

Characteristics of gross motor skills of elementary school students aged 7 and 8 years: a cross-sectional study

Características de las Habilidades Motoras Gruesas de Estudiantes de Primaria de 7 y 8 Años: Un Estudio Transversal

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Abstract. Adequate gross motor skills are believed to be a determinant in realizing optimal and quality physical activity. This research aims to reveal and describe the gross motor skills of students aged 7 and 8 years and reveal the differences. This research uses a cross-sectional approach. The Test of Gross Motor Development Second Edition (TGMD-2) was used as a data collection instrument. The research subjects were male and female elementary school students aged 7 and 8 selected purposively with details (N=140; boys =70 and girls =70). Data were analyzed using the IBM SPSS statistics program version 25. The results showed the average Gross Motor Quotients in general (M=83.39, SD=9.2), the average Gross Motor Quotients for the 7-year age group (M=84.91 SD= 7.8) and the 8-year age group (M=81.87 SD=10.2). Asymp Sig obtained the results of the (2-tailed) (0.200>0.05). The results of the independent samples test show a significant difference in the students' average Gross Motor Quotients (p-value <0.05), the 7-year-old group has superior competence compared to the 8-year-old group. Students' gross motor skills are generally below average; male students have superior skills than female students in both age groups, and students' locomotor skills competence is better than object control skills. It is necessary to optimize physical education learning in elementary schools to support increasing students' gross motor competence.

Keywords: gross motor skills; locomotor; object control; elementary school students

Resumen. Se cree que las habilidades motoras gruesas adecuadas son un determinante para lograr una actividad física óptima y de calidad. Esta investigación tiene como objetivo revelar y describir las habilidades motoras gruesas de estudiantes de 7 y 8 años y revelar las diferencias. Esta investigación utiliza un enfoque transversal. Se utilizó el Test de Desarrollo Motor Grueso Segunda Edición (TGMD-2) como instrumento de recolección de datos. Los sujetos de investigación fueron estudiantes de primaria, hombres y mujeres, de 7 y 8 años seleccionados intencionalmente con detalles (N=140; niños=70 y niñas=70). Los datos se analizaron utilizando el programa IBM SPSS Statistics versión 25. Los resultados mostraron los Cocientes de Habilidades Motoras Gruesas promedio en general (M=83.39, SD=9.2), los Cocientes de Habilidades Motoras Gruesas promedio para el grupo de edad de 7 años (M=84.91 SD=7.8) y el grupo de edad de 8 años (M=81.87 SD=10.2). Asymp Sig obtuvo los resultados de la prueba de Kolmogorov-Smirnov de una muestra. (2-tailed) (0.200>0.05). Los resultados de la prueba de muestras independientes muestran una diferencia significativa en los Cocientes de Habilidades Motoras Gruesas promedio de los estudiantes (p-valor <0.05); el grupo de 7 años tiene una competencia superior en comparación con el grupo de 8 años. Las habilidades motoras gruesas de los estudiantes están generalmente por debajo del promedio; los estudiantes varones tienen habilidades superiores a las estudiantes mujeres en ambos grupos de edad, y la competencia en habilidades locomotoras de los estudiantes es mejor que en habilidades de control de objetos. Es necesario optimizar el aprendizaje de la educación física en las escuelas primarias para apoyar el aumento de la competencia motora gruesa de los estudiantes.

Palabras clave: habilidades motoras gruesas; locomotors; control de objetos; estudiantes de primaria

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Introduction

Quality physical activity (PA) can influence children's well-being and health and holistic development that is relevant in various life domains (Johnstone et al., 2022; Pesce et al., 2021; Whitebread & Coltman, 2016; Clark & Whittall, 2021). It is generally known that PA has health benefits for all individuals, regardless of age, gender, ethnicity, or sports background (Orhan, 2021). Regular PA reduces the risk of chronic diseases, regulates blood pressure, and enhances mental development and motivation (Orhan, Karadağ, et al., 2024). However, irregular PA can cause chronic diseases and even risk premature death (Priadana et al., 2021; Orhan et al., 2024). Practicing being physically active by implementing optimal PA-recommended patterns since the early years of elementary school allows students to stay active and is believed to be a relevant habit throughout

their lives (Aira et al., 2021; Corder et al., 2019; Lounasalo et al., 2019).

Quality PA is essential for stimulating children's growth and development, as it is based on the adequate mastery of fundamental movement skills (Goodway et al., 2019). Physical and cognitive skills development during early childhood forms a critical foundation for future health and academic success (Orhan, 2021). Movement education, which involves structured physical activities designed to enhance various motor and cognitive abilities, plays a significant role in this developmental stage (Orhan, Karaçam, et al., 2024). Early childhood through elementary school is a particularly effective period for promoting basic motor skills (Brian et al., 2020), so that they will willingly conduct continuous PA and influence future recommended PA habits (Goldfield et al., 2012). Physical activities can be designed as dynamic, innovative, and effective

games that are the ideal setting to stimulate students' motor skills (Gutiérrez, 2022).

Motor skills or fundamental motor skills are the basic foundation of skills that will form the basis of all human movement patterns (Pangrazi & Beighle, 2019), as well as fundamental abilities that enable individuals to perform various physical tasks efficiently with structured and correct movements (Logan et al., 2018; van der Fels et al., 2015). Ideally, motor skills should be developed before the start of the rapid growth phase in adolescence, because the most sensitive period for starting motor skill development is at primary school age (Berk, 2007; Clark & Metcalfe, 2002). Moreover, students must be free to explore the environment actively through physical activities to conquer better physical experience and motor skills (Komaini et al., 2023).

The importance of developing gross motor skills has been pursued by child growth and development experts, researchers and policymakers worldwide and has been outlined in the physical education curriculum in elementary schools (U.S Department HHS, 2018). However, the level of motor competence in children and adolescents in most countries worldwide is still low (Chaput et al., 2020; Flynn et al., 2023). Relevant study results were also found in Indonesia which revealed that the average Gross Motor Quotient of early childhood and elementary school students was in the low category (Oktarifaldi et al., 2024; Marta et al., 2023; Hasan et al., 2013). Elementary school students' gross motor skills should be good and adequate (Goodway et al., 2019).

Low and inadequate gross motor competence is a barrier to learning specific motor skills, including sports, and will decline with age if structured guidance and intervention are not provided (Oktarifaldi, Nopembri, Yudanto & Bin Shahril, 2024). A high and adequate level of motor competence is the main capital needed to develop specific skills and additional transition skills to acquire more complex sports skills (Brian et al., 2020). Pang and Fong (2009) explained that while children naturally age, the effective development of gross motor skills requires dedicated instruction and training. Additionally, motor competence must be integrated with other movement patterns within structured physical activities. Research findings indicate that gross motor competence develops most effectively when taught systematically between the ages of 3 and 10 years (Lin & Yang, 2015). Although influenced by the maturation process, gross motor skills should ideally be taught in a systematic motor skills program when students are in the elementary school phase (Goodway & Branta, 2003; Valentini & Rudisill, 2004; Koolwijk et al., 2023).

The need for breakthroughs to improve motor competence can be achieved by facilitating children in exploring movement tasks to improve motor development. Regular and continuous PA in physical education classes is recommended and believed to improve body organs' function, fitness, and psychomotor skills (Nopembri & Sugiyama, 2021). Technical guidance is needed, either in the form of an application or in the form of a learning/exercise manual,

which is believed to be effective in increasing the average motoric growth and development of elementary school students (Kurnaz & Yilmaz, 2023; Oktarifaldi, Nopembri, Yudanto, Bin Shahril, et al., 2024).

It is known that elementary schools facilitate students with access to all children attending school to develop FMS economically through structured physical education and sports subjects (Lander et al., 2017). Elementary school and physical education learning has been believed to be one of the most influential factors in realizing and aims to improve children's motor competence and other essential skills (Jarvis et al., 2022; Gonzalez-Huenulef et al., 2023). To develop gross motor skills, students need to optimize physical education to make learning meaningful.

Motor competency results from a development process through students' active participation in physical activities in the learning process and outside of learning (Rodrigues et al., 2015). Gross motor skills are supported by gross motor coordination skills, such as using large muscles, maintaining balance, and interacting with objects. These skills are the main predictors supporting the realization of specific motor competencies, including in certain physical activities and sports (Loprinzi et al., 2015; Cattuzzo et al., 2016).

Recent studies reveal that it is essential to know the early development and motor skills of students as sources to prepare the proper activities to increase students' motor skills and to predict their physical participation in the future (Dong et al., 2024; Gonzalez-Huenulef et al., 2023). Inadequate motor skills in children reduce PA and movement opportunities and increase the risk of diseases associated with sedentary behaviour (Stodden et al., 2008). Untreated motor development difficulties can continue into adolescence and adulthood, causing long-term physical, psychological and behavioural problems (Davidovitch et al., 2015). However, if a child has suitable and adequate motor competence, it is believed that it will be easy for him to conduct physical activities and specific skills in sports (Hulteen et al., 2018).

The importance of gross motor skills for students from an early age is our main reason for conducting this research; the next aim is to look at the development of children's motor skills in the 7- and 8-year age groups. The theoretical explanation and explanation of the research results provide a concrete framework and the strength of this research. By revealing authentic and factual data in this research, interested parties can use these findings as a basis for adopting policies and considerations for future steps to solve this problem. This study can be used as an initial reference for teachers, parents, research lecturers and policymakers to analyze gaps and factual conditions in West Sumatra Province, Indonesia.

Method

This research's subjects and population are elementary school students in grades 1, 2, and 3, aged 7- and 8-years in West Sumatra. A total of six state schools in two cities and

two districts in West Sumatra Province participated in this research. The sample was taken purposively with 140 students; the 7-year age group consisted of 70 students (35 boys and 35 girls), and the 8-year age group consisted of 70 students (35 boys and 35 girls). The purposive sampling technique is a non-random technique, also called judgment sampling. With deliberate selection, the researcher decides what is needed and tries to find participants who are able and willing based on their needs (Bernard, 2017).

Before collecting data, researchers and the team had to conduct a data collection simulation by training the team using the TGMD-2 instrument which would be applied in the field. Next, the researcher communicated and observed with the school and applied for permission first, after obtaining permission and approval from the school principal, parents and physical education teacher Number: 020/YSO/V/2023 and Number: 019/YSO/III/2023. After that, our data collection process was conducted.

This research is a type of descriptive research with a cross-sectional study approach design, namely a type of observational study design that involves and looks at data from a population at a certain point in time (Wang & Cheng, 2020). This research focuses on students' gross motor skills. The Test of Gross Motor Development Second Edition (TGMD-2) instrument was used as a data collector (Barnett et al., 2016) explained that to measure children's gross motor competence, which is oriented towards relevant processes. This TGMD-2 instrument is reliable for children

aged 3 to 10 years. This instrument consists of twelve sub-skills, which are divided into two subscales: (1) locomotor skills (run, gallop, leap, hop, slide, jump) and (2) object control skills (strike, catch, dribble, throw, under roll, kick) (Ulrich, 2000). Data analysis in this research used descriptive methods, maximum and minimum scores, using averages and standard deviations (Qomusuddin & Romlah, 2021). After testing the normality of the data, an independent samples test was operated to see the difference in average Gross Motor Quotients between the 7- and 8-year age groups. The student's age is recorded (date, month and year of birth), which will later be used to convert it into norms and describe the student's score rating in the TGMD-2 manual guidelines. All data were analyzed using the IBM SPSS Statistics version 25 program.

Results and discussion

Research result

The results of measurements on 140 students in the 7- and 8-year age group, it was found that students' overall gross motor skills were in the below average category with a Gross Motor Quotients of 83.39 and a standard deviation of 9.2. Male students outperform female students in the 7- and 8-year age groups. For more details, see table 1, a summary of the gross motor quotient data obtained.

Table 1.
General description of Gross Motor Skills for the 7- and 8-year-old age group

Group	N	Fundamental Motor Skills					Ratings
		Max	Min	Average	Std		
Global	General	140	109	55	83.39	9.2	Below Average
	Male	70	109	55	85.17	9	Below Average
	Female	70	109	64	81.60	9	Below Average
7 years	General	70	106	67	84.91	7.8	Below Average
	Male	35	106	73	86.88	7.52	Below Average
	Female	35	103	67	82.94	7.72	Below Average
8 years	General	70	109	55	81.87	10.21	Below Average
	Male	35	109	55	83.45	10.11	Below Average
	Female	35	109	64	80.28	10.19	Below Average

*GMQ average rating scale obtained by students, source: Ulrich (2000).

In converting raw data into a scale, seven categories are converted into descriptive ratings achieved by students. The ratings are (very superior, superior, above average, average, below average, low and very low). According to table

2, the gross motor quotient in each age group shows superiority for male students and the 7-year age group. This can be seen in table 2 below.

Table 2.
Gross Motor Quotient Gross Motor Skills 7 and 8 years-old

GROSS MOTORCYCLE QUOTIENT	7 years-old			8 years-old			DESCRIPTIVE RATINGS
	General	Male	Female	General	Male	Female	
> 130	0	0	0	0	0	0	Very Superior
121 - 130	0	0	0	0	0	0	Superior
111 - 120	0	0	0	0	0	0	Above Average
90 - 110	20	13	7	14	9	5	Average
80 - 89	30	15	15	26	12	14	Below Average
70 - 79	19	7	12	24	13	11	Low
< 70	1	0	1	6	1	5	Very Low

*GMQ age group rating scale obtained by students, source: Ulrich (2000)

In both age groups 7- and 8-years, male students have the same locomotor skills, as female students. In object control skills, male students in the 7-year age group were superior to those in the 8-year age group, as were female students. For more details, see table 3 below.

Table 3. Average locomotor skills and object control for 7- and 8-year-old groups

Group	N	Gender	Sub Skills	Standard Score	Descriptive Ratings
7 years	70	Male	Locomotor	9.54	Average
			Object Control	6.09	Below Average
		Female	Locomotor	8.49	Average
			Object Control	5.83	Low
8 years	70	Male	Locomotor	9.46	Average
			Object Control	5.03	Low
		Female	Locomotor	8.17	Average
			Object Control	5.26	Low

Only 1 student is in the superior category for locomotor skills in the 7-year age group, then 4 students are in the above average category, the rest are in the average category, below average to low category. In the 8-year age group, there were 5 students in the above average category, 49 students were in the average category, below average category, low to very low category. For more details, see histogram one below.

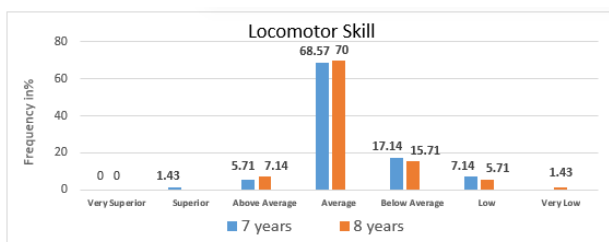


Figure 1. Histogram describing the comparison of average locomotor skills aged 7 and 8 years

For the object control skills of the 7-year age group, it was found that nine students were in the average category, thirty-four students were below average, the rest were in the low category and the extremely low category. For the 8-year age group, it was found that seven students were in the average category, twenty-three students were in the below average category, the rest were in the low category and extremely low category. For more details, see histogram two below.

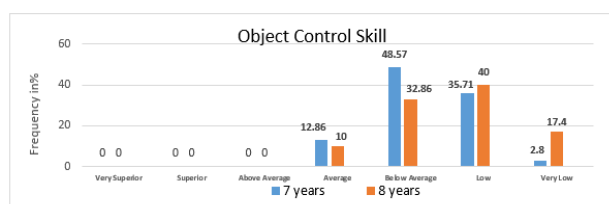


Figure 2. Histogram description of the average comparison of object control skills aged 7 and 8 years.

To see the difference in average competencies between student age groups, data normality testing was conducted before the researchers conducted an independent samples

test which aimed to see the average difference in students' gross motor skills between the 7- and 8-year age groups. The Kolmogorov-Smirnov test was conducted on age groups, the 7-year age group found sig. ($0.200 > 0.05$), it can be concluded that the data for both age groups is normally distributed. Next, the Independent Samples Test mean difference test was used to see the differences between the 7- and 8-year age groups, the test results showed (p value < 0.05). This can be interpreted as meaning that there is a significant difference in the average gross motor skills between the 7- and 8-year age group for students in elementary school.

Discussion

The research results revealed that students' gross motor competence was below average, and the skills of male students were superior to those of female students. This condition is undoubtedly quite worrying; according to Goodway, when students are at elementary school age, their gross motor skills should be approaching a perfect level or already perfect (Goodway et al., 2019). However, these findings reveal that students' gross motor competence must still be appropriate for their age. Another study proves that higher motor skills positively affect students' psychosocial skills. Students with lower motor skills have more significant anxiety than those with higher motor skills in performing physical activities (Luis-De Cos et al., 2019).

Students' low motor competency is believed to be influenced by numerous factors. Bolger et al, (2021) and Marini and Komaini (2021) noted that social and environmental factors, such as the influence of family, peers, teachers, and the physical environment, are dominant predictors affecting students' PA levels and motor competency. Rodrigues et al, (2015) explained that children aged 6 to 9 often experience delays in fundamental movement skills compared to expected developmental milestones. This delay is attributed to their limited participation in various physical activities and games due to inadequate motor competence.

These findings are relevant to most studies in various countries, revealing that many elementary school-age children have low gross motor competence and inadequate gross motor skills (Brian et al., 2023; Nobre et al., 2018; Rodrigues et al., 2015). This research reveals that the average gross motor skills of students in the 7-year age group are superior to those in the 8-year age group. These findings confirm that the development of gross motor competence differs from the increasing age of students. These findings also reveal that the locomotor skills of male and female students in the 7- and 8-year age groups are in the average and above-average categories. However, the object control (manipulative) sub-skill for men and women is only in the average category, and there are still many in the below-average and low categories.

Programmed interventions need to be conducted to improve students' motor competence. Research reveals

that children active in sports games with balls are positively related to object control and locomotor quality. In contrast, students who are active in individual sports are predictors of improving locomotor (Wälti et al., 2023). According to Goodway and the team, locomotor movements and object control develop through a "level" process or can be interpreted as stages of development. Teachers are the main actors in improving children's gross motor skills. Adequate understanding of gross motor development stages will make it easier for teachers to teach gross motor skills optimally (Goodway et al., 2019). Thus, teachers must have adequate knowledge, skills and proficiency in practising FMS in learning (Barratt et al., 2024).

Physical education is a subject that focuses on developing physical movement skills and concepts that are useful for students for education and in their daily lives (Lynch, 2019), as well as having an impact on the motor development of children and adolescents along with the areas most relevant for building social development and individual psycho-evolution (Backman & Barker, 2020). Furthermore, physical education also has the potential to acquire gross motor skills and play a role in building an adequate foundation for sports skills (Romero-Martínez et al., 2024). The role of physical education teachers is to encourage and facilitate students' needs in exploring school-based and extracurricular PA and sports experiences (Zalech, 2021; García-Marín & Fernández-López, 2020). More physical activities and exercises through physical education are beneficial to increase motor skills and to prevent the negative side of a sedentary lifestyle that can cause obesity for students (Rodríguez-Canales et al., 2022).

Intervention programs have been proven to enhance gross motor skills in physical education. The extracurricular practice of physical education for 2 hours a week works effectively for the better motor skill level (García-Marín & Fernández-López, 2020). Bardid proved that the intervention conducted at the "Multimove for Kids" school, attended by children aged 3-8 years, effectively improved children's motor competence (Bardid et al., 2017). Bryce revealed that the realization of 60 minutes of motor intervention every week in the Healthy and Physically Active Schools (HEPAS) program significantly increased children's motor competence optimally (Bryce, 2021). Students' gross motor competence is obtained through variations and combinations of active games and structured and adequate training programs by teachers/trainers who are deliberately taught (Engel et al., 2018).

The low motor competence of students must be kept from the teacher's role in the learning process. Students' acquisition of motor competency depends on whether physical education teachers provide quality learning and implementation programs to their students (NASPE, 2014). Thus, it is necessary to provide training and assistance to physical education teachers in developing their knowledge and skills to teach students basic motor skills correctly and meaningfully (Oktarifaldi et al., 2021). Physical education teachers need to master the material and practice a certain

level of motor competency to be taught efficiently to students (Francesco et al., 2019; Lopes et al., 2021).

As the primary facilitator of learning, equipping physical education teachers with FMS skills and knowledge is an effort to improve students' motor skills (Eddy et al., 2021). Optimizing the physical education process through qualified teachers to realize motor learning in schools is an effective solution. More than one method and approach may be used in the same lesson depending on the objectives and the content that students will learn in physical education (Metzler, 2011). By continuing to see low to moderate levels of FMS competence in children with potential deficits, teachers must encourage and guide them to remain involved in continuous PA so that children's motor competence can also be improved (Jarvis et al., 2022).

Many researchers reveal that a suitable and effective model teachers implement in the learning process is a more game-based approach (Cocca et al., 2020). Physical education activities through games directly improve students' gross motor skills in physical education learning (Komaini, 2017). Coordination abilities need to be recommended to physical education teachers for application in learning programs because motor coordination has been proven to predict the realization of gross motor skills in elementary school students (Marta et al., 2023). Coordinated movement patterns are the basis for effective motor skill implementation and are the core of basic motor skills, such as locomotor skills, object control skills, and stability skills (Coppens et al., 2021; Novak et al., 2017).

It is understood that the low gross motor competence of elementary school students in West Sumatra, Indonesia, needs to be seriously addressed. Optimizing the physical education learning process, both curricular and extracurricular, is a solution that has the potential to make this happen. This can be realized effectively by increasing the competence of physical education teachers with good knowledge and mastery of motor skills material and skills in implementing pedagogical skills (Tsangaridou et al., 2023). Training and mentoring are the right solution to equip physical education teachers to improve their competence. Furthermore, the significant improvement of students' motor skills through physical education can be realized if the following aspects are well-implemented such as curriculum development, sustainable training for teachers, government support, integration of modern technology, implementation of proper policies and strategies, and the active parent involvement (Sumarjono et al., 2024).

This research has revealed the factual conditions in elementary schools in West Sumatra, Indonesia. The findings of this research prove the low motor competence of students in elementary schools. Apart from that, this research has limitations regarding the approach and the small sample size. It is hoped that future researchers can conduct more in-depth research with a larger sample using experiments, interventions, or producing a relevant reference product so that teachers can improve students' motor

competence in physical education learning in elementary schools. Furthermore, it is necessary to involve all related parties in carefully and systematically preparing physical education learning materials in elementary schools so that gaps that occur can be minimized and students' gross motor skills can be improved.

Conclusion

Based on the research results, it is necessary to conduct structured interventions and optimize them in physical education learning in schools to improve students' motor competence. It is recommended that physical education teachers develop systematic and effective learning programs and provide additional opportunities for students to engage in free PA in the school environment. Improving motor coordination is also recommended so that students have a good movement foundation to support motor competence. It is recommended that future researchers conduct in-depth research in the form of interventions, models or experiments that can reveal and produce practical approaches to improve the motor skills of students in Indonesia.

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