

Assessment Tools Measuring Fundamental Movement Skills of Children

Subjects: Education & Educational Research

Contributor: Ágnes Virág Nagy , Márta Wilhelm , Mihály Domokos , Ferenc Győri , Tamás Berki

Childhood is the most sensitive period for the development of fundamental movement skills (FMS). The assessments also help identify strengths and weaknesses in coordination, balance, agility and other important skills.

assessment tool primary school children

1. Introduction

Motor skills are fundamental abilities that enable individuals to perform various physical tasks efficiently [1]. Basic skills like walking, running and jumping and complex activities like sports and fine motor tasks play a crucial role in human development and daily functioning. Developing these skills in childhood is fundamental for competitive sports and lifelong activity, since this contributes to physical, mental and social development as well [2][3][4][5][6]. These benefits also highlight the importance of measuring and continuously monitoring these skills. An accurate motor skill assessment tool serves as an objective measure to evaluate an individual's physical abilities, and it is essential for identifying strengths and weaknesses. Measuring motor skills in children is a priority for both physical education and youth sports, since it can help teachers and coaches to support the motor skills development that the individual requires.

Ideally, the pillars of motor skills should be developed before the onset of the rapid growth phase in adolescence, since previous studies have already demonstrated that childhood is the most sensitive period for the development of fundamental movement skills (FMS) [5][7][8]. Several researchers refer to FMSs as the pillars of motor skills, since they are a set of foundational physical abilities that serve as building blocks for more complex and specialized movements. FMSs are essential for developing complex movements that involve the ability to move confidently and effectively in a wide range of physical activities. There are four main categories of fundamental movement skills: locomotor movement skills, object control movement skills, stability movement skills and fine motor movement skills [1][8].

2. Assessment tools measuring fundamental movement skills of children

Table 1 presents the characteristics of the assessment tools. High standard deviations are seen for both the quantity of test items (SD = 20.44) and the duration of the test (SD = 11.30). Three of the tools (MOT 4–6, MMT

and BOT-2) appear to be results-oriented, while the M-ABC-2 and TGMD are more process-oriented. Only the TGMD has 2-level scaling in the evaluation process, i.e., evaluating correct or incorrect execution. The other process-oriented assessment tool uses a scale with three or more levels to evaluate partially accurate execution. During testing, the age-appropriate standardized scores from the result-focused assessment tools are used from raw performance scores. The instrument requirements of tools also differ widely, but all of them need some kind of sports equipment to produce the test. There are culture-specific differences. For example, the TGMD can also be performed with tennis and baseball [\[9\]](#).

Table 1. Characteristics and theoretical frameworks of movement skill assessment tools

Name	Aim	Age	Time	Items	Results Oriented	Process Oriented	Evaluation	Devices	Strengths	Limitations	Citations
Motor skills test for 4–6-year-old children (MOT 4–6)	Early detection of FMS delay or deficiency	4-6 years	20-25 min	18 items	Yes	Yes	0–2 point/Item–raw score	Also requires sports equipment and special equipment	Can be used in an educational environment. A quality assessment is also possible. The measurement can also be done in the classroom.	It does not include a static balance task. It requires several special tools. It contains several similar tasks, thereby increasing the measurement time.	(Zimmer és Volkamer, 1987; Zimmer, 2006;) [10] [11]
Movement Assessment Battery for Children (M-ABC-2)	Detection of delay or deficiency	3-16 years/3 age bands	20-30 min	8 items	No	Yes	0–5 point/item	Also requires sports equipment and special equipment	All test areas are included. Cross-cultural validity. Few tasks, little assessment time.	It requires several special tools.	(Henderson és Sugden, 1992; Henderson, Sugden és Barnett 2019) [12] [13]
Maastrichtse Motoriek Test (MMT)	To evaluate the quantitative and qualitative components of movement at the same time.	5-6 years, kindergarden school transition	30 min	70 items	Yes	Yes	0–2 point/item	Requires sports equipment	It also includes result- and process-oriented assessments evaluation. It places great emphasis on the evaluation of	There are too many tasks. Time consuming.	(Vles et al., 2004) [14]

Name	Aim	Age	Time	Items	Results Oriented	Process Oriented	Evaluation	Devices	Strengths	Limitations	Citations
Bruininks–Oseretsky Test of Motor Proficiency (BOT-2)	Fine and gross motor skill levels and suitable for identifying movement coordination disorders.	4–21 years	45–60 min	53 items	Yes	No	Ranging from a 2-point scale to a 13-point scale	Also requires sports equipment and special equipment	speed coordination. It also measures sense of rhythm. You can choose composites or necessary subtests. All test areas are included. The measurement of fine motor skills is emphasized.	There are too many tasks that are tiring for young children. Time consuming. It requires several special tools.	(Bruininks, 1978; Bruininks and Bruininks, 2012) [15] [16]
Bruininks–Oseretsky Test of Motor Proficiency–Short form	Screening test	4–21 years	15–20 min	14 items	Yes	No	Ranging from a 2-point scale to a 13-point scale	Also requires sports equipment and special equipment	All test areas are included.	It requires several special tools.	(Bruininks, 1978; Bruininks and Bruininks, 2005) [15] [16]
Körperkoordinationtest für Kinder (KTK)	Screening dynamic balance skills with typical or brain damage, behavioral problems or learning difficulties children.	4–14 years	20 min	4 items	Yes	No	Raw scores/standardized scores	Requires special sports equipment	It differentiates well from light to heavy.	The test only measures the ability of dynamic balance. It requires several special tools.	(Kiphard and Shilling, 1974; Kiphard and Schilling, 2007) [17] [18]
Test of Gross Motor Development-2 (TGMD-2)	Backlog in gross motor performance	3–10 years	15–20 min	12 items	No	Yes	0–1 point/item	Requires sports equipment	Excellent for evaluating movement quality.	No stability subtest. Culturally dependent.	(Ulrich, 1985; Ulrich, 2000) [9] [19]
Test of Gross Motor Development-3 (TGMD-3)	Backlog in gross motor performance	3–10 years	17–22 min	13 items	No	Yes	0–1 point/item	Requires sports equipment	Excellent for evaluating movement quality.	No stability subtest. Culturally dependent.	(Webster and Ulrich, 2017) [20]

Name	Aim	Age	Time	Items	Results Oriented	Process Oriented	Evaluation	Devices	Strengths	Limitations	Citations
Test of Gross Motor Development-3 Short form (TGMD-3 Shord form)	Backlog in gross motor performance	3–10 years	10–13 min	7 items	No	Yes	0–1 point/item	Requires sports equipment	Excellent for evaluating movement quality.	No stability subtest. Culturally dependent.	(Duncan et al., 2022) [21]
Motorische Basiskompetenzen (MOBAK-1)	Screen the level of student's motor competence	6–7 years	10–12 min	8 items	Yes	No	0–2 point/item	Requires sports equipment	The subtests are age-specifically adapted to the curriculum requirements of physical education. It can be used well in PE lessons. Uses appropriate equipment in PE.	Time-consuming: 5 children can be assessed during a 45-min PE lesson.	(Herrmann et al., 2019) [22]
Motorische Basiskompetenzen (MOBAK-3)	Screen the level of student's motor competence	8–9 years	10–12 min	8 items	Yes	No	0–2 point/item	Requires sports equipment	The subtests are age-specifically adapted to the curriculum requirements of physical education. It can be used well in PE. lessons. Uses appropriate equipment in PE.	Time-consuming: 5 children can be assessed during a 45-min PE lesson.	(Herrmann and Seelig, 2017) [23]

The content components of the FMS assessment tools are shown in **Table 2**. Locomotion movement analysis was measured with running tasks in three assessment tools (BOT-2; TGMD-2; TGMD-3). Additionally, most assessment tools involve skipping to measure locomotion movement skills.

Table 2. Content analysis of FMS assessment tools.

Subtests/Tasks	MOT 4–6	M-ABC-2 (3–6 Age)	M-ABC-2 (7–10 Age)	MMT	BOT-2	BOT-2 Short Form	KTK	TGMD- 2	TGMD- 3	TGMD- 3 Short Form	MOBAK- 1 (6–7 Age)	MOBAK- 3 (8–9 Age)
Locomotion Motor Movement Skills												
Run					Shuttle run			X	X			
Hop with 1 leg	X		Forward	Left, Right, Forward left leg, Forward right leg	X	X		X	X	X		
Hop with 2 legs	Jumping Jack	Forward	X	Jumping Jack, Same side synchronized, Opposite side synchronized		Same side synchronized						
Hop with 1 and 2 legs											Forward	
Gallop								X	X	X		
Slide								X	X		X	
Run and slide												X
Leap/Skip								X	X			
High jump	X						X					
Long jump			X									
Long jump from place					X			X	X	X		
Side hop					One-legged, Two-legged							
Rolling around longitudinal axis	X											
Rolling forward											X	X
Knee push ups					X	X						
Sit up					X	X						

Subtests/Tasks	MOT 4–6	M-ABC-2 (3–6 Age)	M-ABC-2 (7–10 Age)	MMT	BOT-2	BOT-2 Short Form	KTK	TGMD- 2	TGMD- 3	TGMD- 3 Short Form	MOBAK- 1 (6–7 Age)	MOBAK- 3 (8–9 Age)
Wall sit					X							
V-up					X							
Hiding through hoops	X											
Complex exercise: Stand up–sit down	X											
<i>Object Control Movement Skills</i>												
Throw overhand	Target				Target			X	X	X	Target	Target
Throw underhand		Target	Target						X			
Catch (two-handed)	Stick, Ring	Beanbag	X	X				X	X	X	X	
Dribble stationary				X	One hand, Alternate hand	Alternate hand		X	X	X		
Dribble forward											X	Slalom
Dribble with leg											X	Slalom
Kick				Right leg, Left leg				X	X			
Strike								X	One hand, Two hands	Two hands		
Underhand roll								X				
Rope skipping												X
Complex exercise: Throw and catch					One hand, Two hand							Two hands

Subtests/Tasks	MOT 4–6	M-ABC-2 (3–6 Age)	M-ABC-2 (7–10 Age)	MMT	BOT-2	BOT-2 Short Form	KTK	TGMD- 2	TGMD- 3	TGMD- 3 Short Form	MOBAK- 1 (6–7 Age)	MOBAK- 3 (8–9 Age)
Complex exercise: Drop and catch					One hand, Two hand	Both hands						
Stability Movement Skills												
Static balance skills												
One-leg balance		X	X	Right leg, Left leg	Eyes open, Eyes closed	X						
Stork stand				Right leg, Left leg								
One-leg balance on a beam					Eyes open, Eyes closed, Heel-to-toe							
Two-leg balance on the line					Eyes open, Eyes closed							
Two-leg balance				Eyes closed, Eyes closed arms forward								
Standing on toes				X								
Dynamic balance skills												
Walk on heels				X								
Walk on the toes				X								
Walking forward on the line	X	Heels raised	Heel-to-toe	Tightrope walker	X, Heel-to-toe	X					Beam	Beam, Barrier
Walking backwards on the line	X						Beam					
Jumping sideways over	Rope				Beam		X					

Subtests/Tasks	MOT 4–6	M-ABC-2 (3–6 Age)	M-ABC-2 (7–10 Age)	MMT	BOT-2	BOT-2 Short Form	KTK	TGMD- 2	TGMD- 3	TGMD- 3 Short Form	MOBAK- 1 (6–7 Age)	MOBAK- 3 (8–9 Age)
a slat												
Moving sideways							X					
Twisting jump in the hoop	X											
Complex exercise: Jump and one-leg balance	X											
Fine Motor Movement skills												
Without equipment												
Hand tapping				Left, Right								
Feet tapping				Left, Right								
Tapping feet and fingers					Same side synchronized; Opposite side synchronized	Same side synchronized						
Pivot thumbs and index fingers					X							
Touching nose with index fingers—eyes closed					X							
Pronation– supination				Dominant hand, Non- dominant hand, Both hands								
Opposition of fingers and thumb				Dominant hand, Non- dominant								

Subtests/Tasks	MOT 4–6	M-ABC-2 (3–6 Age)	M-ABC-2 (7–10 Age)	MMT	BOT-2	BOT-2 Short Form	KTK	TGMD- 2	TGMD- 3	TGMD- 3 Short Form	MOBAK- 1 (6–7 Age)	MOBAK- 3 (8–9 Age)
				hand, Both hands								
Put tennis balls in boxes	X											
Drawing points	X				X							
Drawing lines		X	X		2 items	X						
Copy					8 items	2 items						
Match packing	X											
Grip with toes	X											
Posting coins		X			X	X						
Threading beads		X										
Folding paper					X	X						
Placing pegs			X									
Threading lace			X									
Placing pegs in pegboard					X							
Soring cards					X							
Stringing blocks					X							
Filling in a circle					X							
Filing in a star					X							
Connecting dots					X							
Cutting out a circle					X							

Subtests/Tasks	MOT 4–6	M-ABC-2 (3–6 Age)	M-ABC-2 (7–10 Age)	MMT	BOT-2	BOT-2 Short Form	KTK	TGMD-2	TGMD-3	TGMD-3 Short Form	MOBAK-1 (6–7 Age)	MOBAK-3 (8–9 Age)
Pen				Dominant hand, Non- dominant hand								

Measuring object control movement skills includes different types of throwing, dribbling, kicks, strikes, and other complex exercises (i.e., throw and catch). As seen in **Table 2**, most of the assessment tools measure a skill with one or more tasks; however, the KTK did not include any tests to measure object control movement skills. Furthermore, it is mostly dominated by upper-limb tests, but the MOBAK, TGMD and MMT examine lower leg coordination.

Static and dynamic balance can be found in the analyzed tools. Almost half of the tests include one-leg and/or two-leg static balance tasks executed with eyes open or closed. Except for the TGMD, all of the assessment tools include dynamic balance tasks, such as walking forward and backwards, and walking heel-to-toe on a walking line or balance beam. Only the MMT and BOT-2 assess fine motor skills without equipment (**Table 2**). The test includes mainly tasks involving fingers and hands.

In investigating locomotor movement skills measurement, scholars found that the BOT-2 running test is excellent for testing running ability since they use “shuttle run” tests for running agility ^[16]. For detecting deficiencies in technical execution, the TGMD-2 or TGMD-3 are recommended to use ^[9]. Both tools help to evaluate running techniques with a unitary criteria system. Those coaches or PE teachers who want to investigate the effectiveness of running with the “moving variably” test of the MOBAK-3 will find it useful, in which the running and lateral running should be alternated for effective performance ^[24]. Almost all of the assessment tools include hop tests. Depending on the needs, one can choose between one-leg, two-legs, on-the-spot, and forward hopping. The MMT test is recommended ^[14] for testing the coordination of two body halves like the hands and feet. Assessing crossed movements during the hop, the BOT-2 assessment tool would be favorable, including suitable tasks ^[16]. The MOT 4–6 and KTK are recommended for the high jump, the MMT for the long jump, and the BOT-2 and TGMD for the long jump from a stationary position. The MOBAK is applicable for assessing forward rolls, and the MOT 4–6 test is important for considering the measurement of rolling around the longitudinal axis ^[14].

The throws had a prominent place for object control movement skills. The tasks mainly assess the effectiveness of a target throw, such as a one-handed overarm, or a one-handed underarm throw. The TGMD has a good tool that assesses the quality of the execution of the throw. The two-handed catching skill appears in a variety of different tools. The children were tested with balls, hoops, and bean bags in the different assessment tools. Some tools offer complex tests such as “throw and catch” and “release and catch”; these can be found in the BOT-2 and MOBAK-3. The importance of object control movement skills has been shown in ball games and other sport techniques such as tennis and badminton ^{[25][26][27]}.

Stability movement skills are tested with static and dynamic balance tests. Static balance is assessed in only four assessment tools. One-leg balancing, such as the flamingo test can be tested on the floor, on the line or on the beam, with eyes open and closed.

Overall, the analysis revealed that to assess locomotor movement skills, the BOT-2 has an excellent test for running ability, but for detecting technical difficulties, the TGMD is recommended. To test hopping, the MMT has the best tests. Object control movement skills are measured with throws, dribbles and catches. Most of the tools assessed these skills, but it turned out that the TGMD has the most tests for it. Stability movement skills are tested with static and dynamic balance tests. When dynamic balance is more used, the MOT 4–6, KTK and BOT-2 have the most tools available. However, the MMT is an excellent test for static balance. Fine motor movement skills are easy to assess with the MMT and MOT 4–6, since they have low equipment requirements. The BOT-2 is the best tool for measuring; however, it has high equipment requirements.

References

1. Logan, S.W.; Ross, S.M.; Chee, K.; Stodden, D.F.; Robinson, L.E. Fundamental Motor Skills: A Systematic Review of Terminology. *J. Sports Sci.* 2018, 36, 781–796.
2. Berki, T.; Pikó, B.F.; Page, R.M. Hungarian Adaptation of the Sport Commitment Questionnaire-2 and Test of an Expanded Model with Psychological Variables. *Phys. Cult. Sport Stud. Res.* 2020, 86, 15–26.
3. Haga, M. The Relationship between Physical Fitness and Motor Competence in Children. *Child Care Health Dev.* 2008, 34, 329–334.
4. Piek, J.P.; Baynam, G.B.; Barrett, N.C. The Relationship between Fine and Gross Motor Ability, Self-Perceptions and Self-Worth in Children and Adolescents. *Hum. Mov. Sci.* 2006, 25, 65–75.
5. Géczi, G.; Baji, I. Necessity of Long-Term Athlete Development in Hungarian Sport. *Testnev. Sport Tud.* 2016, 1, 27–37.
6. Molnár, A.; Boros-Balint, I.; Deak, G.F.; Andrei, V.L.; Ardelean, V.P.; Simonek, J.; Halmová, N.; Dobay, B.; Nagy, Á.V.; Vári, B.; et al. Does the Gross Motor Development of Romanian and Hungarian 6–7-Year-Old Children Depend on the Degree of Obesity? (First Phase of a Longitudinal Study). In *Proceedings of ICU 2019; EdLearning: Bologna, Italy, 2020*; pp. 211–216.
7. Berk, L.E. *Development through the Lifespan*, 7th ed.; Pearson Education: Hoboken, NJ, USA, 2018.
8. Clark, J.E.; Metcalfe, J.S. The Mountain of Motor Development: A Metaphor. *Mot. Dev. Res. Rev.* 2002, 163–190.

9. Ulrich, D.A. Test of Gross Motor Development, Examiner's Manual, 2nd ed.; Pro-ED.: Austin, TX, USA, 2000.
10. Zimmer, R. Diagnostik Der Bewegungsentwicklung von Kindern: Beobachten–Einschätzen–Dokumentieren. In Proceedings of the 2nd International Conference Learning Processes in Early Childhood and Assessment Issues, Bolzano, Italy, 22–24 June 2006.
11. Zimmer, R.; Volkamer, M. Motoriktest Für Vier-Bis Sechsjährige Kinder; Beltz Test: Weinheim, Germany, 1987.
12. Henderson, S.E.; Sugden, D.; Barnett, A.L. Movement Assessment Battery for Children-2; American Psychological Association: Washington, DC, USA, 2019.
13. Henderson, S.E.; Sugden, D.A. Movement Assessment Battery for Children; Psychological Corp.: Sidcup, UK, 1992.
14. Vles, J.S.H.; Kroes, M.; Feron, F.J.M. MMT: Maastrichtse Motoriek Test; Pits BV: Leiden, The Netherlands, 2004.
15. Bruininks, R.H. Bruininks Oseretsky Test of Motor Proficiency; American Guidance Service: St. Paul, MI, USA, 1978.
16. Bruininks, R.H.; Bruininks, B.D. Bruininks-Oseretsky Test of Motor Proficiency, 2nd ed.; Pearson: London, UK, 2012.
17. Kiphard, v.E.J.; Schilling, F. Körperkoordinationstest Für Kinder 2; Pro-ED.: Weinheim, Germany, 2007.
18. Kiphard, v.E.J.; Schilling, F. Körperkoordinationstest Für Kinder; Beltz Test: Weinheim, Germany, 1974.
19. Ulrich, D.A. Test of Gross Motor Development; Pro-ED.: Austin, TX, USA, 1985.
20. Webster, E.K.; Ulrich, D.A. Evaluation of the Psychometric Properties of the Test of Gross Motor Development—Third Edition. *J. Mot. Learn. Dev.* 2017, 5, 45–58.
21. Duncan, M.J.; Martins, C.; Ribeiro Bandeira, P.F.; Issartel, J.; Peers, C.; Belton, S.; O'Connor, N.E.; Behan, S. TGMD-3 Short Version: Evidence of Validity and Associations with Sex in Irish Children. *J. Sports Sci.* 2022, 40, 138–145.
22. Herrmann, C.; Heim, C.; Seelig, H. Construct and Correlates of Basic Motor Competencies in Primary School-Aged Children. *J. Sport Health Sci.* 2019, 8, 63–70.
23. Herrmann, C.; Seelig, H. Structure and Profiles of Basic Motor Competencies in the Third Grade—Validation of the Test Instrument MOBAK-3. *Percept. Mot. Skills* 2017, 124, 5–20.
24. Herrmann, C.; Seelig, H. MOBAK-1 Basic Motor Competencies in First Grade; Department of Sport, Exercise and Health (DSBG) of the University of Basel: Basel, Switzerland, 2015.

25. Thomas, J.R.; French, K.E. References for Motor Tasks--Gender Differences across Age in Motor Performance: A Meta-Analysis. *Percept. Mot. Skills* 1987, 64, 503–506.
26. Hands, B.P.; Larkin, D. Gender Bias in Measurement of Movement. *ACHPER Healthy Lifestyles J.* 1997, 44, 12–16.
27. Wright, J. Fundamental Motor Skills Testing as Problematic Practice: A Feminist Analysis. *ACHPER Healthy Lifestyles J.* 1997, 18–20.

Retrieved from <https://encyclopedia.pub/entry/history/show/118316>