

**1st International Conference, Exhibition & Innovation  
on Public Health & International Community Services  
Waterfront Hotel Kuching, Sarawak, Malaysia  
19-22 Aug 2025**

Organiser: Universiti Teknologi MARA (UiTM), Malaysia  
Co-Organisers: Universitas Muhammadiyah Malang (UMM), Indonesia, Universitas Airlangga (UNAIR), Indonesia, UiTM Technoventure, Malaysia

**Movement and Function Assessment Kit (MFAK)  
for Children with Specific Learning Disabilities**

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## Abstract

**Introduction:** The Movement and Function Assessment Kit (MFAK) was developed to address the lack of comprehensive tools for assessing movement skills and functional performance in Malaysian children with Specific Learning Disabilities (SLD). **Methodology:** This three-phase study involved: (i) analysis using four standardized tools with 148 children with SLD, (ii) expert focus group discussions to construct MFAK items, and (iii) validity and reliability testing of the alpha-prototype with 45 participants. **Results:** Results showed that MFAK is a valid and reliable tool. **Conclusion:** MFAK benefits occupational therapists, special education teachers, and parents in evaluating movement and functional abilities in children with SLD.

**Keywords:** Assessment; Functional performance; Movement skills; Specific Learning Disabilities

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## 1.0 Introduction

Children with Specific Learning Disabilities (SLD) often face challenges beyond literacy skills, including delays in motor, social and language development compared to their typically developing peers (Bozatlı et al., 2024), as well as difficulties with self-care skills (İzoğlu-Tok & Doğan, 2024). These limitations impose adverse effects on later academic performances, according to İzoğlu-Tok & Doğan (2024). Early identification and intervention are therefore critical to support development in these children (Bozatlı et al., 2024).

Health professionals, particularly occupational therapists (OTs), rely on standardized instruments to evaluate motor and functional abilities in children (Velentini, 2024). However, these tools offer several challenges, such as high cost, lengthy administration time, the

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need for trained professionals, limited cultural adaptability, and a lack of comprehensiveness. The use of multiple tools also reduces assessment efficiency.

Therefore, this study aims to develop an alpha-prototype of the Movement and Function Assessment Kit (MFAK) for Malaysian children with SLD aged 4 to 17 years. Specifically, the objectives of the study are:

- a) To identify the performance of movement skills (gross motor, fine motor, balance) and functional performance (daily activities) of children with SLD in Malaysia.
- b) To determine the test items for the alpha prototype of the MFAK based on the results of factor analysis and correlation analysis from the first phase.
- c) To develop an alpha prototype of the MFAK in terms of test item content, test instructions, scoring scale, and required equipment through Focus Group Discussion (FGD).
- d) To determine the concurrent validity of the alpha prototype of the MFAK among children with SLD.
- e) To determine the inter-rater and test-retest reliability of the alpha prototype of the MFAK among children with SLD.

The MFAK is designed to offer a practical and inclusive approach for evaluating movement skills and functional performance in diverse Malaysian settings. This will allow for earlier identification and intervention among children experiencing SLD.

## 2.0 Literature Review

According to the Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition – Text Revision (DSM-5-TR), SLD is a neurodevelopmental disorder that affects the ability to acquire specific academic skills, despite otherwise typical development (American Psychiatric Association, 2017). According to research, there are currently no reliable figures regarding the overall number of SLD children in Malaysia. However, the prevalence survey reported that 7% of students are at risk for dyslexia, with the majority being classified as "very highly at-risk" (Ramli S. et al., 2024). This statistic highlights a substantial need for support, especially in areas beyond literacy, such as motor and functional development.

Recent research continues to demonstrate that children with SLD often experience motor and sensorimotor difficulties, including challenges with fine motor control, balance, spatial awareness, and postural stability that are essential for academic and daily life functioning (Hussein et al., 2023). Another study by Tezel et al. (2024) found that upper extremity proprioception levels were significantly related to motor proficiency in children aged 11 to 13 with SLD. In addition, a qualitative study among parents and teachers of children at risk for SLD described early childhood motor and self-care challenges as part of a broader developmental profile for these children (İzoğlu-Tok & Doğan, 2024). These findings reinforce that motor or functional delays are relevant and actionable in this population.

Numerous standardized tools exist for assessing movement and functional performance in children, such as Bruininks-Oseretsky Test of Motor Proficiency – 2<sup>nd</sup> edition, BOT-2 (Deitz et al., 2007), Movement Assessment Battery for Children, MABC-2 (Brown & Lalor, 2009), and Pediatric Balance Scale, PBS (Franjoine et al., 2010) for movement skills, and Pediatric Evaluation of Disability Inventory – Computer Adaptive Test, PEDI-CAT (Dumas et al., 2010), for functional performances. Nevertheless, many of these tools are costly, require specialist training, contain culturally inappropriate items, and are primarily in English, posing difficulties for Malaysian parents and non-specialist users (Baharudin et al., 2020). A recent Malaysian review by Baharudin et al. (2020) of five standardized assessment tools for children with SLD emphasized these limitations and the need for culturally appropriate and user-friendly instruments.

Currently, no validated local instrument in Malaysia has been developed specifically for assessing both movement and functional performance in children with SLD. Addressing this gap, the MFAK was designed to provide a comprehensive, cost-effective, and user-friendly tool. It includes evaluations of gross and fine motor skills, balance, and daily functional tasks. MFAK is designed for use by health professionals, educators, and parents, aiming to facilitate early identification of movement and functional delays and enable timely targeted interventions. This study, therefore, undertakes the development and psychometric evaluation of the MFAK for Malaysian children with SLD aged 4 to 17 years.

## 3.0 Methodology

This study was conducted in three sequential phases to develop and validate the MFAK for Malaysian children with SLD. Fig.1 summarizes the research flow.

### 3.1 Phase 1: Pre-development of Alpha-Prototype MFAK

A cross-sectional study was conducted involving 148 children with SLD aged 4 to 17 years, who were recruited from government special and inclusive education programs as well as the Dyslexia Association Malaysia. Phase 1 was conducted to address study objectives (a) and (b) as outlined above. Children's movement skills (gross motor, fine motor, and balance) were assessed using the BOT-2, MABC-2, and PBS, while parents completed the PEDI-CAT to evaluate daily functional performance. Data were analyzed using SPSS version 22 for descriptive, correlation, and factor analyses to determine key component domains.

### 3.2 Phase 2: Development of Alpha-Prototype MFAK

A qualitative FGD was conducted with six experts (two occupational therapists, two physiotherapists, and two special education teachers) and one mother of children with SLD. Phase 2 was conducted to address study objectives (c) as outlined above. Results from Phase 1 were presented to refine item content, scaling, and clarity. Two FGD sessions were held to reach consensus on item inclusion. Thematic analysis was performed using NVivo.

### 3.3 Phase 3: Validity and Reliability Testing of Alpha-Prototype MFAK

A cross-sectional validation study was conducted among 45 children with SLD, with 15 children in three age groups: (i) 4 to 6 years, (ii) 7 to 12 years, and (iii) 13 to 17 years. The sample size for this study was determined based on a minimum sample size of 30 respondents, specifically to test the reliability of a questionnaire (Bujang, MA et al., 2024). Phase 3 was conducted to address study objectives (d) and (e) as outlined above. The MFAK results were compared with BOT-2 and PEDI-CAT scores to determine concurrent validity. Inter-rater and intra-rater reliability were assessed using the Intraclass Correlation Coefficient (ICC), with repeated testing conducted 14 days after the initial assessment.

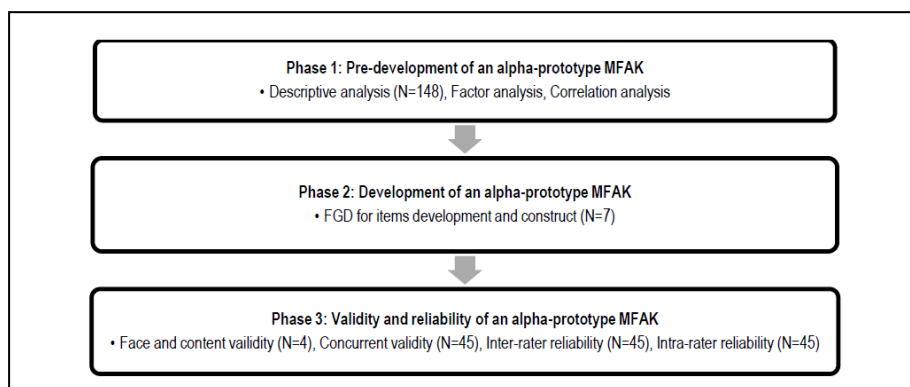


Fig. 1: Illustration of the MFAK development and validation process

## 4.0 Findings

The result for each phase was described in detail in the following text.

### 4.1 Phase 1: Pre-development of an alpha-prototype MFAK

#### Phase 1(a)

Socio-demographic profiles (parents and children)

A total of 148 children with SLD from the PPKI Program. The majority were male (59.5%) and Malay (76.4%), with a median age between 8 and 14 years (41.9%). Dyslexia was the most common diagnosis (55.4%). Table 1 presents the demographic profile of the participating children with SLD and their parents.

#### Movement skills (gross motor, fine motor, balance) and functional performance (daily activities)

The overall scores from each instrument assessed movement performance (gross motor, fine motor, and balance) and functional performance (daily activities) in children with SLD. The total movement score from the BOT-2 instrument was 41.92 (SD = 11.49), while the score from the MABC-2 instrument was 6.72 (SD = 3.35). For body balance, the PBS instrument yielded a mean score of 54.4 (SD = 1.7). Meanwhile, the PEDI-CAT instrument recorded a mean T-score of 52.55 (SD = 12.52) for overall performance in daily activities.

Table 1. Socio-demographic profiles of parents and children with SLD (N=148)

Demographic characteristics	Mean	SD	N	%
<b>PARENTS</b>				
Relationship				
Father			47	61.5
Mother			91	31.8
Grandfather/ Grandmother/Others			10	6.8
<b>CHILDREN</b>				
Gender				
Male			88	59.5
Female			60	40.5
Race				
Malay			113	76.4
Chinese			17	11.5
Indian			14	9.5
Others			4	2.7
Age	11.50	11.30		
Age group				
4-6 years			25	16.9
7-12 years			62	41.9
13-17 years			61	41.2
Median (IQR)			12 (8-14)	
Types of learning disabilities				

Dyslexia	82	55.4
Dyscalculia	1	0.7
Slow Learner	65	43.9

Source: MFAK for children with SLD

### Phase 1(b)

Factor analysis for gross motor, fine motor, and balance according to the instruments BOT-2 and PBS.

Exploratory factor analysis was conducted on mobility test items from the BOT-2 and PBS instrument to examine the relationships among movement and functional assessment items. This analysis aimed to identify underlying characteristics represented by related items and to remove items that did not fit within the emerging factor structure (item reduction). Four-factor components were identified for gross motor skills, while five were found for fine motor skills and four for body balance.

### Relationship among the gross motor, fine motor, and balance domains in the MABC-2 instrument

The relationship among gross motor, fine motor, and balance domains in the MABC-2 instrument was analyzed using correlation analysis across three age groups. The MABC-2 assesses three main domains: gross motor (aiming and catching), fine motor (hand dexterity), and balance. For the gross motor test, a strong correlation was observed between catching the ball with the preferred hand and catching the ball with the non-preferred hand ( $r = 0.78$ ) in the youngest age group (Band 1).

In the fine motor domain, several items showed high correlations, including posting coins with the preferred hand and threading beads ( $r = 0.50$ ) in Band 1, placing pegs with the preferred hand and non-preferred hands ( $r = 0.78$ ) in Band 2, as well as the triangle with bolt and nut task ( $r = 0.58$ ), and turning pegs with the non-preferred hand while installing bolts and nuts ( $r = 0.52$ ) in Band 3.

Similarly, high correlations were found in the balance domain. In Band 1, one-leg balance on the best leg and one-leg balance on the other leg showed a strong correlation ( $r = 0.77$ ). In Band 2, one board balance on the best leg and one board balance on the other leg correlated at  $r = 0.63$ , while hopping on a mat with the other leg had a high correlation ( $r = 0.85$ ). In Band 3, zig-zag hopping on the best leg and the other leg were strongly correlated ( $r = 0.75$ ), as well as walking heel to toe backward and zig-zag hopping on the best leg ( $r = 0.58$ ).

### 4.2 Phase 2: Development of an alpha-prototype MFAK FGD with Experts

This study included an FGD with seven panelists comprising health professionals (occupational therapists and physiotherapists), special education teachers, and mothers of children with SLD. The panel consisted of five female and two male participants, six of whom held a bachelor's degree, and one a master's degree. All panelists had a minimum of five years of experience working with children with SLD. During the FGD, the panelists shared and compared their professional perspectives and experiences on the discussed theme.

### Content analysis

The FGD content was analyzed based on the topics established in the Phase 2 study. The first topic focused on movement skills tests, while the second addressed functional performance tests. The content analysis identified four sub-themes: test item suitability, test item verbal instructions, test item scoring, and test item equipment. Each test item was reviewed for acceptance, rejection, or inclusion in the alpha-prototype MFAK.

**Theme 1 - Movement skills tests:** A total of 18 task items were deemed suitable for the gross motor skill test, while 10 were not selected. For fine motor skills, 20 task items were agreed upon as appropriate, three were excluded, and four new items were introduced. Additionally, 15 task items were accepted for the balance skills test, with one item removed and three new items incorporated. All panel members agreed that spoken instructions for each test item should be simple and clear. The evaluation form should also include demonstrations and trial sessions. In addition, verbal instructions must adhere to standardized procedures, guiding participants through the tasks from start to finish. The panelists endorsed a scoring system of 0, 1, 2, and 3 for all movement skill test items, with a uniform rubric: a full score of 3, followed by 2, 1, and 0. The inclusion of time limits and repetition counts was recommended to ensure accurate scoring for children with SLD. Moreover, point and time scores can be used to compare the performance of children with SLD with that of their typically developing peers. The FGD session also reviewed appropriate test item equipment for gross motor skills, fine motor skills, and balance assessments. Equipment for gross motor skills included bounce balls, softballs, and target boards. Fine motor skills were assessed using a fine motor booklet, pencil, scissors, lacing set, pegboard, blocks, cards, coin and box, and threading lace. A balance board was provided to evaluate balance skills in the alpha-prototype MFAK.

**Theme 2 - Functional performance tests:** The FGD panel agreed to retain 57 out of the 68 task items reviewed for inclusion in the functional performance tests. Meanwhile, 11 items were excluded, and several new tasks were proposed during the discussion. The newly suggested items included folding clothes, hanging clothes, sweeping the trash, flushing the toilet after use, washing the dishes, and opening and closing the car door. The panel concluded that the assessment form should feature clear, precise, and consistent written instructions that examiners can easily follow. To enhance understanding, the instructions should also include supporting materials such as images of the task items. For scoring functional performance, the panels agreed to a four-point Likert scale: (3) able to perform independently, (2) able to perform with some difficulty, (1) needs minimal assistance, and (0) not able to perform or needs maximal assistance. The only equipment required for the functional performance test was the assessment form and the MFAK manual.

### 4.3 Phase 3: Validity and reliability of an alpha-prototype MFAK

This study yielded two types of validity: face validity and concurrent validity. Inter-rater and test-retest reliability tests are used in this study.

#### *Phase 3 (a)*

##### *Face and content validity*

Four panel members in the FGD reviewed the alpha-prototype MFAK set in this study. All panelists agreed that the alpha-prototype MFAK demonstrated good face validity, indicating that it effectively measures what it is intended to measure for each movement skill task item (gross motor, fine motor, balance) and functional performance task item (eating and drinking hygiene and personal grooming, clothing management, and work/home activities). Additionally, the alpha-prototype MFAK exhibited strong content validity. The assessment instrument was deemed appropriate for evaluating movement skills and functional performance in children with SLD, assessing their current performance levels, comparing them with those of typically developing children, and identifying developmental delays in movement and functional skills.

##### *Concurrent validity*

This study conducted a concurrent validity test to compare the alpha-prototype MFAK with established gold standard instruments. For movement skills, the MFAK was validated against the BOT-2 instrument, while for functional performance, it was compared with the PEDI-CAT instrument. The Pearson Correlation Test demonstrated a strong correlation between the assessments. The MFAK (movement) showed a high correlation coefficient of 0.97 with the BOT-2, while the MFAK (functional) exhibited a correlation coefficient of 0.95 with the PEDI-CAT, indicating strong concurrent validity.

#### *Phase 3(b)*

##### *Inter-rater reliability*

The ICC value for inter-rater stability and internal consistency of the MFAK total movement score was found to be high, with a value of 0.99.

##### *Test-retest reliability*

The test-retest reliability of the alpha-prototype MFAK (movement) was assessed by conducting two evaluations within 14 days. The scores for both assessments were compared, and the ICC value for stability and internal consistency over time was found to be high at 0.99.

##### *Intra-rater reliability*

For functional performance, the intra-rater reliability of the alpha-prototype MFAK (functional) was assessed through two evaluations conducted within 14 days. The scores from both assessments were compared, and the ICC value for stability and internal consistency over time was found to be high at 0.99.

## **5.0 Discussion**

In Phase 1, the pre-development stage of the alpha-prototype MFAK, moderate levels of difficulty were identified, consistent with recent findings indicating significant motor impairments among children with SLD (Blanchet & Assaïante, 2022). This supports the need for a movement assessment tailored to Malaysian children with SLD. Functional performance scores using PEDI-CAT also reflected moderate ability. A previous study by Suhaili et al. (2019) reported that motor skills, specifically manual dexterity and balance, were significant predictors of functional mobility scores as measured by the MABC-2 and PEDI-CAT.

The item development process for the MFAK followed established instrument design protocols and integrated insights from expert focus group input. The final prototype includes 18 gross motor, 24 fine motor, 18 balance, and 69 functional performance items. Expert reviewers recommended the removal of items that were too simple, overly difficult, culturally irrelevant, or non-feasible for children with SLD. The importance of population-specific relevance was emphasized (Abid et al., 2023).

From a clinical perspective, the findings highlight that rehabilitation programmes for children with SLD should include targeted training in gross motor skills, fine motor skills, and balance. For example, a recent randomised controlled trial found that goal-directed perceptual-motor training significantly improved motor skills, attention, and quality of life in children with SLD (Punar & Sevgin, 2024). Notably, one FGD panel recommended omitting endurance or agility tasks (e.g., push-ups, 15-meter runs) from MFAK due to suitability for this population, highlighting the need for tool and intervention adaptation.

The MFAK demonstrated strong psychometric properties, with high face validity confirmed by expert evaluation and strong concurrent validity with established instruments such as the BOT-2 and PEDI-CAT. These findings suggest that the MFAK is a valid and reliable tool for assessing movement skills and functional performance in children with SLD. The high inter-rater reliability observed may be attributed to standardized administration procedures, including clear test instructions and consistent timing protocols, which minimized variability across assessments. Controlled environmental conditions during testing further enhanced scoring consistency. Similarly, the high test-retest reliability for the functional component reflects the consistency of parental reporting regarding their children's daily functional abilities. These outcomes align with previous studies emphasizing the importance of standardized procedures and environmental control in achieving robust reliability in pediatric motor assessments (Smits-Engelsman et al., 2022).

In summary, the MFAK provides a practical and accessible tool for assessing movement skills and functional performance in children with SLD, suitable for use by therapists, educators, and parents. Its development fills a gap in culturally relevant assessment tools. The next step is full psychometric validation, norming in the Malaysian context, and expansion into broader paediatric populations beyond SLD.

## 6.0 Conclusion & Recommendations

This study developed the MFAK to evaluate movement and functional performance in children with SLD. Its structured and practical design supports early identification of motor and functional challenges. Although the psychometric results are promising, further steps are required to integrate MFAK into clinical and educational practice. This study was limited by its relatively small sample size and absence of a control group of typically developing children, which restricts the generalizability of comparative findings. Establishing Malaysian normative data, creating a scoring manual, and user training are recommended to ensure consistency. Future research should include typically developing control groups, examining predictive validity, and exploring digital applications to enhance accessibility and broader use.

## Acknowledgements

The authors are grateful to the informants who participated and shared their experiences. This research was funded by the Ministry of Science, Technology, and Innovation (MOSTI) Malaysia (06-01-02-SF1233).

## Paper Contribution to the Related Field of Study

This study advances the field of occupational therapy by addressing the lack of standardized tools for assessing movement and functional performance among Malaysian children with SLD. The development of the alpha-prototype MFAK provides a valid, reliable, and contextually relevant instrument. MFAK supports evidence-based assessment and intervention planning and can be effectively applied across clinical, educational, and community settings by occupational therapists, special educators, and parents.

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