

Profiles and Differences in Gross Motor Development of Children Aged 3-10 Years by Type of Institution: A Cross-Sectional Study Using Test of Gross Motor Development-2 (TGMD-2) in The DKI Jakarta and Bekasi Regions

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Abstract

Gross motor development is an important component of children's physical development and may vary across different institutional settings. However, evidence comparing gross motor development across different types of institutions in Indonesian contexts remains limited. This study aimed to describe gross motor development profiles and examine differences in Gross Motor Quotient (GMQ) among children aged 3–10 years across different institutional settings in the DKI Jakarta and Bekasi regions. This cross-sectional study involved 112 children aged 3–10 years from nine participating institutional settings, comprising six elementary schools, one early childhood education (ECE) institutional, one orphanage, and one volleyball sport club. Gross motor development was assessed using the Test of Gross Motor Development-2 (TGMD-2). Participant sex information was verified from the original participant records and incorporated into the final dataset before the conversion of raw scores into standardized scores and GMQ. Differences in GMQ across institutional settings were examined using the Kruskal–Wallis test, followed by pairwise Mann–Whitney U tests with Bonferroni adjustment. Effect sizes were reported using epsilon-squared (ϵ^2) for the Kruskal–Wallis analysis and r for pairwise comparisons. The overall GMQ distribution showed that 21 children (18.8%) were classified as Very Poor, 50 (44.6%) as Poor, 20 (17.9%) as Below Average, and 21 (18.8%) as Average. No participants were classified as Above Average, Superior, or Very Superior. GMQ differed significantly across the four institutional settings, $H(3) = 51.35$, $p < .001$, with a large effect size ($\epsilon^2 = .448$). Significant pairwise differences were observed between elementary schools and Early Childhood Education (ECE) ($r = .532$), elementary schools and orphanages ($r = .457$), elementary schools and the sport club ($r = .405$), and Early Childhood Education (ECE) and the orphanage ($r = .833$). Differences between Early Childhood Education (ECE) and the sport club and between the orphanage and the sport club were not statistically significant after Bonferroni adjustment. The findings indicate substantial differences in gross motor development among the participating institutional settings. However, these findings should be interpreted within the context of the sampled institutions and the unequal group sizes. Because of the cross-sectional design and the absence of direct measures of movement opportunities and environmental characteristics, the observed differences should not be interpreted as evidence of causal effects of institutional settings on gross motor development.

Keywords: Children, Gross Motor Development, Gross Motor Quotient, TGMD-2

1. Introduction

Gross motor development is a fundamental aspect of children's growth and development that underlies their ability to move and participate in physical activities throughout life. The period from 3 to 10 years represents an important stage for the development of fundamental movement skills, including locomotor and object-control skills. However, global levels of physical activity among children and adolescents remain insufficient (Guthold et al., 2020), consistent with World Health Organization guidelines emphasizing adequate physical activity and reduced sedentary behavior from an early age (Bull et al., 2020). Therefore, systematic assessment of children's gross motor development using standardized instruments such as the Test of Gross Motor Development-2 (TGMD-2), Ulrich (2000) remains important for understanding children's motor competence.

The significance of motor competence extends beyond physical performance. The model proposed by Stodden et al (2008) describes a reciprocal relationship between motor competence

and physical activity, while systematic reviews have reported associations between childhood motor competence and physical, cognitive, and psychosocial outcomes (Barnett et al., 2022; Bourke et al., 2025; Hill et al., 2024). From the perspective of Dynamic Systems Theory, children's movement skills emerge through dynamic interactions among individual characteristics, task demands, and environmental conditions rather than being determined solely by age (Thelen & Smith, 1994). Previous studies have suggested that environmental characteristics, including the availability of open spaces, caregiver-child ratios (True et al., 2017), movement affordances (Fathirezaie et al., 2021), and opportunities for movement practice (Jones et al., 2020) may be associated with children's motor development. Thus, the environmental context in which children participate may be associated with differences in gross motor development. However, the present study did not directly measure children's movement opportunities, environmental affordances, or frequency of physical activity. Therefore, these factors should be considered plausible explanations supported by previous literature rather than direct explanations of the differences observed in the present sample (Robinson et al., 2015).

Unfortunately, empirical evidence regarding these environmental factors remains fragmented and is rarely examined comparatively across different contexts within a single study design. Previous studies have generally focused on individual variables (Barnett et al., 2022), the effectiveness of intervention programs (Hassan et al., 2022), or specific settings, such as childcare center (True et al., 2017) and open versus closed spaces (Fathirezaie et al., 2021) without extending the comparison to structurally different settings such as child social welfare institutions. Children living in orphanages with limited mobility opportunities may be more likely to experience motor delays (Roerber et al., 2012), however, such settings are rarely directly compared with other institutional settings using the same standardized instrument. In Indonesia, TGMD-2 research has more commonly compared geographical conditions among elementary school students (Ramadhani et al., 2024) rather than examining different types of institutions across a wider age range. Children aged 3–10 years in Indonesia participate in various institutional settings, including elementary schools, early childhood education institutions, orphanages, and sports clubs, which may differ in their activity structures. However, comparative evidence across these different institutional settings using the same standardized instrument remains limited.

Departing from these gaps, this study aims to describe and compare the gross motor development profiles of children aged 3–10 years across four types of participating institutions through a cross-sectional design. The contribution of this study lies in the comparison of children's motor competencies across four institutional settings within the same study, using the same standardized instrument, thereby allowing comparisons across the sampled settings. Specifically, this study aims to describe children's Gross Motor Quotient (GMQ) profiles and analyze differences according to the type of institution in which the children participated.

2. Method

This study employed a descriptive quantitative approach with a non-experimental cross-sectional design. No intervention or manipulation was applied, and data were collected at a single period to describe and compare the gross motor development of children across different institutional settings. Gross motor development was assessed using the locomotor and object-control subtests of the Test of Gross Motor Development–Second Edition (TGMD-2) and summarized as the Gross Motor Quotient (GMQ).

Data collection was conducted from January 30th to April 5th, 2026, following ethical approval issued by the Ethics Committee of the Institute for Research and Community Service (LPPM), State University of Jakarta. The assessment was carried out across nine participating groups/locations representing four types of institutional settings: six elementary schools, one early childhood education (ECE) institution, one orphanage, and one volleyball sports club in the DKI Jakarta and Bekasi regions.

The participating institutions were selected as study settings based on their accessibility and participation in the research and were not intended to represent all institutions of the corresponding types in DKI Jakarta or Bekasi. Accordingly, the findings should be interpreted as reflecting the characteristics of the participating groups and institutional settings rather than as estimates representative of the broader population of children or institutions in these regions. The study population consisted of children aged 3–10 years who were enrolled and actively participated in activities at the nine participating institutions/groups, including six elementary

schools, one early childhood education (ECE) institution, one orphanage, and one volleyball sports club.

Saturated sampling (total sampling) was applied within the selected participating institutions. All children who met the inclusion criteria and completed the assessment procedures were included in the study. This approach was selected because the number of eligible children within each participating institution was relatively limited and accessible. Importantly, the use of total sampling within the participating institutions does not imply that the institutions themselves were selected to represent all elementary schools, ECE institutions, orphanages, or sports clubs in DKI Jakarta and Bekasi.

A total of 112 children from nine groups/locations were included in the final analysis. The inclusion criteria were: (1) being actively enrolled in the relevant institution; (2) being physically able to participate in the assessment and having no motor or physical condition that prevented completion of the test; (3) completing all locomotor and object-control subtests; and (4) having informed consent from a parent, guardian, or the relevant institution. Children who did not complete all test items or experienced an injury or other condition that prevented completion of the assessment during data collection were excluded.

Table 1. Distribution of Research Samples per Group/Location

No	Group/Location	Types of Institutions	n	Age Range
1	SDN Jatinegara Kaum 14	Elementary School	32	8–9 years
2	SDN Kedaung Kaliangke 11 Pagi	Elementary School	10	8-9 years
3	KB Negeri 07 Cengkareng	Early Childhood Education (ECE)	10	3-6 years
4	SDN Pondok Kopi 02 Pagi	Elementary School	10	9-10 years
5	SDN Pulogebang 11 Pagi	Elementary School	10	6–7 years
6	Panti Asuhan Yatim Dhuafa Mizan Amanah	Orphanage	10	5–9 years
7	SDN Batu Ampar 05 Pagi	Elementary School	10	8–9 years
8	SDN 02 Rawamangun	Elementary School	10	7–8 years
9	PBV Victory Bekasi	Sports Club (Volleyball)	10	6–10 years
Total			112	3–10 years

The Test of Gross Motor Development–Second Edition (TGMD-2) (Ulrich, 2000) was used to assess gross motor development. The TGMD-2 consists of 12 fundamental movement skills divided into two subtests: locomotor skills and object-control skills. Each skill was performed in two trials and evaluated according to the performance criteria specified in the TGMD-2 administration and scoring procedures. Scores for each skill were summed to obtain the raw scores for the locomotor and object-control subtests.

Table 2. Details of the TGMD-2 Basic Movement Skills Subtest and Item

Subtest		Movement Skills	Number of Attempts
Locomotor	Run		2
Locomotor	Gallop		2
Locomotor	Hop		2
Locomotor	Leap		2
Locomotor	Horizontal jump		2
Locomotor	Slide		2
Object Control	Striking a stationary ball		2
Object Control	Stationary dribble		2
Object Control	Catch		2
Object Control	Kick		2
Object Control	Overhand throw		2
Object Control	Underhand roll		2

Before data collection, the assessors received a briefing on the TGMD-2 administration and scoring procedures to promote consistency in test administration and scoring. Each child received standardized instructions and demonstrations before performing two trials of each locomotor and object-control skill. The assessors recorded each child's performance on the TGMD-2 scoring sheet according to the specified performance criteria.

The completed scoring sheets were subsequently recapitulated into the participant-level dataset, including the locomotor and object-control raw scores, chronological age, sex, and group/location information.

No formal inter-rater reliability coefficient was calculated. Therefore, the assessor briefing and standardization procedures should be interpreted as efforts to promote consistency in test administration and scoring rather than as a formal assessment of inter-rater reliability. TGMD-2 scoring was conducted according to the standard scoring procedure described in the TGMD-2 manual. Raw scores for the locomotor and object-control subtests were obtained by summing the scores across the specified performance criteria and two trials.

Participant demographic information was reviewed and completed using the original participant records before the final scoring procedure. Age- and sex-appropriate normative information was then used to convert the locomotor and object-control raw scores into the corresponding standard scores according to the TGMD-2 normative tables. The two subtest standard scores were subsequently combined to obtain the Gross Motor Quotient (GMQ).

The final GMQ values used in all statistical analyses were based on the completed dataset of 112 participants, with no missing data for sex.

Table 3. Descriptive Category of Gross Motor Quotient

Category: GMQ	Rentang Standard Score
Very Superior	≥ 130
Superior	121–129
Above Average	111–120
Average	90–110
Below Average	80–89
Poor	70–79
Very Poor	≤ 69

Descriptive statistics were used to summarize participant characteristics and GMQ scores. Differences in GMQ among the four types of participating institutions were examined using the Kruskal–Wallis test. When significant differences were identified, pairwise comparisons were performed using the Mann–Whitney U test with Bonferroni adjustment for multiple comparisons.

Effect sizes were also calculated to assess the magnitude of the observed differences. Epsilon-squared (ϵ^2) was reported for the Kruskal–Wallis analysis, while r was calculated for the pairwise Mann–Whitney U comparisons. For the pairwise comparisons, r values were interpreted as negligible ($< .10$), small ($.10\text{--}.29$), medium ($.30\text{--}.49$), and large ($\geq .50$). Statistical analyses were performed using IBM SPSS Statistics, with the significance level set at $p < .005$.

3. Result and Discussion

A total of 112 children were included in the final analysis. The sample consisted of 82 children from elementary schools, 10 from an early childhood education (ECE) institution, 10 from an orphanage, and 10 from a volleyball sports club. The distribution of GMQ categories showed that 21 children (18.8%) were classified as Very Poor, 50 (44.6%) as Poor, 20 (17.9%) as Below Average, and 21 (18.8%) as Average. No participants were classified as Above Average, Superior, or Very Superior.

Table 4. Distribution of Gross Motor Quotient Categories

GMQ Category	n	%
Very Superior	0	0.0
Superior	0	0.0
Above Average	0	0.0
Average	21	18.8
Below Average	20	17.9
Poor	50	44.6
Very Poor	21	18.8
Total	112	100.0

Overall, 91 of 112 participants (81.3%) were classified as Below Average, Poor, or Very Poor, whereas 21 participants (18.8%) were classified as Average. No participants were classified as Above Average, Superior, or Very Superior.

Table 5. Descriptive Statistics of Gross Motor Quotient by Institutional Setting

Institutional Setting	n	Mean ± SD	Median	Min–Max	IQR
Elementary School	82	72.56 ± 9.35	73.00	46–97	12
Early Childhood Education (ECE)	10	98.50 ± 4.06	100.00	91–103	7
Orphanage	10	87.10 ± 3.18	86.50	82–91	6
Sports Club	10	88.00 ± 10.10	88.00	73–103	17

Descriptive statistics indicated variation in Gross Motor Quotient (GMQ) across the four institutional settings. Children attending Early Childhood Education (ECE) demonstrated the highest mean GMQ ($M = 98.50$, $SD = 4.06$), followed by children participating in the Sports Club ($M = 88.00$, $SD = 10.10$) and those living in the Orphanage ($M = 87.10$, $SD = 3.18$). Children attending Elementary Schools demonstrated the lowest mean GMQ ($M = 72.56$, $SD = 9.35$). A similar pattern was observed for the median GMQ scores. The ECE group demonstrated the highest median score (Median = 100.00), followed by the Sports Club (Median = 88.00), Orphanage (Median = 86.50), and Elementary School groups (Median = 73.00). The ECE and Orphanage groups showed relatively smaller interquartile ranges ($IQR = 7$ and 6 , respectively), whereas the Sports Club group demonstrated the greatest score variability ($IQR = 17$).

The Kruskal–Wallis test indicated a statistically significant difference in GMQ across the four participating institutional settings, $H(3) = 51.35$, $p < .001$. The omnibus effect size was large ($\epsilon^2 = .448$), indicating substantial variation in GMQ across the institutional groups within the present sample.

Table 6. Kruskal–Wallis Test for Differences in GMQ Across Institutional Settings

Test	H	df	p-value	ϵ^2
Kruskal-Wallis	51.35	3	<.001	.448

The significant Kruskal–Wallis test was followed by post-hoc pairwise comparisons using Mann–Whitney U tests with a Bonferroni adjustment for six comparisons. Statistically significant differences were observed between Elementary School and ECE ($r = .532$), Elementary School and Orphanage ($r = .457$), Elementary School and Sports Club ($r = .405$), and ECE and Orphanage ($r = .833$). These findings indicate large, medium, medium, and large effect sizes, respectively. No statistically significant differences were detected between ECE and Sports Club ($r = .542$) or between Orphanage and Sports Club ($r = .017$) after Bonferroni adjustment. Although the ECE–Sports Club comparison demonstrated a large effect size, the difference was not statistically significant after adjustment. The Orphanage–Sports Club comparison showed a negligible effect size.

Table 7. Pairwise Comparisons of GMQ Between Participating Institutional Settings

Comparison	Statistical Significance	Effect Size (r)	Interpretation
	After Bonferroni Adjustment		
Elementary School vs ECE	Significant	.532	Large
Elementary School vs Orphanage	Significant	.457	Medium
Elementary School vs Volleyball Sports Club	Significant	.405	Medium
ECE vs Orphanage	Significant	.833	Large
ECE vs Volleyball Sports Club	Not Significant	.542	Large
Orphanage vs Volleyball Sports Club	Not Significant	.017	Negligible

Note: Pairwise comparisons were conducted following the significant Kruskal–Wallis test using Mann–Whitney U tests with a Bonferroni adjustment for six comparisons. Effect size was expressed as r , calculated from the standardized test statistic. Effect sizes were interpreted as negligible ($< .10$), small ($.10$ – $.29$), medium ($.30$ – $.49$), and large ($\geq .50$).

Differences in Gross Motor Competence across Institutional Settings

The present study identified statistically significant differences in Gross Motor Quotient (GMQ) among children from four participating institutional settings: Elementary Schools, Early Childhood Education (ECE), an Orphanage, and a Volleyball Sports Club. The Kruskal–Wallis analysis demonstrated a statistically significant overall difference in GMQ, $H(3) = 51.35$, $p < .001$, with a large omnibus effect size ($\epsilon^2 = .448$). This finding indicates substantial variation in GMQ scores among the institutional groups included in the study. However, because the present study used a cross-sectional observational design, these differences should be interpreted as associations with

the participating institutional contexts rather than evidence that institutional setting itself caused differences in gross motor competence.

The descriptive findings showed that children in the ECE group had the highest GMQ scores, followed by those in the Sports Club and Orphanage groups, whereas the Elementary School group had the lowest GMQ scores. Nevertheless, the statistical pattern was more complex than a simple ranking of institutional settings. After Bonferroni adjustment, significant differences were observed between Elementary Schools and ECE, Orphanages, and Sports Clubs, as well as between ECE and Orphanages. In contrast, the differences between ECE and Sports Clubs and between Orphanages and Sports Clubs were not statistically significant. Therefore, the findings do not support the interpretation that one type of institution is uniformly superior to all others in supporting gross motor competence.

This pattern may be interpreted using Dynamic Systems Theory, which conceptualizes motor development as an emergent process resulting from interactions among individual characteristics, task demands, and environmental conditions (Thelen & Smith, 1994). From this perspective, institutional categories themselves are unlikely to directly determine motor competence. Instead, the differences observed between groups may reflect variation in children's accumulated opportunities to practice, explore, adapt, and refine fundamental movement skills. The reciprocal model proposed by Stodden et al (2008) further suggests that motor competence and physical activity may reinforce one another over time, potentially contributing to different developmental trajectories during childhood.

The findings are also consistent with literature suggesting that children's motor competence is influenced by both individual and environmental factors. Barnett et al (2022) emphasized the importance of movement opportunities, environmental affordances, and social support in the development of motor competence. Accordingly, the participating institutional settings may represent different developmental contexts in which children are exposed to varying opportunities for movement and skill practice. However, the present study did not directly assess physical activity levels, sedentary behaviour, environmental affordances, equipment availability, instructional practices, or the frequency and quality of movement experiences. These factors should therefore be considered possible explanatory mechanisms rather than directly established causes of the observed differences.

The results may also be understood within an ecological perspective, in which children's development is influenced by the immediate environments in which they live, learn, and participate. Schools, early childhood education settings, residential institutions, and sports organizations may provide different combinations of physical space, social support, structured activities, and opportunities for active play. Importantly, the present findings should not be interpreted as indicating that institutional labels alone determine children's developmental outcomes. Rather, they suggest that the characteristics of the environments and movement experiences available within specific institutional contexts may be relevant to differences in gross motor competence.

Gross Motor Competence among Children in Early Childhood Education

Children in the ECE group demonstrated the highest descriptive GMQ, with a mean score of 98.50 and a median score of 100.00. The ECE group also differed significantly from both the Elementary School and Orphanage groups. These findings suggest that the children attending the participating ECE institution demonstrated relatively high gross motor competence within the present sample.

One possible explanation is that early childhood education may provide frequent opportunities for active exploration and movement through play-based learning. Play-based activities can expose children to a variety of locomotor, object-control, and balance-related movements while allowing repeated practice in meaningful and motivating contexts. Previous literature has emphasized the developmental importance of active play and early movement experiences for the acquisition of fundamental motor skills (Pyle & Danniels, 2017; Robinson et al., 2015; Zosh et al., 2017).

However, the higher GMQ observed in the ECE group should be interpreted with particular caution. The ECE group included children aged 3–6 years, whereas the other groups covered different age ranges. Although GMQ was derived using age-referenced normative procedures, differences in age composition and developmental characteristics may still influence comparisons

between institutional groups. Therefore, the observed ECE advantage cannot be attributed solely to the educational environment.

The absence of a statistically significant difference between ECE and Sports Clubs is nevertheless noteworthy. This result suggests that relatively high gross motor competence may be observed in different types of movement environments. Structured sports participation may provide repeated practice, progressive task demands, and instructional feedback, whereas ECE environments may promote diverse movement experiences through active exploration and play. Thus, the present findings support the possibility that multiple developmental pathways may contribute to gross motor competence.

Although the comparison between ECE and Sports Clubs did not reach the Bonferroni-adjusted significance threshold, the relatively large effect size ($r = .542$) indicates that the absence of statistical significance should not be interpreted as evidence of a negligible difference between the two groups. Given the small sample sizes in both groups ($n = 10$), the comparison may have had limited statistical precision. Therefore, further research with larger and more balanced samples is needed to determine whether the observed difference reflects a meaningful pattern at the population level. From a practical perspective, the findings reinforce the importance of maintaining active and developmentally appropriate movement experiences during early childhood. Play-based learning may be particularly valuable when children are also provided with intentional opportunities to practice fundamental locomotor and object-control skills. However, because only one ECE institution was included in the present study, the findings should not be generalized to all ECE settings.

Gross Motor Competence among Children in Sports Clubs

Children participating in the Volleyball Sports Club demonstrated the second-highest descriptive GMQ, with a mean of 88.00 and a median of 88.00. The Sports Club group differed significantly from the Elementary School group but did not differ significantly from either the ECE or Orphanage groups after Bonferroni adjustment. The difference between the Sports Club and Elementary School groups is theoretically consistent with principles of motor learning. Structured sports participation may provide repeated opportunities to perform, refine, and adapt movement skills through practice, progressive task difficulty, and instructional feedback (Magill & Anderson, 2024; Schmidt et al., 2018). Sports participation may also expose children to frequent locomotor and object-control activities, which are central components of gross motor competence. Previous research has similarly suggested that structured physical activity and sport participation can provide opportunities for the development and refinement of fundamental movement skills (Hassan et al., 2022).

However, the results do not support the conclusion that participation in organized sport necessarily produces the highest gross motor competence. Although the Sports Club group demonstrated a relatively high descriptive GMQ, the difference between Sports Clubs and ECE was not statistically significant after adjustment for multiple comparisons. Similarly, no statistically significant difference was detected between Sports Clubs and Orphanages. These findings indicate that organized sport represents only one possible context in which children may develop gross motor competence. The quality and frequency of movement experiences may be more relevant than whether those experiences occur within a formal sports organization. The relatively wide score dispersion within the Sports Club group, reflected by the largest IQR among the four groups, also suggests substantial individual variation in motor competence among participating children. From a practical perspective, sports programs may support motor development by providing repeated movement opportunities, progressive challenges, and appropriate feedback. Nevertheless, programs for children should remain developmentally appropriate and should emphasize broad motor development rather than premature specialization. This perspective is consistent with principles of long-term athletic development, which emphasize progressive and age-appropriate development across childhood (Lloyd et al., 2016).

Gross Motor Competence among Children in Elementary Schools

The Elementary School group demonstrated the lowest descriptive GMQ among the four participating groups, with a mean of 72.56 and a median of 73.00. Pairwise comparisons showed that this group differed significantly from ECE, Orphanage, and Sports Club groups. These findings may indicate that the children included in the participating elementary schools experienced different movement opportunities compared with children in the other institutional

contexts. In elementary school environments, opportunities for gross motor development may be influenced by factors such as physical education provision, school facilities, recess practices, curriculum priorities, and opportunities for active play. However, none of these factors were directly measured in the present study. Therefore, it cannot be concluded that elementary school attendance itself negatively influences gross motor competence.

Another important consideration is the age distribution of the sample. The Elementary School group included children across a different developmental range from the ECE group. Although the GMQ scores were derived using age-referenced normative procedures, differences in developmental characteristics, movement histories, and the applicability of normative references across the sampled age groups may contribute to the observed group differences. Consequently, the lower GMQ observed in the Elementary School group should be interpreted cautiously.

The findings nevertheless highlight the importance of ensuring continued opportunities for fundamental movement skill development throughout the elementary school years. Motor development should not be considered complete once children transition from early childhood education to elementary school. Instead, children may benefit from continued exposure to diverse, engaging, and developmentally appropriate locomotor and object-control activities. Physical education and active play may therefore represent important contexts for maintaining and further developing gross motor competence (Barnett et al., 2016).

Gross Motor Competence among Children Living in an Orphanages

Children living in the participating Orphanage demonstrated a mean GMQ of 87.10 and a median of 86.50. The Orphanage group differed significantly from both the Elementary School and ECE groups but did not differ significantly from the Sports Club group after Bonferroni adjustment. The absence of a statistically significant difference between the Orphanage and Sports Club groups further demonstrates that the findings cannot be interpreted as a simple hierarchy of institutional environments. Although sports participation may provide structured opportunities for movement practice, children living in the participating orphanage may have experienced other forms of movement exposure that contributed to their gross motor competence. These opportunities could potentially include active play, shared recreational activities, daily routines, or access to physical activities.

However, these possibilities were not measured directly. The present study did not assess duration of institutional care, quality of caregiving, previous developmental experiences, nutritional status, socioeconomic background, or the quantity and quality of physical activity available to children living in the orphanage. Therefore, these factors cannot be identified as explanations for the observed GMQ scores. The results should also not be generalized to all children living in institutional care. The Orphanage group consisted of children from only one participating institution and included only 10 participants. Consequently, the findings may reflect characteristics of the specific orphanage included in the study rather than representing the broader population of children living in orphanages.

Overall Interpretation of Gross Motor Competence

The overall distribution of GMQ categories provides additional context for interpreting the between-group differences. Of the 112 participants, 81.3% were classified as Below Average, Poor, or Very Poor, while only 18.8% were classified as Average. No children were classified as Above Average, Superior, or Very Superior. This distribution suggests that, despite the relatively higher GMQ observed in some institutional groups, gross motor competence across the overall study sample was generally below the higher normative categories. The findings therefore indicate that relative differences between institutional groups should not be interpreted independently from the broader motor competence profile of the sample.

The substantial overall effect identified by the Kruskal–Wallis analysis indicates that differences among groups were meaningful within the present sample. However, the pairwise results demonstrate that these differences were concentrated in specific group comparisons rather than occurring uniformly across all institutional settings. This pattern supports a more nuanced interpretation in which gross motor competence may be influenced by multiple interacting developmental and environmental factors.

Fundamental movement skills develop through accumulated opportunities for movement, practice, adaptation, and learning. Consequently, responsibility for supporting children's gross motor development should not be assigned exclusively to sports organizations. ECE institutions,

elementary schools, families, community programs, and sports organizations may all contribute to creating environments that provide children with frequent, diverse, and developmentally appropriate movement experiences.

Practical and Educational Implications

The findings have several practical implications. In ECE settings, active and play-based learning should be maintained while ensuring that children have intentional opportunities to practice fundamental locomotor and object-control skills. Structured motor activities may complement naturally occurring play and provide additional opportunities for skill development (Logan et al., 2015). For elementary schools, the significantly lower GMQ observed in the present sample highlights the importance of evaluating whether children receive sufficient opportunities to practice fundamental movement skills. Physical education programs should provide regular and developmentally appropriate opportunities for active participation rather than focusing primarily on theoretical instruction or sport-specific performance. Fundamental movement skills should remain an important developmental objective throughout the elementary school years (Barnett et al., 2016). For sports organizations, the findings support the potential value of structured practice, progressive task demands, and appropriate feedback. However, children's sports programs should promote broad motor development and remain appropriate to developmental stage rather than emphasizing early specialization (Lloyd et al., 2016). At a broader level, the results support a multisectoral approach to children's motor development. Schools, ECE institutions, families, communities, and sports organizations may each contribute to the availability of movement opportunities. Because motor competence is associated with physical activity and broader aspects of child development, opportunities to practice fundamental movement skills should be supported across multiple environments rather than being confined to formal sports participation (Hill et al., 2024).

Research Implications and Limitations

Several limitations should be considered when interpreting the present findings. First, the cross-sectional observational design does not allow causal conclusions. Although significant differences in GMQ were observed among the participating institutional settings, it cannot be determined whether characteristics of the institutional environments contributed to these differences or whether other developmental, demographic, and experiential factors were responsible. Second, the group sizes were substantially unequal. The Elementary School group included 82 participants, whereas the ECE, Orphanage, and Sports Club groups each included only 10 participants. This imbalance may affect the precision of group estimates and the statistical power of pairwise comparisons. Therefore, non-significant findings should not be interpreted as evidence that the corresponding groups are equivalent.

Third, the institutional categories were represented by different numbers of participating sites. The Elementary School category included children recruited from multiple schools, whereas the ECE, Orphanage, and Sports Club groups were each represented by a single participating institution. Consequently, the observed differences may partly reflect characteristics specific to the sampled institutions rather than broader characteristics of all institutions of the same type. The findings should therefore be generalized cautiously. Fourth, the institutional groups differed in age composition. Children in the ECE group were generally younger than those in the Elementary School and Sports Club groups, while the groups covered overlapping but non-identical age ranges. Although GMQ was derived using age-referenced normative procedures, age-related developmental characteristics, cohort differences, and differences in the applicability of normative references may still influence comparisons between groups. Future studies should therefore consider age-adjusted or multivariable analyses when examining institutional differences.

Fifth, several potentially important explanatory variables were not directly assessed, including daily physical activity, sedentary behaviour, nutritional status, socioeconomic characteristics, parental or caregiver support, previous sports participation, physical education exposure, environmental affordances, and access to movement facilities. These factors may contribute to differences in motor competence and should be incorporated into future research. Finally, the study focused on children from specific participating institutions in the Jakarta and Bekasi regions. The relatively small and non-random sample limits the generalizability of the findings to other populations and institutional contexts.

Future research should include larger and more balanced samples across multiple institutions within each category. Longitudinal and intervention-based designs would provide stronger evidence regarding developmental trajectories and the potential effects of specific movement environments. Multivariable analyses incorporating age, sex, physical activity, movement opportunities, socioeconomic factors, and environmental characteristics would also help clarify the factors associated with gross motor competence.

4. Conclusion

This study identified significant differences in Gross Motor Quotient (GMQ) among children from four participating institutional settings. The Kruskal–Wallis analysis demonstrated a statistically significant overall difference with a large effect size, $H(3) = 51.35$, $p < .001$, $\epsilon^2 = .448$. Pairwise comparisons indicated significant differences between Elementary Schools and ECE, Orphanages, and Sports Clubs, as well as between ECE and Orphanages. In contrast, no statistically significant differences were observed between ECE and Sports Clubs or between Orphanages and Sports Clubs after Bonferroni adjustment.

The descriptive results showed the highest GMQ in the participating ECE group, followed by the Sports Club and Orphanage groups, whereas the Elementary School group demonstrated the lowest GMQ. However, the pattern of results does not support a simple conclusion that one type of institution is inherently superior to another. Instead, the findings suggest that gross motor competence varies across the specific institutional contexts included in the study.

Because this study used a cross-sectional observational design, the observed differences cannot be interpreted as evidence that institutional setting causes differences in gross motor development. Moreover, differences in age composition, unequal group sizes, and the unequal representation of participating institutions should be considered when interpreting the findings. In particular, the ECE, Orphanage, and Sports Club categories were each represented by a single participating institution, whereas the Elementary School category included children from multiple schools. Therefore, the results may reflect characteristics of the specific sampled environments in addition to broader institutional differences.

Overall, the findings support the view that children's gross motor competence may develop through multiple pathways and may be associated with the movement opportunities available within their everyday environments. Structured sports participation and developmentally appropriate play-based activities may both provide meaningful opportunities for motor skill development. Efforts to improve children's gross motor competence should therefore focus not only on institutional categories but also on increasing the frequency, diversity, and developmental appropriateness of movement experiences across educational, sporting, residential, family, and community settings.

Future studies should use larger and more balanced samples across multiple institutions and apply longitudinal or multivariable approaches to examine the contribution of age, sex, physical activity, environmental affordances, instructional practices, and other contextual factors. Such research would provide stronger evidence regarding the mechanisms underlying differences in gross motor competence and help inform targeted interventions to support fundamental movement skill development throughout childhood.

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References

- Barnett, L. M., Lai, S. K., Veldman, S. L. C., Hardy, L. L., Cliff, D. P., Morgan, P. J., Zask, A., Lubans, D. R., Shultz, S. P., Ridgers, N. D., Rush, E., Brown, H. L., & Okely, A. D. (2016). Correlates of Gross Motor Competence in Children and Adolescents: A Systematic Review and Meta-Analysis. In *Sports Medicine* (Vol. 46, Number 11, pp. 1663–1688). Springer International Publishing. <https://doi.org/10.1007/s40279-016-0495-z>
- Barnett, L. M., Webster, E. K., Hulteen, R. M., De Meester, A., Valentini, N. C., Lenoir, M., Pesce, C., Getchell, N., Lopes, V. P., Robinson, L. E., Brian, A., & Rodrigues, L. P. (2022). Through the Looking Glass: A Systematic Review of Longitudinal Evidence, Providing New Insight for Motor Competence and Health. In *Sports Medicine* (Vol. 52, Number 4, pp. 875–920).

Springer Science and Business Media Deutschland GmbH. <https://doi.org/10.1007/s40279-021-01516-8>

- Bourke, M., Wang, H. F. W., Wicks, H., Barnett, L. M., Cairney, J., & Fortnum, K. (2025). Children's and Adolescents' Actual Motor Competence, Perceived Physical Competence and Physical Activity: A Structural Equation Modelling Meta-Analysis. In *Sports Medicine* (Vol. 55, Number 8, pp. 1923–1936). Springer Science and Business Media Deutschland GmbH. <https://doi.org/10.1007/s40279-025-02233-2>
- Bull, F. C., Al-Ansari, S. S., Biddle, S., Borodulin, K., Buman, M. P., Cardon, G., Carty, C., Chaput, J. P., Chastin, S., Chou, R., Dempsey, P. C., Dipietro, L., Ekelund, U., Firth, J., Friedenreich, C. M., Garcia, L., Gichu, M., Jago, R., Katzmarzyk, P. T., ... Willumsen, J. F. (2020). World Health Organization 2020 guidelines on physical activity and sedentary behaviour. In *British Journal of Sports Medicine* (Vol. 54, Number 24, pp. 1451–1462). BMJ Publishing Group. <https://doi.org/10.1136/bjsports-2020-102955>
- Fathirezaie, Z., Abbaspour, K., Badicu, G., Sani, S. H. Z., & Nobari, H. (2021). The effect of environmental contexts on motor proficiency and social maturity of children: An ecological perspective. *Children*, 8(2). <https://doi.org/10.3390/children8020157>
- Guthold, R., Stevens, G. A., Riley, L. M., & Bull, F. C. (2020). Global trends in insufficient physical activity among adolescents: a pooled analysis of 298 population-based surveys with 1.6 million participants. *The Lancet Child and Adolescent Health*, 4(1), 23–35. [https://doi.org/10.1016/S2352-4642\(19\)30323-2](https://doi.org/10.1016/S2352-4642(19)30323-2)
- Hassan, M. A., Liu, W., McDonough, D. J., Su, X., & Gao, Z. (2022). Comparative Effectiveness of Physical Activity Intervention Programs on Motor Skills in Children and Adolescents: A Systematic Review and Network Meta-Analysis. In *International Journal of Environmental Research and Public Health* (Vol. 19, Number 19). MDPI. <https://doi.org/10.3390/ijerph191911914>
- Hill, P. J., McNarry, M. A., Mackintosh, K. A., Murray, M. A., Pesce, C., Valentini, N. C., Getchell, N., Tomporowski, P. D., Robinson, L. E., & Barnett, L. M. (2024). The Influence of Motor Competence on Broader Aspects of Health: A Systematic Review of the Longitudinal Associations Between Motor Competence and Cognitive and Social-Emotional Outcomes. In *Sports Medicine* (Vol. 54, Number 2, pp. 375–427). Springer Science and Business Media Deutschland GmbH. <https://doi.org/10.1007/s40279-023-01939-5>
- Jones, D., Innerd, A., Giles, E. L., & Azevedo, L. B. (2020). Association between fundamental motor skills and physical activity in the early years: A systematic review and meta-analysis. In *Journal of Sport and Health Science* (Vol. 9, Number 6, pp. 542–552). Elsevier B.V. <https://doi.org/10.1016/j.jshs.2020.03.001>
- Lloyd, R. S., Cronin, J. B., Faigenbaum, A. D., Gregory Haff, G., Howard, R., Kraemer, W. J., Micheli, L. J., Myer, G. D., & Oliver, J. L. (2016). OFFICIAL POSITION STAND OF THE NATIONAL STRENGTH AND CONDITIONING ASSOCIATION NATIONAL STRENGTH AND CONDITIONING ASSOCIATION POSITION STATEMENT ON LONG-TERM ATHLETIC DEVELOPMENT. In *Journal of Strength and Conditioning Research* Ó 2016 National Strength and Conditioning Association (Vol. 30, Number 6). www.nscs.com
- Logan, S. W., Kipling Webster, E., Getchell, N., Pfeiffer, K. A., & Robinson, L. E. (2015). Relationship Between Fundamental Motor Skill Competence and Physical Activity During Childhood and Adolescence: A Systematic Review. *Kinesiology Review*, 4(4), 416–426. <https://doi.org/10.1123/kr.2013-0012>
- Magill, R. A. ., & Anderson, David. (2024). Motor learning and control : concepts and applications. 604.
- Nurul Safitri Ramadhani, Arief Darmawan, & Gema Fitriady. (2024). Studi Kemampuan Motorik Kasar Siswa Sekolah Dasar Kelas I dan II di Daerah Pesisir Pantai, Perkotaan dan Dataran Tinggi Kabupaten Lombok Timur. *Jurnal Kejaora (Kesehatan Jasmani Dan Olah Raga)*, 9(2), 150–159. <https://doi.org/10.36526/kejaora.v9i2.3721>
- Pyle, A., & Danniels, E. (2017). A Continuum of Play-Based Learning: The Role of the Teacher in Play-Based Pedagogy and the Fear of Hijacking Play. *Early Education and Development*, 28(3), 274–289. <https://doi.org/10.1080/10409289.2016.1220771>
- Robinson, L. E., Stodden, D. F., Barnett, L. M., Lopes, V. P., Logan, S. W., Rodrigues, L. P., & D'Hondt, E. (2015). Motor Competence and its Effect on Positive Developmental Trajectories of Health. In *Sports Medicine* (Vol. 45, Number 9, pp. 1273–1284). Springer International Publishing. <https://doi.org/10.1007/s40279-015-0351-6>
- Roeber, B. J., Tober, C. L., Bolt, D. M., & Pollak, S. D. (2012). Gross motor development in children adopted from orphanage settings. *Developmental Medicine and Child Neurology*,

54(6), 527–531. <https://doi.org/10.1111/j.1469-8749.2012.04257.x>

Schmidt, R. A. ., Schmidt, R. A. /Lee, T. D. ., & Winstein, Carolee. (2018). Motor Control and Learning.
https://books.google.com/books/about/Motor_Control_and_Learning.html?hl=id&id=EvJ6DwAAQBAJ

Stodden, D. F., Langendorfer, S. J., Goodway, J. D., Roberton, M. A., Rudisill, M. E., Garcia, C., & Garcia, L. E. (2008). A developmental perspective on the role of motor skill competence in physical activity: An emergent relationship. *Quest*, 60(2), 290–306.
<https://doi.org/10.1080/00336297.2008.10483582>

Thelen, Esther., & Smith, L. B. . (1994). A dynamic systems approach to the development of cognition and action. 376.

True, L., Pfeiffer, K. A., Dowda, M., Williams, H. G., Brown, W. H., O'Neill, J. R., & Pate, R. R. (2017). Motor competence and characteristics within the preschool environment. *Journal of Science and Medicine in Sport*, 20(8), 751–755. <https://doi.org/10.1016/j.jsams.2016.11.019>

Ulrich. (2000). Test of Gross Motor Development 2nd.

Zosh, J. N. ., Hopkins, Emily., Jensen, Hanne., Liu, Claire., Neale, Dave., Hirsh-Pasek, Kathy., Solis, Lynneth., & Whitebread, David. (2017). Learning through play : a review of the evidence. LEGO Foundation.

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