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Original Article

VALIDITY AND RELIABILITY OF "ACTIVE MOTOR CARD" (AMC): WEB-BASED MODIFIED FUNDAMENTAL MOVEMENT SKILL ASSESSMENTS FOR PRESCHOOLERS IN INDONESIAN CONTEXT

VALIDADE E CONFIABILIDADE DO "ACTIVE MOTOR CARD" (AMC): AVALIAÇÕES DE HABILIDADES MOTORAS FUNDAMENTAIS MODIFICADAS BASEADAS NA WEB PARA PRÉ-ESCOLARES NO CONTEXTO INDONÉSIO

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RESUMO

Este estudo teve como objetivo determinar a validade e confiabilidade do "Active Motor Card" (AMC) para pré-escolares indonésios. Para determinar as Habilidades de Movimentos Fundamentais (FMS) apropriadas para o contexto indonésio, foram realizadas discussões de grupos focais (FGD) com especialistas em medição e avaliação e referenciadas às ferramentas existentes (TGMD-2/3) que são usadas globalmente como referência. Ambas as abordagens construtiva e concorrente foram utilizadas para avaliar a validade e confiabilidade do AMC por meio de procedimentos de teste e reteste. O escore de validade concorrente (r) foi de 0,148, indicando validade moderada. O valor da correlação intraclasse foi mais significativo que 0,60, indicando boa confiabilidade. O AMC possui oito habilidades medidas, com faixa de valores de validade e confiabilidade de 0,735-0,971. No entanto, o teste de habilidade não locomotora (balanço manual) produziu resultados ruins com um valor de validade de 0,310 e um valor de confiabilidade de 0,735. Concluindo, o instrumento FMS modificado, AMC, possui validade e confiabilidade adequadas e pode ser utilizado para avaliar as habilidades motoras de crianças indonésias.

Palavras-chave: Validade, Confiança, Habilidade motora grossa, Active Motor Card

ABSTRACT

This study aimed to determine the validity and reliability of the "Active Motor Card" (AMC) for Indonesian preschoolers. To determine the appropriate Fundamental Movements Skills (FMS) for the Indonesian context, focus group discussions (FGD) were conducted with measurement and assessment experts and referred to the existing tools (TGMD-2/3) that are globally used as a reference. Both construct and concurrent approaches were used to assess the validity and reliability of the AMC via test and re-test procedures. The concurrent validity score (r) was 0.148, indicating moderate validity. The intra-class correlation value was more significant than 0.60, indicating good dependability. The AMC has eight measured skills, with a validity and reliability value range of 0.735-0.971. However, the non-locomotor (swing hand roll) skill test yielded poor results with a validity value of 0.310 and a reliability value of 0.735. In conclusion, the modified FMS instrument, AMC, has adequate validity and reliability, and it can be used to assess the motor skills of Indonesian children.

Keywords: Validity, Reliability, Gross motor skill, Preschoolers, Active Motor Card.

Introduction

Nowadays, measurements carried out in childcare or kindergarten are less focused on developing gross motor skills (GMS). It is essential to measure fundamental skills because it's crucial for children's development and as a predictor of motor developmental delay[1]. Gross motor skills could also predict the composition of physical activity and cognitive function in children [2–4]. It is essential to measure children's GMS, which includes locomotor, non-locomotor, and manipulative movements, and each of them needs to be developed to support motoric abilities by the child's age or class. In the Indonesian context, it is regulated by the Ministry of Education in the basic framework and structure of the current curriculum regarding early childhood education, which explains that early childhood activities must include motor movements that develop movement abilities in children [5]. So, in this case, valid measurements are needed for children aged 4-5 years to determine the development of children's motor skills.

In line with the importance of assessment for educational elements in Indonesia, knowing children's motor development from an early age and evaluating children's motor skills can be used to develop recommendations on children's physical needs. Early childhood development used to be recorded using an evaluation process using a Test of Gross Motor Development (TGMD). However, in a previous study conducted by Apriyani et al.[6], it was found that the validity and reliability of the results obtained from the application of TGMD-2 in Indonesian children were not very high. The developed components are related to the gross motor skills of children aged 4-5. Fundamental movement skills (FMS) may be the foundation of an active and healthy lifestyle [7]. The modified FMS assessments are expected to be a tool with a high level of conformity with the characteristics of Indonesian preschoolers. Traditional parenting is still dominated by an authoritarian manner, leading to nonoptimal behaviour, including motor skills [8,9]. It facilitates the assessment process and supports the development of fundamental movement skills, especially related to gross motor competence for preschoolers and the surrounding environment, as a form of self-development. This tool can also be used to evaluate preschoolers' motor skills periodically. Several studies have been conducted to determine the validity and reliability of the motor ability measurements for preschoolers (aged 4-5 years), and most of the studies focused on Test of Gross Motor Development (TGMD) [4,10–14]. Studies showed that TGMD was a valid and reliable assessment tool for measuring gross motor skills in preschoolers. However, On the other hand, it still had a weak validity and reliability score regarding the difference of age, sex, cultural and sociodemographic predictors [15–18].

It was necessary to develop measurements that are valid and reliable for Indonesian preschoolers because Indonesia is a multicultural society. It has been discovered that there is a need for a measuring instrument that can be used for subjects of diverse cultures in Indonesia. Cultural differences are a major factor affecting the accuracy and reliability of the results of existing measurements (TGMD-2/-3) in a specific region or country. Therefore, adjusting the content related to the skills being measured is necessary. Supervision and monitoring efforts are needed to find gaps in the coaching process, so development that focuses on the results of the physical evaluation of children is required [19]. The aim of this study was to create modified FMS assessments that considered cultural differences. Children's physical and motor development must be considered in a particular context. Gross motor development, when hampered, will affect the achievement of child maturity.

Methods

Sample

The cluster sample procedure was carried out by children aged 3-5 who met the criteria for inclusion [20,21]. The inclusion criteria were based on the signed consent form by parents or legal guardians, and if parents did not sign the consent form, they would be excluded. At the outset of the research, 227 preschool children from across Malang were included. Each child's parent or guardian was given a consent form as an initial step toward obtaining permission for their participation in the study. Out of the 227 parents or guardians who were given consent forms, 173 gave their consent for their children to participate, while 54 parents or guardians either did not return the form or declined to allow their children to join the study. The participants were from different ethnicities (Maduranese, Javanese, Chinese, Osing, Sundanese) because most of their parents came to Malang from across Indonesia as their job deployments. Parents and caregivers of the children agreed to sign the consent form, and the kindergarten director signed the director's consent form. Participation is optional and without compensation, and each participant understands the objective and procedure of the research, which is communicated directly to them. This study has been approved ethically with certificate 620/KEPK-POLKESMA/2022.

Procedures

This study was initiated with a literature review and focus group discussion with several experts in motor skills assessments. The main point was to review the AMC as a modified FMS assessment and use TGMD-2, which was developed by 22, as a reference regarding measured skills and their criteria. This step was to review the context of the TGMD-2 implementation in the previous study in Indonesia 6, which was found that the validity and reliability of the results obtained from the application of TGMD-2 in Indonesian children were not very high, especially focusing on the measured skills and achievement criteria. These steps provided the researchers with recommendations for modifying FMS measurement tools to assess the motor skills of Indonesian preschoolers (ages 4-5 years) and then to gain recommendations for developing the measurements that are suitable for the Indonesian context. This step underwent Focus Group discussion (FGD) with motor skills experts (Physical education lecturer, associate Professor, who has a research interest in Motor skills Measurement and assessment).

The procedures were as follows:

1) Draft the modified version of AMC that fits the Indonesian context after reviewing the previous study[15–18], which included TGMD as the measurement tools as references.
2) Conducting a focus group discussion (FGD) with the experts in early childhood gross motor evaluation and finalizing modifying the FMS assessments then naming it with "Active Motor Card".
3) Conducting the validity test of the AMC using the Lawshe content validity formula 23 and reliability test following the method of Hallgren [24]; after the validity and reliability tests were conducted, then continued with testing the AMC with the research participants.

The skills were measured AMC were horse jumping, one front-leg jump, crab slide, supine timed up and go, hand's catch, kickball, raise hand throw, and swing hand roll.

Statistical analysis

To analyze data using CVR (Content Validity Ratio), we follow a process where we gather inputs from expert panel discussions. This step aimed to identify the assessment results of necessary skill items required for measuring with the modified TGMD-2. This team of experts determines the appropriateness and relevance of each item on the scale, calculates the percentage of relevant items per expert, and then averages the percentages among all experts.

To determine reliability, the process involves creating functions based on observed proportions that reflect how much agreement exists among observers. Test statistics are then constructed to test hypotheses related to these functions. Test for interobserver bias uses first-order marginal homogeneity, and measures of interobserver agreement are developed as generalized kappa-type statistics. Construct validity results were determined using the entire skill set in practical trial tests conducted on two occasions. These results were then correlated with the results of CVR analysis.

This analysis was done using MS Excel, and the greater the CVR result of a value of 0, the more "important" and the higher the validity. The reliability test evaluates test and retest outcomes for each instrument using estimated values from intra-class correlation (ICC) and 95% confidence intervals [24]. The reliability test criteria with a category value of less than 0.00 (very poor), 0.00-0.20 (less), 0.21-0.40 (sufficient), 0.41-0.60 (moderate)). 0.61-0.80 (good), 0.81-1.00 (very good) (25). The data analysis process uses the 26th version of SPSS.

Results

The construct validity of the 15 measured skills assessed revealed that eight items were valid: 1) horse jumping, 2) one front-leg jump, 3) crab slide, 4) supine timed up and go, 5) hand's catch, 6) kickball, 7) raise hand throw, and 8) swing hand roll. These skills have an average

Content Validity Index (CVI) value of 1, which is greater than the CVI table (0.78), indicating that meet the validity criteria. The average value of the Content Validity Ratio (CVR) is 1 with the CVR (Table 1), meaning that the value was also good. The study did not use seven skills with invalid CVI and CVR data. These items were modified from Test of Gross Motor Development 3 (TGMD 3) [26]. The average correlation coefficient of each test was between 0 and 1(23), and each skill obtained above 0,5 on average, as seen in Figure 1 below.

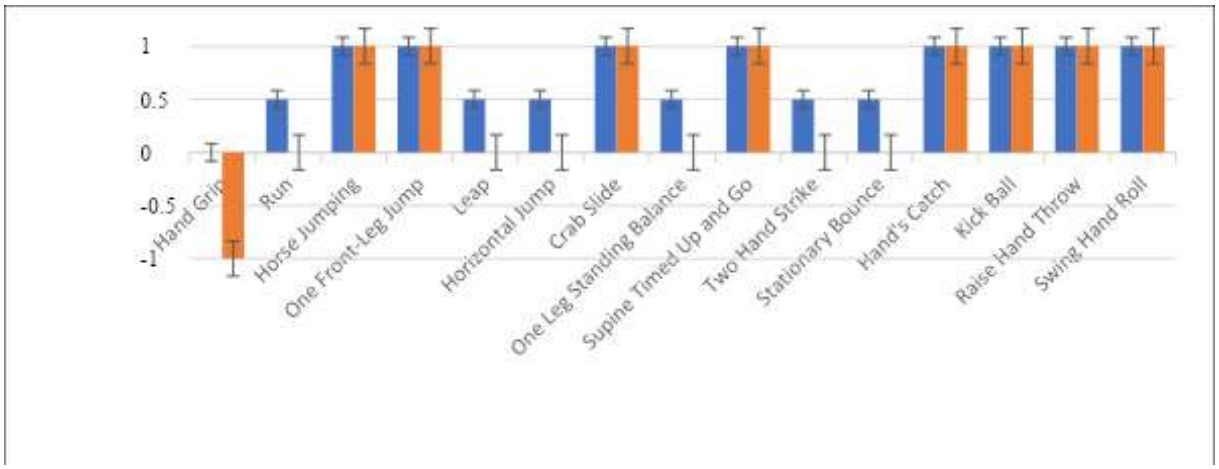

Figure 1. CVR and CVI results for Content Validity of Early Childhood Gross Motor Instrument Development
Note:VI: Content Validity Index; CVR: Content Validity Ratio
Source: authors

All eight skills developed were obtained through the expert judgment process, which was carried out using the FGD (focus group discussion) method, with an average percentage value of 76% (valid/can be used without revision) based on Focus group discussion results there were eight skills could be utilized regarding the features and fundamental movement abilities for children (aged: 4-5 years). The main discussion point was to declare the content validity, objectivity, accountability, and fairness of the measurements and control the measurement process. (The results are shown in the Figure. 2 below).

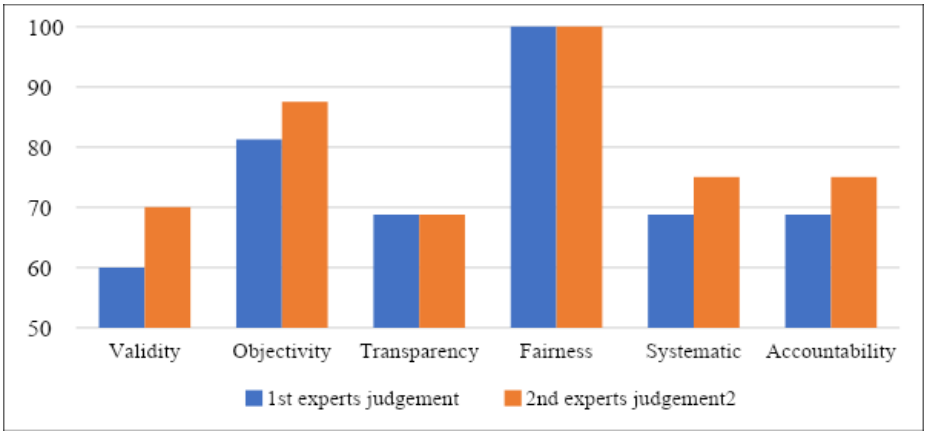

Figure 2. Expert's judgments result for gross motor test instruments using AMC.
Source: authors.

Based on Figure. 2, the following FGD outcomes were analyzed for each component: 1) Content Validity, with an eligibility score of 65% (valid); 2) objectivity, with an eligibility score of 84% (very valid); 3) Transparency: with a score of 69% (valid), 4) fair with a score of 100% (very valid), 5) systematicity; with a score of 72% (valid), and 6) accountability; with a score of 72 (valid) (see Figure 2.).

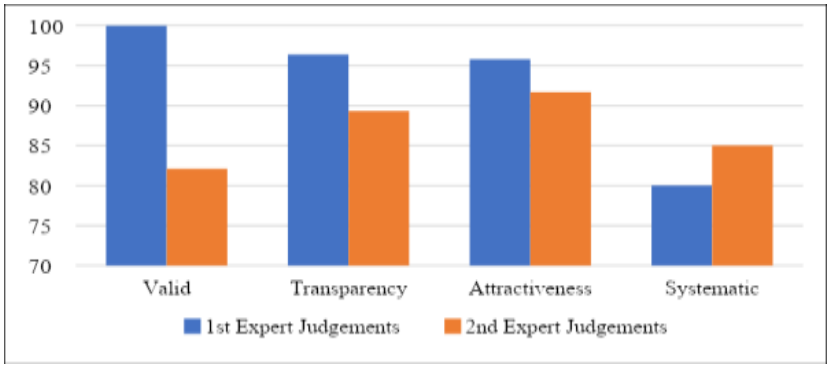

Figure 3. Experts' judgment (Practitioner and Childcare Teachers) for gross motor test instruments using AMC.
Source: authors.

The trial results obtained from the practitioners (principals or persons in charge of kindergarten) possessed percentages of 94% and 87%, respectively, which led to an average result of 90.5% (very valid) and deemed suitable for usage without any further revision. The empirical validity of each component yielded the following results: 1) Construct validity, with an eligibility percentage of 91% (very valid); 2) transparency, with a percentage of 93% (very valid); 3) attractiveness, with a percentage of 94% (very valid), and 4) systematicity, has a score of 83% (very valid). There were no significant differences between experts (see Figure 3 - experts' judgments), and above 80% of the positive judgments.

In light of the trial results, additional trials were conducted on all measurements in children aged 4-5. There were 173 children (aged 4-5) years were enrolled to the AMC trials and the subscale generated highly reliable results (with a reliability coefficient reach above 0,800- See Figure. 4).

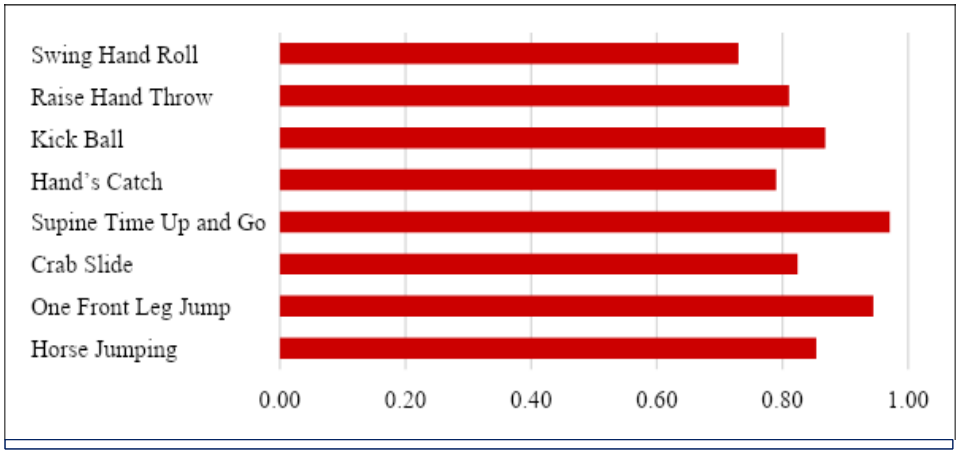

Figure 4. Reliability test results for gross motor skills.
Note: A correlation coefficient of reliability score of AMC.
Source: authors.

Assessments for the reliability of motor skills test were excellent, with a value of 0.939 (95% CI: 0.917-0.955) compared to the reliability of the control object skill, which possesses a value of 0.836 (95% CI: 0.778-0.879). These findings indicate that the locomotor ability test is more reliable than manipulative activity (object control) when performed on children (aged 4-5 years). In this case, the locomotor skill and the control object in AMC can be utilized simultaneously without separating the locomotor aspect or the control object. Using test skills built with the battery test model is more effective when utilized as a complete rather than separating numerous components [27]. As seen in the figure. 5 below indicates that AMC had a valid battery test score average.

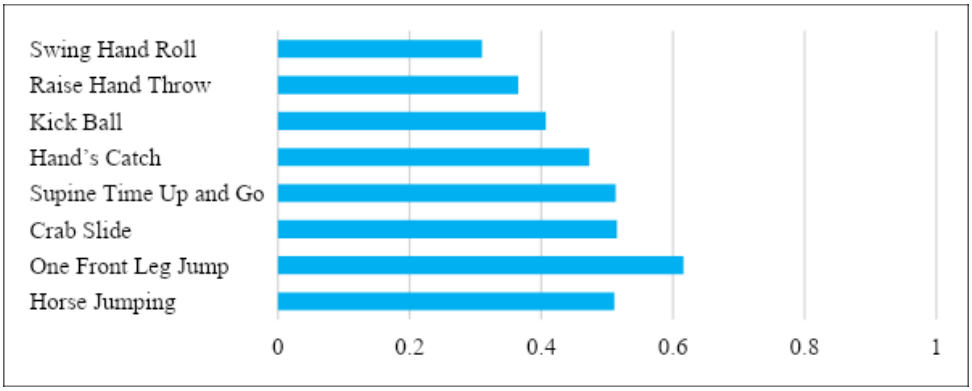

Figure 5. Validity of Battery test for gross motor skills in AMC
Source: authors.

The validity of the skill trial results was determined based on the coefficient value (r: 0.148) on 173 subjects. Horse jumping skill had a validity of 0.511; the one front leg jump skill had a reality of 0.616; the crab slide: 0.514; the supine time up and go: 0.513; the hand's catch: 0.473; the ball kick: 0.407; and swing hand roll possessed a validity of 0.310. All eight skills have a high to very high-reliability value, with gains like the following (see Table. 1):

Table 1. Reliability statistics of the assessment of gross motor skills based on the AMC

Motor skill	Range Value	Motor skill quotients mean ± SD	ICC	95% CI
Horse jumping	0-6	5,26 ± 1.26	0.852	0.799-0.890
One front leg jump	0-10	8,21 ± 2.13	0.944	0.925-0.959
Crab slide	0-6	5,50 ± 1.32	0.825	0.764-0.870
Supine time up and go	0-12	10,97 ± 2.73	0.971	0.960-0.978
Hand's Catch	2-6	5,17 ± 1.03	0.795	0.714-0.852
Kick Ball	2-6	5,29 ± 1.16	0.867	0.821-0.901
Raise Hand Throw	2-8	6,62 ± 1.35	0.811	0.745-0.860
Swing Hand Roll	2-10	6,73 ± 1.74	0.735	0.642-0.804
Total	22-64	53,59 ± 6.00	0.915	0.885-0.937

Note: AMC: Active Motor Card;CI : confidence interval of each variable (Motor skills);ICC : intra-class correlation of each AMC Instrument; SD: standard deviation
Source: authors.

The validity score of horse jumping was 0.511; one front leg jump: 0.616; crab slide: 0.514; supine time up and go: 0.513; hand's catch: 0.473; ball kick: 0.407; and the validity of the raise hand throw proved 0.407. Raise hand throw and swing hand roll tests have a lower level of reality than other tests, particularly the locomotor test, where the highest result (one front leg jump test), performed with the child's movement jumping forward repeatedly, possesses a coefficient of 0.616. The AMC (retrieved balls) has less valuable reliability than previous skills, with each component obtaining a value of 1) 0.37, 2) 0.42, and 3) 0.89, and the findings of the second trial were 1) 0.52, 2) 0.53, and 3) 0.81. The best value is in ball-catching, which is achieved solely with the hands and without anybody's support [28]. This study was limited to finding the validity and reliability of the measurements. The CRT (Criterion-Referenced Test) as the standardized norm was still not determined as the recommended procedure to develop measurements in this study.

Discussion

It is the same as the TGMD-2 instrument, which contains 12 instruments divided into two components: locomotor and object control [29]. Certain easy movements are connected to kicking, sprinting, leaping, and moving laterally [30], while other activities are more intricate. Designing measurements suitable for children (aged 4-5) involves considering additional factors such as their gender, dietary habits, lifestyle, and surroundings, which influence their physical attributes [31]. Early childhood use of the TGMD-2 instrument can identify a child's gross motor skills[32]. For children aged 4-6 years, using various instruments associated with leaping, standing on one leg, hand strength, and speed tests indicated moderate motor ability results [33]. This value is determined utilizing the test items in each instrument. A specific requirements procedure provides a reference for the deal for every used item. The hand roll test results in fewer validities than the single front leg leap test. Considering the swing hand roll instrument has a lower value than the other locomotor instruments, it is more difficult for children to execute. Children at preschool age exhibit more excellent proficiency in fundamental movement than in games [34]. Children will find it more achievable to perform fundamental movements such as gallops, slides, and coordinated actions without the use of coordinating objects. Engaging in activities that focus on coordination and balance twice a week can enhance the gross motor skills of preschool-aged children. This development can aid in their integration into educational institutions by prioritizing the enhancement of their locomotor abilities first [35,36]. Until the review process is completed, identifying movement must support these circumstances. Still, no standard instrument is available to measure the motor skills of children aged 3 to 5 years.

An assessment tool for a child's movement while performing physical activities is required to determine the degree of a child's motor development. Children aged 4-5 years have more excellent motor development, with a level of coordination that needs to improve quickly following the availability of impulses to children; this is a crucial aspect for developing children's talents [37]. The assessment method in physical education focuses on evaluating the gross motor skills of children to understand how their bodies develop and the outcomes of their movement recognition process. Engaging in physical activities helps develop neuromuscular skills, which in turn impacts their motor ability[38]. This is critical for improving motor abilities, which affect social aspects. Strength, endurance, coordination, speed, and flexibility are essential motor skills for children's growth and development. The five fundamental movements can be developed into components of other activities, such as running as fast as they can, agility, endurance, and the ability to coordinate body movements [39,40].This study provided measurement tools that had valid and reliable scores and were fitted to the features of children aged 4-5 years. Gross motor skills instruments must be created in kindergarten or childcare to assist the assessment process and increase the teacher's capacity to emphasize children's gross motor skills to support the child development line with their age and the characteristics of children in the particular area [21].

The World Health Organization has underscored the vital role of physical activity in promoting overall health. Physical activity has been shown to have a significant positive impact on the metabolic health, cognitive function, and mental well-being of children and adolescents. This encompasses enhancements in cardiovascular fitness, blood pressure, glucose levels, academic performance, executive functioning, and reduced depressive symptoms. It is advised that children should engage in moderate to vigorous intensity physical activity for at least 60 minutes per day throughout the week [41]. To complete this task, simultaneous cooperation from supporting countries is essential. The Active Healthy Kids Global Alliance focuses on promoting physical activity among children and adolescents worldwide through a "Report Card" document, which outlines and monitors various indicators [42]. The World Health Organization (WHO) has reported that 5-25% of preschool-age children suffer from developmental disorders. Additionally, the WHO has documented that 8 to 9% of preschool-age children encounter challenges in the psychomotor development of their gross motor skills [43]. In light of the current post-pandemic conditions, studies have indicated a significant decline in children's motor skills and physical activity [44,45]. When it comes to policies and mechanisms concerning children's physical and motor development, it is crucial for every school to have a teacher or facilitator who comprehends the movement needs of children. These educators should provide opportunities and support for children to engage in gross and fine motor exercises, and adopt a healthy lifestyle. The availability of spaces, equipment, and time for strength, agility, flexibility, and coordination exercises is essential for children to achieve kinesthetics maturity and develop habits for a healthy lifestyle.

Promoting physical activity among children and adolescents requires supportive policies in schools and the broader community. These policies should encompass education, the built environment, and a well-structured curriculum. Healthy physical activity patterns established in childhood contribute to a lifelong healthy lifestyle. Thus, it's essential to sustain these habits. Countries with high human development indexes must address social and economic factors, aiming to increase physical activity among young people. Encouraging physical activity among children requires implementing supportive government policies and programs in schools, communities, and family settings. It is dedicated to fostering a culture of active transportation, introducing engaging physical activities into social, familial, and educational environments, and actively decreasing the amount of time spent being sedentary in our everyday lives.

Nevertheless, developing movement literacy is critical in ensuring that children adopt physical activity as a habit. We should pay more attention to children's motor abilities and physical activity issues. Physical literacy endeavours to elevate awareness regarding the significance of physical activity, inculcate a positive mindset in the younger generation, and ultimately contribute to the cultivation of a healthier lifestyle. This effort is designed to empower individuals to unlock their potential and develop enduring healthy living habits. Employing age-appropriate pedagogical approaches linked to physical literacy is crucial for nurturing children's interests and potential, thereby enhancing their skills and focusing on their movement performance.

Conclusion

In conclusion, AMC was suitable for measuring the fundamental motor skills of preschoolers in an Indonesian context. Using the following steps through trials provided high validity and reliable measurements. This tool was also applicable and easy for kindergarten teachers to use for measuring motor skills with some particular conditions such as lack of facility or even not having a large space to undergo. This study may indicate exploratory insights about the policies related to physical activity and sports in childcare or school to tackle risk factors of non-communicable diseases among students. It also could express three policies: administrative support and leadership commitment, the provision of facilities, and the implementation of physical activity and sports. Determining CRT (Criterion-Referenced Test) needs to be implemented as a recommendation for future study. So it would be able to provide standardized norms as references.

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