist PE teachers. In the United Kingdom (UK), primary school PE is commonly delivered by generalist teachers who receive less than 6 hours of PE training during initial teacher training (Harris et al., 2012). These classroom teachers are regarded as non-specialists of PE and cite

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their lack of knowledge and confidence in the subject as being a barrier to them assessing FMS more frequently (Van Rossum et al., 2019). Thus, further investigation is warranted to establish a protocol that allows specialist and non-specialist teachers of PE to assess the FMS of children in primary PE settings.

In response to a call for primary school teachers to be more involved in the assessment of children's FMS (Morley et al., 2015), we were commissioned by the Youth Sport Trust, a national children's charity in the United Kingdom focused on improving children's well-being through physical education and physical activity, to develop a teacher-oriented movement assessment tool (MAT) for use with children aged 4–7 years old. An important aspect of tool development is content validity, defined as "the degree to which the content of an instrument is an adequate reflection of the construct to be measured" (Mokkink et al., 2010). To establish content validity, it is recommended that assessments are developed with input from experts in the field, alongside literature reviews and, importantly, with the involvement of the target population (i.e., the assessment users) (Mokkink et al., 2010). Therefore, the first stage of the MAT development involved interviews with thirty-nine primary school teachers of PE to gain their recommendations for the development of a tool to assess children's FMS in school (Van Rossum et al., 2019). The present study reports on the second stage of the project, in which expert consensus was sought to establish the content and format of the MAT.

It has been suggested that defining which skills should be used to assess FMS would provide consistency and improve comparisons between measurements (Tompsett et al., 2017). Yet, currently, there is no definitive list of skills to assess FMS. This was highlighted in a recent systematic review (Hulteen et al., 2020), that reported 33 unique skills were found in 57 different FMS assessments. Furthermore, not all sub-categories of FMS are included in each FMS assessment. For example, the TGMD-2 (Ulrich, 2000) only assesses components of locomotor and object control skills. For an assessment to be valued in an educational setting, the establishment of curricular validity is essential (Scheuer, Bund et al., 2019). Consequently, the absence of a stability component within the TGMD-2 suggests it is unsuitable for use in PE settings for children aged 4–7 years old as this is a requirement of statutory primary PE curriculum guidance (Department for Education, 2013; Society of Health and Physical Educators America, 2013). Whilst expert opinion has been sought, to varying degrees, in the development of previous FMS assessments (Burton & Miller, 1998), information pertaining to content validity is lacking in the literature and expert perspectives, particularly when targeted toward the specific context of assessment within primary school settings by teachers, are rarely reported (Bardid et al., 2019; Eddy et al., 2020; Hulteen et al., 2020). As primary PE in some countries, such as the UK, is primarily taught by generalist teachers, it is essential that the design and creation of FMS assessments for use in schools consider the specific settings and level of understanding of the teachers (Lander et al., 2015). The present research is therefore warranted to inform the formation of content for the MAT and advance the field of knowledge for the assessment of FMS by specialist PE teachers and generalist teachers.

The level of competency in which FMS are performed is assessed using a product- or process-oriented scoring approach, or a combination of both (Barnett et al., 2020; Logan et al., 2017). A product-oriented assessment (e.g., Bruininks-Oseretsky Test of Motor Proficiency - Second Edition [BOTMP-2]; Bruininks & Bruininks, 2005) evaluates movement based on the outcome achieved (e.g., recording the number of times a child caught the ball, or distance recorded for a horizontal jump). This style of assessment does not require the assessor to have prior knowledge of the skill, but as it involves no consideration of how the movement was achieved, it provides limited information on how to help support children's movement development (Stodden et al., 2009). Whereas, a process-oriented assessment (e.g., TGMD-2; Ulrich, 2000) evaluates movement based on the completion of pre-defined behavioral criteria (e.g., two handed catch = arms are extended and held in front of the body). This process requires the assessor to have some prior knowledge and understanding of the movement skills undertaken and the results provide indication of which aspects of the movement each child may need to develop (Barnett et al., 2020). However, with non-specialist teachers of PE lacking subject knowledge (Harris et al., 2012; Van Rossum et al., 2019), the reliability and feasibility of teachers using a process-oriented assessment could become an issue. Logan et al. (2017) reported differences in the level of children's FMS competence when measured by trained researchers with process- and product-oriented approaches for the same skills, suggesting that there is no perfect model for scoring and that the purpose and context of the assessment is an important consideration for developing the MAT. With the uncertainty around the suitability of untrained assessors using process-oriented assessments, it will be important to gain consensus from experts to establish the most appropriate format of assessment for teachers to use in school.

To this end, we designed the present study in order to gain expert opinions to inform the development of

a teacher-oriented MAT for children aged 4–7 years. Specifically, this study sought to a) generate consensus for the content of skills within the MAT, and; b) establish the format of the assessment and scoring approach to be used, considering the target users being both generalist teachers and specialist PE teachers. A Delphi poll (RAND, 1967), which draws upon the expertise of invited participants through numerous polling rounds to reach consensus agreement (Okoli & Pawlowski, 2004), was chosen as an appropriate method to establish face and content validity of movement-oriented measurement tools (Jimenez-Garcia et al., 2020).

Method

Recruitment and participants

Participants were identified as experts and invited to the study if they were: (i) an academic or coach with experience in children's movement development and/or assessment, (ii) an academic involved in Physical Education Teacher Education, or (iii) a primary school PE specialist with experience in developing movement-based resources and/or assessments for children. Given the school-based context that the MAT is intended to be used, it was deemed essential to only include the voice of academics and teachers with expertise in children's movement development and Physical Education. Cantrill et al. (1996) defined an expert as "any individual with relevant knowledge and experience of a particular topic" (p. 69). Therefore, no minimum length of experience was required for inclusion within the study.

A search of electronic databases (SPORTDiscus, EBSCOhost, and Science Direct) was conducted to identify academics who had: (i) authored peer-reviewed papers, and/or (ii) authored textbooks, or chapters within textbooks. The search was directed with the keywords 'fundamental movement skills,' 'movement competence,' 'motor proficiency,' and 'movement assessment'. Because teachers and coaches were not detectable through this search strategy, we identified potential participants through existing professional and research networks. A snowball method (Streeton et al., 2004) was used, through which the participants initially recruited provided contact details of associates meeting the inclusion criteria. To maintain anonymity, participants who made recommendations for prospective participants were given no confirmation of successful recruitment of their contacts. Participants were invited from Australia, Austria, Canada, England, Finland, Northern Ireland, Republic of Ireland, Scotland, Sweden, Switzerland, United States of America, and Wales. A minimum of 30 participants were targeted for the study to sufficiently meet the recommendations for the size of a Delphi panel (Okoli & Pawlowski, 2004). Previous studies have reported a positive response rate to invitations of 50% (Francis et al., 2016) and 62% (Sitlington & Coetzer, 2015). Therefore, a list of 75 potential participants to invite was created to achieve the target set.

Ethical approval for the study was obtained from the Research Ethics Comittee of Liverpool John Moores University (15/EHC/027). All communication with participants was conducted via e-mail and participants were informed that they were free to withdraw from the study at any time.

Delphi process

Three to five rounds of questions are considered appropriate for a Delphi poll (Jünger et al., 2017). Three rounds were selected for this study to optimize participant retention by reducing the potential fatigue and attrition caused by repeated rounds (Walker & Selfe, 1996). Each round was designed to take no more than 10 minutes to complete and was administered via a web-based survey site (SurveyMonkey Inc, CA, USA). The link for each round remained open for two weeks and reminders were emailed to participants two days prior to the poll ending. The context of the study, to establish content specifically for a teacher-oriented FMS assessment for children aged 4–7 years, was highlighted to participants in the pre-study information (invitation e-mail and participant information sheet) and repeated in the briefing materials for each round.

Round one

Consisting of 9 questions, the aim of round one was to: i) establish which skills should be included in the MAT, and; ii) establish if the MAT should account for gender or age. Prior to round one, existing movement assessment protocols suitable for children aged 4–7 years were reviewed and a complete list of the movement skills included in these assessments was compiled. The movement skills that occurred in two or more assessments were grouped in three categories (stability: 9 skills; object control: 11 skills; and locomotor: 13 skills) and formed the complete list of skills that were provided to participants in round one (see Figure 1 for this list of skills). Participants were provided with a guidance sheet detailing a brief description and illustration of each movement skill. Using this information as a guide, participants were asked to rate, using a Likert scale (1 = very unimportant to 5 = very important), the importance of each skill within the three categories to measure the movement competency of children aged 4–7 years.

Stability	Object control	Locomotor
Back support	Catching a ball with one hand	Agility run
Dorsal raise	Catching a ball with two hands	Cross-overs
Forward roll	Dribbling a ball with alternate hands while stood stationary	Galloping
Front support	Dribbling a ball while moving (using feet)	Hopping forwards
Plank hold	Dribbling a ball while moving (using hands)	Hopping sideways
One leg balance	Kicking a ball	Horizontal jump
Sideways roll	Overarm throw	Leaping
Walking backwards heel to toe	Rolling a ball underarm	Rope skipping
Walking forwards along a beam	Striking off a tee	Running
	Trapping a ball with feet	Side-stepping
	Underarm throw	Skipping
		Step up
		Vertical jump

Figure 1. List of skills within each category of movement for round one. Movement skills drawn from Bruininks-Oseretsky Test of Motor Proficiency (second edition) (Bruininks & Bruininks, 2005); Canadian Agility and Movement Skills (Longmuir et al., 2015); Children's Activity and Movement in Preschool Study Motor Skills Protocol (Williams et al., 2009); Dragon Tracker (Sport Wales, 2014); Get Skills Get Active (NSW Department of Education and Training Curriculum, 2000); Körperkoordinationstest für Kinder (Schilling & Kiphard, 1974); Motorische Basiskompetenzen (MOBAK) (Herrmann et al., 2015); Movement Assessment Battery for Children-2 (Henderson et al., 2010), NyTid Test (Tidén et al., 2015); Peabody Developmental Motor Scale 2nd Edition (Folio & Fewell, 2002); Physical Literacy Assessment for Youth (Canadian Sport for Life 2013); Stability testing protocol (Rudd et al., 2015); Test of Gross Motor Development-2 (Ulrich, 2000).

Participants were also asked to quantify the number of: (i) stability, (ii) object control and (iii) locomotor skills needed to assess children's competence in the MAT. Participants were then asked to determine if the MAT should account for chronological age and, if so, to indicate the preferred distinction between age categories (1 year, 2 years, school year, other). Finally, participants were asked if the MAT should account for gender. Prior to the commencement of polling, it was determined that the consensus level for questions in each of three rounds was 51% agreement between participants (Okoli & Pawlowski, 2004). Consensus for the Likert-scale questions was achieved if a minimum of 51% of participants rated the item as 'Important' or 'Very Important'.

Round two

Consisting of 5 questions, the aim of round two was to: i) determine the order that the skills should be introduced in the MAT, and; ii) establish if the MAT should account for age or development stage. Participants were presented with the most important skills within the categories of stability, object control and locomotor, as determined from round one, and asked to score them in the order that they should be introduced (1 = first, 2 = second, etc.). These skills were listed in rank order calculated on their mean ranking from round one. In round one, consensus on whether the MAT should account for age was not achieved. Qualitative comments suggested that a developmental stage approach should be considered, which aligns with stage-based model of movement development forwarded by Goodway et al. (2019). To further explore this in round two, the question was presented again with the addition of a developmental stage-based response option.

Round three

Consisting of 7 questions, the aim of round three was to: i) determine the number of developmental stages to be included in the MAT for children aged 4–7 years old; ii) establish the scoring approach for the MAT, and: iii) find consensus for the final selection of skills to include in the MAT. Participants were asked to indicate how many developmental stages should be accounted for within the MAT (drop-down menu of 1–9). Next, the most important skills in each category from round one, that fell within the minimum number of skills required

to assess each component of FMS (e.g., the four most important stability skills), were presented to the participants in the order that was established in round two. For each of these skills, participants were asked to indicate whether a product-oriented, process-oriented, or hybrid scoring approach (combining both) should be used to assess each skill. Participants were also asked to indicate the number of process-oriented criteria to use, should this approach be agreed for use in the MAT. Finally, participants were asked to return to unresolved questions from round two to choose between two equally ranked movement skills in each of the object control and locomotor categories to reach the preferred number of FMS in each subset. In some questions pertaining to the scoring approach, a consensus level of 51% was not reached. As this was the final round and participants had been invited to the study under the premise of there being a total of three rounds of polling, responses for these questions were not returned to participants for further consideration. However, it is accepted that consensus does not have to be achieved for all questions in the final round, and the data can be used to identify the extent that participants agree on a topic (Mullen, 2003).

Results

Participants

Of the 75 experts (academics, n = 34; coaches/teachers, n = 41) invited to participate in the study, 6 did not respond, 11 declined and 58 agreed (academics, n = 27; coaches/teachers, n = 31). This acceptance rate of 77% was higher than that seen in previous studies using a Delphi (Francis et al., 2016; Sitlington & Coetzer, 2015) and presented a larger group of participants than is typically seen for a Delphi poll (Jünger et al., 2017).

Forty-six participants (academics, n = 24, coaches/teachers, n = 22) provided responses to round one (79% response rate), forty-two completed round two, and thirty-six completed round three. The overall retention of 79% from round one to round three was higher than the threshold of 70% described by Walker and Selfe (1996) for the findings to be valid. Table 1 describes the details of the participants who completed round one.

Table 1. Characteristics of participants who completed round one of the Delphi poll.

Characteristic	Descriptor	Total (n)
Current role	Professor	7
	Lecturer/Senior Lecturer	14
	Academic researcher	3
	PE consultant to Primary schools	4
	Primary school teacher trainer of PE	6
	PE subject lead	12
Area expertise	Published papers in the subject area of movement competence/assessment	19
	Published papers in the subject area of PE in primary school settings	14
	Developed movement assessments	28
	Developed movement-based interventions	29
	Developed PE resources for primary school setting	35

Analysis

Round one

Table 2 provides a summary of the results of questions that spanned round one, two, and three related to the content of the assessment. Responses from round one of the poll indicated the number of movement skills needed to assess each subset of FMS and further clarified the importance of each skill within each subset. For instance, 98% of participants agreed that the two-handed catch was "important" or "very important" for teachers to assess the FMS of children aged 4–7 years, establishing this as the most important movement skill within the object control component of FMS. Likewise, the one leg balance (89%) and running (96%) were ranked as the most important movement skills within the stability and locomotor components of FMS. Furthermore, the experts agreed upon the order in which the movements should be introduced (see Table 2).

Round two

There was strong consensus from the responses in round one that the assessment should not be differentiated by gender (See Table 3). Responses in round one were inconclusive if the MAT should be differentiated for by the chronological age of the child. This question was reformulated and returned to participants in round two. Responses in round two established consensus that the MAT should be differentiated by the developmental stage of the child.

Round three

Round three primarily addressed the scoring approach that should be adopted for each movement skill within the assessment. As indicated in Table 2, process-oriented scoring was the preferred approach for all but two skills (One leg balance, 44.5% product-oriented scoring; Dribbling a ball with alternate hands while stood stationary, 42% hybrid scoring approach).

Discussion

A three-round Delphi poll was used to generate consensus from experts to establish the content and format of a teacher-oriented MAT for children aged 4–7 years (see Table 4 for the established content). It was established that

Table 2. Results indicating consensus from rounds one, two, and three related to the number of skills, their importance, sequencing, and scoring approach for teachers to assess FMS of children aged 4–7 years.

			Round one (n = 46)		Round two (n = 42)		Round three (n = 36)							
									Scoring approach					
			Importance of skill to assess FMS of children aged 4–7 years		Sequential order for skills to be learnt		Most important skill to assess FMS**		Product-oriented		Process-oriented		Hybrid (product and process)	
Category of movement	FMS	Number of skills to assess FMS (Mean)*	Mean*	% responses rated "important" or "very important"	Mean* ranking	Order	n	%	n	n%	n	%	n	%
Stability		4.16												
	One leg balance		4.89	89	1.85	1			16	44.5	12	33.5	8	22
	Walking forwards along a line		4.09	83	2.98	2			9	25	17	47	10	28
	Walking backwards toe to heel		3.65	57	4.07	5								
	Dorsal raise		3.37	52	4.67	6								
	Forward roll		3.33	46										
	Sideways roll		3.85	70	3.69	3			4	11	27	75	5	14
	Plank hold		3.39	44										
	Front support		3.72	63	3.74	4			12	33.5	17	47	7	19.5
	Back support		3.54	48										
Object control		4.78												
	Rolling a ball underarm		4.09	74	3.07	3	6	16.5	5	14	24	66.5	7	19.5
	Underarm throw		4.43	87	2.67	2			5	14	25	69.5	6	16.5
	Overarm throw		4.41	89	3.98	4			5	14	21	58	10	28
	Trapping a ball with feet		3.63	61										
	Kicking a ball		4.32	85	4.38	5			4	11	21	58	11	31
	Catching a ball with two hands		4.67	98	2.36	1			7	19.5	17	47	12	33.5
	Catching a ball with one hand		3.78	70	7.17	8								
	Dribbling a ball with alternate hands while stood stationary		3.96	74	5.55	6	30	83.5	7	19.5	14	39	15	42
	Dribbling a ball while moving with hands		3.67	59										
	Dribbling a ball while moving with feet		3.63	61										
	Striking off a tee		3.78	70	6.83	7								
Locomotion		5.02												
	Step up		3.72	57										
	Hopping forwards		4.41	94	3.80	2			6	16.5	21	58.5	9	25
	Sideways hop		3.65	52										
	Running		4.74	96	1.07	1			6	16.5	23	64	7	19.5
	Galloping		4.11	78	6.19	8								
	Leaping		4.17	80	5.89	7	9	25	5	14	24	66.5	7	19.5
	Sidestepping		4.20	80	5.05	5	27	75	4	11	25	69.5	7	19.5
	Horizontal jump		4.41	85	3.83	3			4	11	23	64	9	25
	Vertical jump		4.15	76	5.02	4								
	Skipping		4.35	94	5.14	6			5	14	24	66.5	7	19.5
	Rope skipping		3.26	35										
	Cross overs		3.30	39										
	Agility run		3.74	66										

* Mean rounded to 2 decimal points.

** These questions were included in round three to establish consensus agreement as their importance to assess FMS was rated equal in their respective domains in round one.

Table 3. Gender, developmental, and chronological age differentiation considerations across rounds one and two.

Round one: Differentiation approach			
	Yes	No	Neutral
Chronological age	37%	46%	17%
Gender	9%	78%	13%
Round two: Method of differentiation			
	Developmental stage	Chronological age	Do not differentiate
Scoring criteria	63%	14%	21%
Task	52.5%	14%	33.5%

a teacher-oriented MAT should contain skills from each FMS construct; specifically, stability (n = 4), object control (n = 5), and locomotor (n = 5). This emphasizes the importance of assessing stability, object control, and locomotor in order to provide a holistic measurement of FMS competence that is not currently quantified in other established FMS assessment tools (e.g., TGMD-2 contains no skills assessing stability), and is in line with research (Rudd et al., 2015) that indicates stability needs to be assessed independently of object control and locomotor. The emerging importance of stability within an FMS assessment for teachers could be due to the recently published global guidelines and curricula (Australian Curriculum Assessment and Reporting Authority, 2015; Department for Education, 2013; European Physical Education Association, 2017; Society of Health and Physical Educators America, 2013; United Nations Educational, Scientifc and Culture Organisation, 2015) that advocate the promotion of physical literacy and movement development in childhood, with specific guidance to provide opportunities to promote learning of stability skills.

The findings from the polling provide confirmation of the configuration of skills in each category of FMS, and the results emphasize the level of importance of individual skills contained within each category. Ranking the importance of each movement skill to assess FMS provides consensus for the skills to be included in the MAT and provides important guidance to a teacher or practitioner seeking to plan and deliver assessment or interventions to promote children's development of FMS. For example, knowing that the two-handed catch (98% consensus in round one) is given more importance than kicking a ball (59% in round one) to assess object control, could be beneficial to a teacher to inform their planning of a skills-based scheme of learning. The importance that participants placed on the two-handed catch correlates to the high frequency that it occurs in existing movement assessment tools (Hulteen et al., 2020). In the present study, the one-handed catch (70%) was given less importance than two-handed catch (98%). This could be a result of the assessment specifically being targeted for 4–7 year olds and is in-line with theoretical perspectives of the sequence of emergence of movement skills (Goodway et al., 2019; Payne & Isaacs, 2016). In addition to composing the contents of the MAT, these findings respond to earlier calls (Hulteen et al., 2020; Tompsett et al., 2017) by providing a definitive list of skills to assess FMS in childhood and may help to inform the development of standardized assessment tools (Tompsett et al., 2017).

Table 4. Established content of the MAT to assess FMS competence of children aged 4–7 years.

Stability	Object control	Locomotor
One leg balance	Two handed catch	Running
Walk forwards along a beam	Underarm throw	Hopping forwards
Front support	Overarm throw	Horizontal jump
Sideways roll	Kicking a ball	Sidestepping
	Bouncing a ball with alternate hands while stood stationary	Skipping

In round one of the Delphi poll, skipping was ranked as an important skill to assess locomotor (94%, ranked 3rd equal within the 11 locomotor skills), yet in round two participants ranked it as the sixth skill in sequential order to be learnt. Hopping forwards was deemed to be of equal importance as skipping (94%), yet the results in round two suggest that hopping forwards should be the second locomotor skill to be learnt, being introduced before skipping. This is supported by Roberton and Halverson (1984) description of skipping as a complex skill involving "a step and a hop" on the same foot, which is also observed to be one of the last locomotor skills to develop in childhood (Goodway et al., 2019; Payne & Isaacs, 2016). The importance given by experts to the skill of skipping indicates that it is an important movement skill for children to learn but it should not be introduced until other related FMS (e.g., running and hopping) have been developed.

The combined findings of round one and round two of the poll established a level of agreement that the scoring criteria (63%) and the movement skill (53%) should be differentiated within the assessment using a developmental stage approach. The developmental stage approach is less common in existing FMS assessments that were originally designed for health professionals and/or physical therapists, which either do not differentiate (Bruininks & Bruininks, 2005; Schilling & Kiphard, 1974; Ulrich, 2000) or differentiate the movement skill by the age of the participants (Henderson et al., 2010). Expert agreement for adopting a developmental stage approach could relate to the influence of other factors such as peers, opportunities for practice, and physical maturity on the development

of FMS (Goodway et al., 2019; Robinson & Goodway, 2009). It is important to note that school-based subject related assessments are typically measured against age-related norms (Hansen, 2015). Whilst a developmental stage approach is not typical, it could assist teachers by providing a holistic perspective of the child's movement development, which is not constrained by chronological age (Jess et al., 2016).

In terms of the scoring approach for the MAT, 14 out of 16 skills received a consensus level of over 40% for adopting process-oriented scoring. Even though consensus did not reach 51%, the level of agreement favoring process-oriented over product-oriented scoring may be indicative of the association between the former and assessment for learning, in which the assessment can be used as a guide to provide information to support subsequent teaching and instruction (Stodden et al., 2008; Hay & Penney, 2009). It could be suggested that the level of consensus achieved for the questions pertaining to the scoring approach was lower due to the potentially opposing perspectives of teachers, who work in a field that encourages assessment for learning strategies for teaching and learning (Assessment Reform Group, 2002), and academics who are perhaps more familiar with product-oriented scoring, as seen in traditional FMS assessments intended for research purposes (Bardid et al., 2019; Hulteen et al., 2020). Providing a teacher a criterion referenced breakdown of the skill, achieved through process-oriented scoring, would aid the teacher in identifying the performance change required for the child to learn the skill (Morley et al., 2019). This suggestion does have implications for the development of the MAT, as process-oriented scoring approaches can be complex and require the assessor to have a greater level of knowledge of the skill to assess accurately (Logan et al., 2017). It has been suggested that watching a video of a movement being performed is beneficial for assessors with a lower level of knowledge and understanding (Knudson & Morrison, 2002) and that digital technology and video content could revolutionize assessment practises in PE (Graham et al., 2013; O'Loughlin et al., 2013). Therefore, teacher-oriented FMS assessments developed using digital technology platforms could be an effective process to enable teachers to assess FMS and provide feedback to children in order to improve learning (Morley et al., 2019).

Limitations

The research team acknowledges that this study is not without its limitations. First, the list of movement skills provided to participants in round one did not include foundational skills (such as cycling, swimming strokes, body weight squat) that have been suggested to be equally important as the skills that were deemed here as being fundamental movement skills (e.g., throw, catch, jump) (Hulteen et al., 2018). Recent research has highlighted how becoming competent in these foundational skills, specifically bodyweight squat and lunge, during childhood could benefit physical activity as they would enhance movement competence and reduce risk of injury (Miller et al., 2020). However, foundational skills were not considered for inclusion in the MAT due to the remit of the project to measure children's FMS. Second, whilst capturing opinions from experts from 12 countries demonstrates a level of rigor not evident in the development of other FMS assessments, the broad range of participants may have influenced the interpretation as to the role of a teacher. For example, PE in the UK is primarily taught by generalist teachers, whereas in the United States, PE is taught by specialist PE teachers. Third, a general limitation of a Delphi poll is that the results are specific to the panel of experts taking part and a different group of participants may not produce the same responses, reflecting individual experiences and backgrounds. Finally, the responses from academics and practitioners, for reasons of anonymity, were collated together and it was not possible to distinguish responses from the respective groups. Analyzing and reporting the results for the academic and practitioner groups separately would have provided a unique perspective of the differences and similarities in how academics and practitioners viewed the assessment of FMS and would build on previous research of these differing expert perspectives (Morley et al., 2019).

Future research

Considering the breadth of existing valid and reliable FMS assessments currently available, the success of the MAT will be measured by the degree to which it is accepted and can be implemented by primary school teachers in a PE lesson. A feasibility trial of the MAT being used in schools by primary teachers will take place, along with validity and reliability testing. Owing to the emergence of literature emphasizing the importance of foundational movement skills (Miller et al., 2020), a future iteration of the MAT could seek expert opinion to provide further understanding of the scope for these skills to be assessed alongside FMS.

Conclusions

The data from the present study have provided a definitive description of the content and format of the MAT. Given the importance of developing context-specific FMS assessments (Bardid et al., 2019), the findings of this Delphi poll, establishing the content of a teacher-oriented FMS assessment for children aged 4–7 years, have the potential to make an important contribution to teaching and learning

to promote children's development of movement competence. Although children are capable of reaching FMS competence by the age of 7 years (Goodway et al., 2019), it is reported that many children do not achieve this stage of FMS development by this age (De Meester et al., 2018). Adopting the content and format of the MAT could provide the basis for optimal post-assessment interventions in schools, where meaningful learning of FMS can occur (Morgan et al., 2013; Morley et al., 2015). By achieving consensus from academic and practitioner experts in children's movement development, these findings provide content validity for the MAT. Not only have these results informed the development of the MAT, the knowledge gained is beneficial to a teacher planning a program of movement-based learning around FMS, as it allows them to design activities to include the movement skills that are judged to be the most important within this age range.

Finally, this is the first study to compile a definitive list of FMS that can be used by teachers to establish and develop movement competence in children aged 4–7 years and goes some way in responding to the call to establish which movements constitute FMS (Tompsett et al., 2017). The current findings are novel because they situate expert opinion in the specific context in which the assessment takes place and highlight the nature of the assessor. It is likely, therefore, that the development and use of the MAT based on these findings has the potential to be more successful than existing assessments in allowing teachers to identify children's movement competence within schools, providing a greater level of feedback required to positively support children's movement development across crucial early years.

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