Gross Motor Skills of Students with Autism Spectrum Disorder Aged 6-10 Years And Typically Developing Children on TGMD-2

Ezra Pratama[1], Rama Kurniawan[2], Laras Putri Gamagitta[3]

[1,2,3] Faculty of Sports Science, Malang State University, Indonesia

email: rama.kurniawan.fik@um.ac.id

Abstract

Gross motor skill (GMS) development is crucial for children with autism to increase independence in daily activities, physical fitness, and self-confidence. This study aims to quantitatively analyze the physical features based on GMS of autism spectrum disorder students aged 6-10. The method utilized in this study was a survey with a quantitative descriptive approach. The sampling technique is determined using purposive sampling based on specific considerations in the population. In this study, the total participants are 57 students, consisting of 14 students from SLB Autis Laboratorium UM and 43 from SDN 2 Sumbersari as supporting data. The test instrument operated in this study is the Test of Gross Motor Development-2 (TGMD-2), which assesses the gross motor skills of children aged 3-10 years in locomotor aspects and control objects. The research results on the physical features analysis of gross motor skills aged 6-10 years of autistic students at the SLB Autis Laboratorium UM obtained an inferior category. It impacts student development in daily activities, and consequently, teachers need to rearrange the design of learning programs for autistic students to improve gross motor skills. The teachers should evaluate the effectiveness of programs and interventions that have been implemented.

Keywords: Gross Motor Skill, Students Autism, Test of Gross Motor Development-2

INTRODUCTION

Education is a human right, including persons with disabilities, as stipulated in Article 10 of the Law on Persons with Disabilities number 8 of 2016. These laws guarantee the right of persons with disabilities to obtain quality education and proper concession. Based on this regulation, it is consequential to improve the quality of services for people with disabilities. Analyzing physical features is a crucial first step to improving the quality of services for people with disabilities to identify the limitations of their abilities. In addition, measuring physical features is beneficial as a reference in designing appropriate learning programs and evaluating the effectiveness of programs and interventions applied to persons with disabilities. Delayed development of gross motor skills (GMS) is a significant problem faced by people with disabilities. Most have delays in cognitive, psychomotor,

behavioral language, communication, and social interaction aspects of autism (Purnamasari et al., 2023; Siswantoyo & Oktavia, 2018; Veldman et al., 2020).

Children with Autism Spectrum Disorder (ASD) have varying conditions of gross motor skills but are generally characterized by delays in development, poor coordination, and difficulty in performing gross motor movements. According to Nababan et al. (2019), children with autism repeatedly experience problems in their motor development, such as decreased sensory sensitivity, lack of control over balance, stiffness when anticipating disturbances, lack of control over speed and strength, and difficulty regulating body movements properly. A similar study conducted by Bedford et al. (2016) stated that most autistic children have difficulty moving due to impaired sensory sensitivity, which results in them tending to be unable to perform various play activities that require good coordination and gross motor skills. Late handling of motor disorders will cause difficulty in being independent and will always depend on others (Nofianti, 2020).

The development of gross motor skills measures children's growth and development in self-help, social assistance, play, and school skills (Djuanda & Adipura, 2020). Therefore, gross motor skill development must be trained to provide various benefits for children with autism spectrum disorder, such as increased independence, physical fitness, and self-confidence. It can help autistic children in carrying out daily activities. In addition, the development of gross motor skills can support and improve the ability of autistic children to interact with the surrounding environment and their peers (Aulia & Kartiko, 2017).

In the development of Autism Spectrum Disorder (ASD) children, each child certainly has dissimilar motor abilities, such as slow, medium, and fast. The level of development of children's motor skills is affected quickly or slowly by several factors, such as the environment, movement experience, and learning facilities, which impact learning outcomes (Setiawan et al., 2020). Gross motor skills services are essential for children aged 6-10 years, where the development of gross motor skills is clearly seen. At this age, children actively explore activities in the surrounding environment, such as running, climbing, walking, jumping, and throwing (Mahfud & Yuliandra, 2020). However, the services provided to children with autism cannot be generalized due to the varying in each child's development.

The services provided should be adjusted to their abilities and needs. This service is a challenge for teachers to provide service programs that follow the characteristics of each student (Kurniawan, 2018). Appropriate services are crucial to optimizing the development of children with ASD. Therefore, to get appropriate services, it is necessary to measure the gross motor skills of autistic children first. The measurement of the motor skills of autistic children can support them in achieving the full potential of their abilities (Grant & Nozyce, 2013; Irvan, 2020).

These measurements aim to identify skill development, provide appropriate learning, and evaluate the effectiveness of programs and interventions that have been implemented. Adaptive physical education teachers also require this measurement to measure students' gross motor skills. Measurement of affective aspects in autistic children can be noticed from interest in learning, courage to try, and the ability to move independently. Cognitive aspects can be measured through the Wechsler Intelligence Scale for Children (WISC) test, which measures the intelligence of autistic children. This test consists of verbal and performance assessments that cover various aspects such as vocabulary, comprehension, associative thinking skills, and practical skills in daily activities. As for implementing the psychomotor aspect, there are barriers to measuring the gross motor skills of children with autism.

The obstacles in the psychomotor aspect for children with autism are in the memory system, especially prospective memory, which is an obstacle in measuring gross motor skills. In line with this statement, it impacts tasks that require a lot of cognitive concentration, such as complex procedural tasks. This problem causes children with disabilities accompanied by low prospective memory ability to need an exceptional approach to measuring skills. In addition to deliberate cognitive and psychomotor development, instruments for autistic children are still minimal. Therefore, it is important to design simple gross motor skill measurement tasks so that autistic children with low prospective memory ability can accomplish them (Battah et al., 2023; Manalu & Suparmi, 2023; Ramadhani et al., 2016; Rasam et al., 2019; Sheppard et al., 2018).

The measurement of gross motor skills, according to several studies using the TGMD-2 instrument in autistic children aged 3-10 years, compares different locomotor results and control objects. Gross motor measurements with the TGMD-2 instrument were carried out on a population of autistic children with characteristics aged 6-10 years, which

showed significant delays in gross motor skills. Gross motor measurements were carried out on autistic children with age characteristics of 8-10 years, which showed that motor skills were better along with the level of autistic disorder. Based on several research results using the TGMD-2 instrument in autistic children aged 3-10 years, differences were observed in locomotor and object control skills, while in children aged 6-10 years, locomotor control with the TGMD-2 instrument shows a significant increase in locomotor performance and better object control.

The measurement of gross motor skills using the TGMD-2 instrument in autistic children in Indonesia is still limited. So far, the measurement of gross motor skills of autistic children is restrained to direct observation of daily activities and interviews with parents. Therefore, this research aims to analyze the physical features of autistic students in Indonesia using TGMD-2 (Kruger et al., 2019; Liu et al., 2014; Zikl et al., 2013). These research results can provide valuable information to physical education teachers about the gross motor skill status of autistic students. This information will assist in designing learning programs that address their needs, improving their gross motor skills, and evaluating the effectiveness of existing programs and interventions.

METHOD

This research is a non-experiment design that uses a quantitative descriptive approach with a survey method. The quantitative descriptive approach describes specific characteristics or phenomena by collecting and analyzing numerical data. The subjects in this study were students with autism spectrum disorders aged 6-10 years. Meanwhile, the variable is the level of gross motor skills of students of the SLB Autis Laboratorium UM inclusion school and SDN 2 Sumbersari (regular schools) in the identical area as a comparison.

The population of the research subject is 62 students. The sample in this study was determined using the purposive sampling technique, with the concept of taking and determining the sample chosen based on specific considerations. The consideration to determine the subjects to be sampled in this study is based on (1) inclusive schools with specifications for autistic students; (2) regular schools with students who develop without barriers as a comparison that are still in the identical area as inclusive schools; (3) grade levels I-III with an age range of 6-10 years; (4) Autistic students used in this study are at level 1 or mild. Based on the consideration, the sample is 57 students, as seen in Table 1.

**Table 1** Data After Determined Using Purposive Sampling

Description	ASD Total		Non-ASD Total	
Gender	**F**	**%**	**F**	**%**
Male	12	85.7%	26	60.5%
Female	2	14.3%	17	39.5%
	14	100%	43	100%
Age	F	%	F	%
10	2	14.3%	7	16.3%
9	4	28.6%	17	39.5%
8	2	14.3%	12	27.9%
7	6	42.8%	7	16.3%
6	0	0%	0	0%
	14	100%	43	100%

The most psychometrically appropriate measurement of gross motor skills in children with disabilities aged 6-10 years is the Test of Gross Motor Development-2 (TGMD-2) instrument. The test aims to measure the locomotor abilities and control objects of children aged 3-10 years which include (1) run, (2) gallop, (3) hop, (4) leap, (5) horizontal jump, (6) slide; (7) striking a stationary ball; (8) stationary dribble; (9) catch; (10) kick; (11) overhand throw; (12) underhand roll. The TGMD-2 has a validity level of 0.95, a reliability of 0.91 for the locomotor test, a validity of 0.96, and a reliability of 0.88 for the control object test. In the validity of the application of TGMD-2 with children aged 7-10 years, it has significant validity with the results of t count 2.27> t table 1.65, and this instrument has a relatively high level of reliability with a degree of correlation coefficient worth 0.765. Therefore, the TGMD-2 is one of the instruments with high validity and reliability so that the instrument can be applied to children with autism (Apriyani et al., 2018; Ulrich, 2000)

The TGMD-2 instrument has a total of 48 assessment criteria on aspects of locomotor skills and control objects. Data collection in this study was obtained by applying TGMD-2 to students aged 6-10 years at SLB Autis Laboratorium UM. The period for data collection was 2 weeks in the second to third week of May 2024. The technique used to analyze data in research is descriptive quantitative. Before conducting the analysis, the test data was converted into the TGMD-2 norm, after which data tabulation was carried out to analyze the data in the form of diagrams, percentages, and descriptive, then conclude the data and report the results.
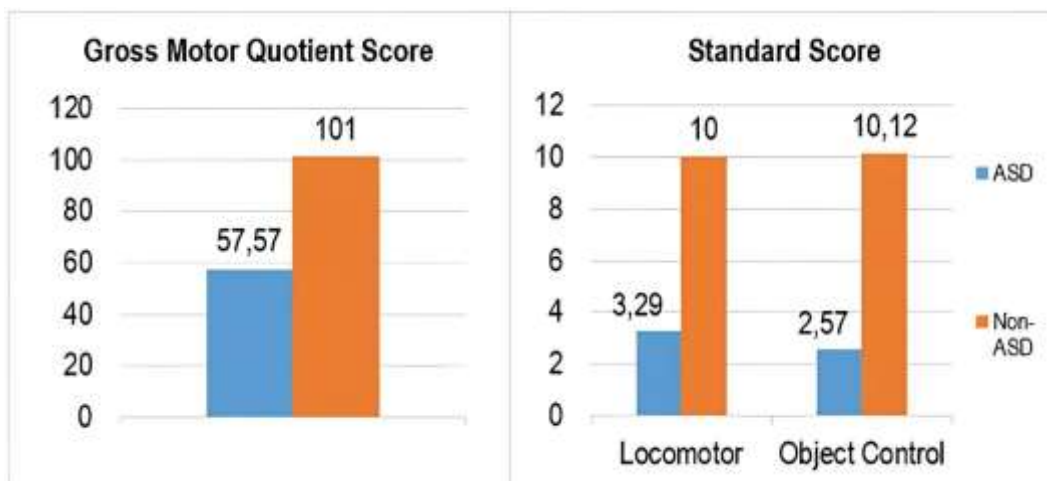
RESULT

This study aims to quantitatively analyze the gross motor skills of students with autism spectrum disorder aged 6-10 years at SLB Autis Laboratorium UM. Specifically, it will examine the extent to which students' gross motor skills level is based on the specific criteria. Table 1 presents the results of student's gross motor skills diagrams, percentages, and descriptive statistics (Sasminto & Teguh Hari Wiguno, 2024).
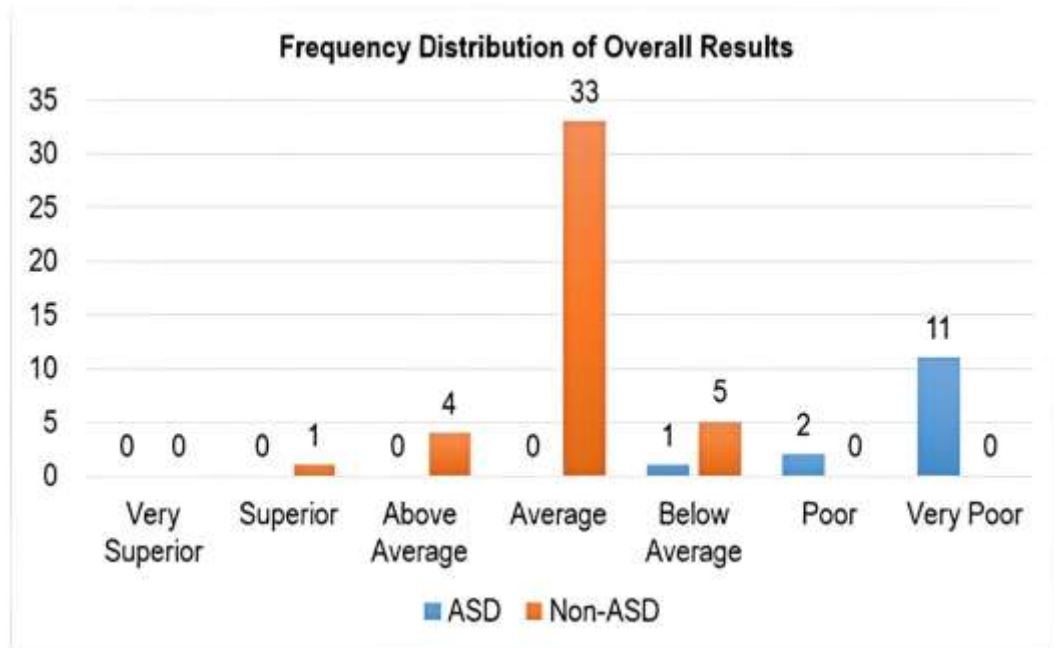

Figure 1 Frequency Distribution Diagram of Overall TGMD-2 Result

Based on Figure 1, the data analysis of gross motor skills shows a significant difference between students with Autism Spectrum Disorder (ASD) and non-ASD. Students with ASD show the highest frequency in the very poor criteria, with a total of 11 students. For the below-average criteria, there is 1 student, and for the very poor criteria, there are 2 students. No students obtained perfect, good, above average, and average criteria. In contrast, non-ASD students showed the highest frequency in the average criteria, with 33 students. For the good criteria, there was 1 student, and for the 'above average' criteria, there were 4 students. Additionally, 5 students were in the below-average criteria. No students fell into the very superior, poor, or very poor categories.

Figure 2 Diagram of Gross Motor Quotient Score Result and Standard Score of SLB Autis Laboratorium UM and SDN Sumbersari 2

Based on Figure 2, the analysis of gross motor skills data using the gross motor quotient score shows that the average score obtained by ASD students is 57.57. Meanwhile, non-ASD students get an average score of 101. Based on the gross motor skills analysis data for the locomotor subtest, the average score for ASD students is 3.29, while the average score for non-ASD students is 10. In the standard score of the control object subtest, the average value obtained by ASD students is 2.57. In comparison, the acquisition of the average value obtained by non-ASD students is 10.12.
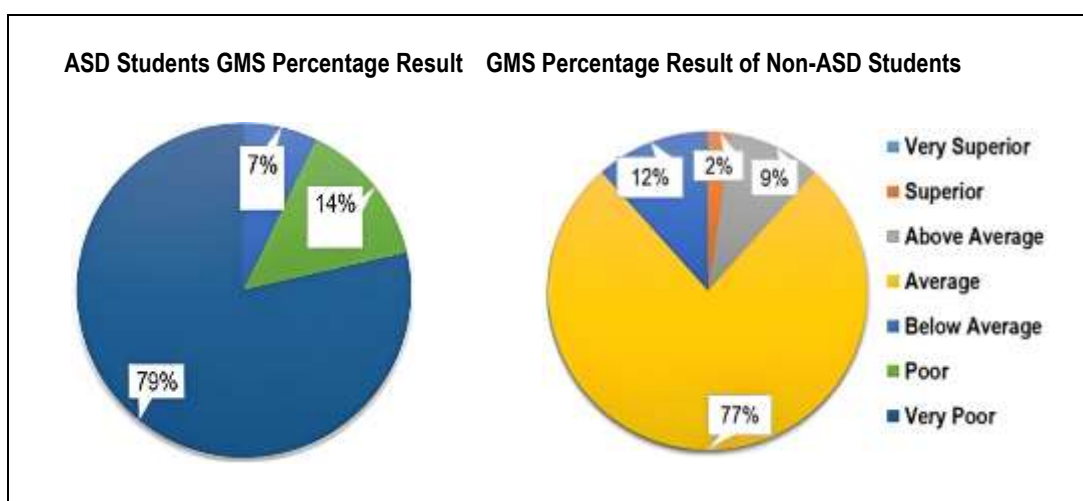
Figure 3 Diagram of Percentage Result of Gross Motor Skill Students of SLB Autis Laboratorium UM and SDN 2 Sumbersari

Based on the GMS diagram for ASD students below, the data analysis reveals that the highest percentage of gross motor skill levels among SLB Autis Laboratorium UM students falls into the very poor criteria, with a percentage of 79%. The less criteria have a percentage of 14%, and the criteria below the average have a percentage of 7%. No students fall into the very good, good, above average, or average criteria. Meanwhile, based on the diagram of non-ASD students, the results of data analysis of the overall gross motor skill level show that the highest percentage is in the average criteria with a percentage of 77%. The good criteria have a percentage of 2%, and the above-average criteria have a percentage of 9%. There are criteria below average with a percentage of 12%. No students get very good, less, or very low criteria. Based on the results of the overall analysis show that the level of gross motor skills of students with autism spectrum disorder is in the very poor category.

DISCUSSION

In this study, researchers measured gross motor skills in autistic students at SLB Autis Laboratorium UM and compared them to students without developmental obstacles at SDN 2 Sumbersari as supporting data. This measurement is carried out by considering the characteristics of the identical regional scope and the age range of 6-10 years. Children aged 6-10 years are in the transition period between the specialized and more complex motion stage, affecting gross motor skills (Ardi & Purwanto, 2020). Based on the analysis of the gross motor quotient score diagram and the standard score of ASD students at the SLB Autis Laboratorium UM, it shows the highest percentage by obtaining criteria in locomotors and control objects is very lacking, so the development of gross motor skills of ASD students aged 6-10 years is delayed. Liu et al. (2014) state that the performance of autistic children in locomotor development and object control is very poor. The motor abilities of autistic children are influenced by the condition of lagging mental development, which is caused by disorders of the central nervous system.

Kruger et al. (2019) stated that there is a correlation between lifestyle and the level of ASD; the delay in the development of gross motor skills increases along with the severity of ASD. Conversely, based on the gross motor quotient results and standard scores analysis, non-ASD students generally show much better gross motor skills in locomotor subtests and object control, achieving average criteria. This score indicates that the development of gross motor skills in students aged 6-10 years at SDN 2 Sumbersari is

progressing without obstacles. These results are to the findings of Sasminto & Teguh Hari Wiguno (2024), who stated that the level of gross motor skills of lower grade students aged 7-9 years at SDN in the Klojen District of Malang City as a whole achieved average category. Similar to this research, Yusdianto & Teguh Hari Wiguno (2024) stated that the level of gross motor skills of low-grade students at SDN in Wagir Sub-district, Malang City, was in the normal category.

The gross motor skill development condition of ASD students aged 6-10 years is concluded in adequate criteria due to the analysis results based on the gross motor skill percentage diagram, which shows the most significant gain is in the very poor category. These results are still far below the average when referring to the standards set by the TGMD-2 guidebook (Ulrich, 2000). Non-ASD children aged 6-10 years, in the development of gross motor skills, have mastered more complex and coordinated movements, such as kicking the ball with the instep, dribbling the ball in place, and throwing the ball to hit the target. It is relatively good, as evidenced by the analysis results based on the gross motor skill percentage diagram, which shows the most significant achievement is in the average category. It can be noticed in the development of gross motor skill levels between ASD and non-ASD students, resulting in different developments (Timansah & Nurhadiyati, 2023).

The differences in gross motor skills are caused by several factors, such as the development of the nervous system, physical conditions, strong motivation, and a pleasant environment (Asfinolia & Jafar, 2023). Students who usually develop have more opportunities to learn gross motor skills through structured physical activities at school and a supportive play environment. On the other hand, ASD students require a specialized and focused approach to build their gross motor skills (Abu Hanifah & Oktadinata, 2020; Kurniawan, Heynoek, & Wijaya, 2022).

In the early years of schooling, gross motor skills are essential in influencing children's movement skills. It indirectly affects how they perceive themselves and others (Pradaya, Admojo, & Dewi, 2020). Children with sufficient gross motor skill development will easily integrate into socializing with children their age, while children with delayed motor development will experience the opposite. Training gross motor skills serves as a facilitator in carrying out play and learning activities (Saripudin, 2019). In addition, health function will increase by having sufficient gross motor skills. It also has positive benefits,

such as improving breathing and blood circulation and shaping posture (Handayani, Sudarsini, & Wahyuno, 2018).

To develop the gross motor skills of ASD students, teachers need to design learning modules that follow students' physical features and necessities. As Kurniawan's research (2022) states, learning modules can improve the manipulative skills of autistic students, which have an impact on increasing social participation and communication. Research conducted by Kurniawan et al. (2022) stated that teacher modules in learning locomotor movements for class II SDLB (Elementary School for Students with Special Needs) can improve the motor skills of autistic students. Similar research conducted by Kurniawan et al. (2022) states that the use of modules in learning can improve the static dominant movement skills of autistic students. Learning modules for children with autism have proven effective in improving their movement skills, including variations and combinations, static dominant movements, manipulative skills, and fundamental movement combinations (Kurniawan et al., 2022; Kurniawan et al., 2022)

This research provides a reference in providing information to physical education teachers regarding the condition of the gross motor skill status of autism spectrum disorder students aged 6-10 years at the SLB Autis Laboratorium UM. The research result is essential data for designing learning programs according to student needs and evaluating the effectiveness of programs and interventions that have been implemented.

CONCLUSION

This study aims to quantitatively analyze the condition of gross motor skills of autism spectrum disorder students aged 6-10 years at SLB Autis Laboratorium UM. The data from this study were obtained by applying Ulrich's test instrument entitled Test of Gross Motor Development-2 (TGMD-2), which consists of locomotor tests and control objects with 48 assessment criteria. Therefore, it can be concluded that the results of the research on Gross Motor Skill Analysis of Autism Spectrum Disorder Students Aged 6-10 Years at SLB Autis Laboratorium UM are very far below average. This result is evidenced by the overall GMS analysis results, which show that locomotor movements and object control drop into the very poor category. It is hoped that the results of this study can be a reference for improving the gross motor skills of autistic students to achieve independence in carrying out daily activities.

Handling this problem by involving various parties between schools, physical education teachers, and parents is essential. The collaboration could provide services to improve gross motor skills through the preparation of learning modules made by teachers by considering the different abilities of each student. The special approach method that can be applied in learning is to motivate children to move and provide fun video-based learning education to attract autistic children. This study has several limitations; specifically, researchers did not reach the qualitative stage to see other factors that affect the gross motor skills of students with autism spectrum disorder, so suggestions for further research need to conduct more in-depth research in qualitative studies to find out the factors that affect gross motor skills of students with an autism spectrum disorder. Furthermore, this research must also be applied or tested on children with disabilities with other characteristics.

REFERENCE

Abu Hanifah, P., & Oktadinata, A. (2020). Develop gross motor skills in kindergarten students through modification games. *Jurnal Penelitian Pembelajaran*, *6*(3), 575–587. https://doi.org/https://doi.org/10.29407/js_unpgri.v6i3.14979

Apriyani, I., Suntoda, A., & Didin, B. (2018). Uji Validitas Dan Reliability Test Of Gross Motor Development-2 (TGMD-2). *Journal of Teaching Physical Education in Elementary School*, *2*(229), 40–45.

Ardi, M., & Purwanto, S. (2020). *Model Aktivitas Kebugaran Jasmani dan Kedisiplinan Berbasis Permainan*. Yogyakarta: UNY press.

Aulia, F., & Kartiko, D. C. (2017). Peningkatan Motorik Kasar Pada Anak Autistik Hipoaktif Melalui Senam Irama Di SLB Arya Satya Hati Pasuruan. *Jurnal Pendidikan Olahraga dan Kesehatan*, *05*(02), 171–175.

Battah, H. W., Lotan, M., & Moran, D. S. (2023). The Need for a Motor Assessment Tool for Children with Autism—An Opinion Article. *Diagnostics*, *13*(12). https://doi.org/10.3390/diagnostics13122095

Bedford, R., Pickles, A., & Lord, C. (2016). Early Gross Motor Skills Predict the Subsequent Language Development in Children with Autism Spectrum Disorder. *Autism Research*, *9*(9), 993–1001. https://doi.org/10.1002/aur.1587

Djuanda, I., & Adipura, P. (2020). Peningkatan Kemampuan Motorik Kasar Anak Usia Dini Melalui Bermain Lempar Tangkap Bola. *Jurnal Kordinat*, *19*(2), 265–274.

Grant, R., & Nozyce, M. (2013). Proposed changes to the American Psychiatric Association diagnostic criteria for autism spectrum disorder: Implications for young children and their families. *Maternal and Child Health Journal*, *17*(4), 586–592. https://doi.org/10.1007/s10995-013-1250-9

Handayani, S. M., Sudarsini, & Wahyuno, E. (2018). The Effect of Functional Play towards Gross Motor Skill for Children with Autism. *Journal of ICSAR*, *2*(1), 37–42. https://doi.org/10.17977/um005v2i12018p037

Irvan, M. (2020). Urgensi Identifikasi dan Asesmen Anak Berkebutuhan Khusus Usia Dini. *Jurnal ORTOPEDAGOGIA*, *6*(2), 108–112. https://doi.org/10.17977/um031v6i22020p108-112

Kruger, G. R., Silveira, J. R., & Marques, A. C. (2019). Motor Skills of Children With Autism Spectrum Disorder. *Rev Bras Cineantropom Hum*, *21*(7), 2–8. https://doi.org/https://doi.org/10.1590/1980-0037.2019v21e60515

Kurniawan, R. (2018). Analisis Gerak Dasar Anak Usia 6-7 Tahun. *JPUD - Jurnal Pendidikan Usia Dini*, *12*(2), 311–320. https://doi.org/10.21009/jpud.122.12

Kurniawan, R., Heynoek, F. P., & Wijaya, D. P. R. M. (2022a). Development of Teacher Modules on Learning Locomotor Movement Materials. *Jurnal Menssana*, *5*(2), 146–156. https://doi.org/https://doi.org/10.24036/MensSana.07022022.16

Kurniawan, R., Heynoek, F., & Wijaya, M. A. I. (2022b). Pengembangan Modul Guru pada Pembelajaran Materi Gerak Dasar Lokomotor Kelas II SDLB Autis. *Jurnal Patriot*, *4*(3), 190–206. https://doi.org/10.24036/patriot.v%vi%i.856

Kurniawan, R., Mu'arifin, Kurniawan, A. W., Heynoek, F. P., & Sigit, C. N. (2022). Development of Teacher E-Module for Dynamic Balance Movement for Grade 3 Elementary School with Autism. *Proceedings of the 5th International Conference on Sport Science and Health (ICSSH 2021)*, *45*(Icssh, 2021), 98–103. https://doi.org/10.2991/ahsr.k.220203.015

Kurniawan, R., Noviardah, D. P., Heynoek, F. P., & Sigit, C. N. (2022). Development of Teacher Modules for Learning Manipulative Movement for Autistic Students. In *Proceedings of the International Conference on Sports Science and Health (ICSSH 2022)*. Atlantis Press International BV. https://doi.org/10.2991/978-94-6463-072-5

Kurniawan, R., Paulina Heynoek, F., Nawfal Asyrof, M., & Nugroho Sigit, C. (2022). Development of Teacher Module for Learning Static Dominant Movement for Students with Autism. *KnE Social Sciences*, *2022*(2), 648–662. https://doi.org/10.18502/kss.v7i19.12484

Kurniawan, R., Pradana, I. A., & Heynoek, F. P. (2022). Pengembangan modul guru materi variasi dan kombinasi gerak lokomotor non-lokomotor manipulatif untuk siswa autis. *Multilateral : Jurnal Pendidikan Jasmani dan Olahraga*, *21*(2), 98. https://doi.org/10.20527/multilateral.v21i2.13161

Liu, T., Hamilton, M., Davis, L., & Elgarhy, S. (2014). Gross Motor Performance by Children with Autism Spectrum Disorder and Typically Developing Children on TGMD-2. *Journal of Child and Adolescent Behaviour*, *2*(1), 2–5. https://doi.org/10.4172/2375-4494.1000123

Mahfud, I., & Yuliandra, R. (2020). Pengembangan Model Gerak Dasar Keterampilan Motorik Untuk Kelompok Usia 6-8 Tahun. *SPORT-Mu: Jurnal Pendidikan Olahraga*, *1*(1), 54–66. Diambil dari http://jurnal.unmuhjember.ac.id/index.php/sportmu/article/view/3055

Manalu, T. M., & Suparmi, S. (2023). Meningkatkan Memori Jangka Pendek pada Anak Autis dengan Senam Otak. *GUIDENA: Jurnal Ilmu Pendidikan, Psikologi, Bimbingan dan Konseling*, *13*(3), 650. https://doi.org/10.24127/gdn.v13i3.7688

Nababan, M. K., Daulay, S., & Hadi, W. (2019). Speech Act of " Touch " Therapy in the Intervention Service Foundation For Autism and Developmental Delay (YISADDI) in the Method of Traffic Light Games. *Budapest International Research And Critics In Linguistics And Education (Birle) Journal*, *2*(4), 68–78. https://doi.org/Https://Doi.Org/10.33258/Birle.V2i4.493

Nofianti, R. (2020). Upaya Meningkatkan Keterampilan Motorik Halus Melalui Kegiatan Menggunting Dengan Menggunakan Pola Pada Anak Usia Dini. *Jurnal Fakultas Psikologi Universitas Hang Tuah Surabaya*, *13*(1), 115–130.

Pradaya, B., Admojo, I. R. W., & Dewi, N. K. (2020). Peningkatan Kemampuan Motorik Kasar Melalui Permainan Modifikasi Bola Basket Pada Anak Usia 5-6 Tahun. *Kumara Cendekia*, *8*(1), 56. https://doi.org/10.20961/kc.v8i1.32572

Purnamasari, N., Ahsaniyah, A. B., Widyastuti, W., & Trisna, K. (2023). Hubungan Dukungan Orang Tua dengan Kemampuan Motorik Kasar Anak Cerebral Palsy. *Jurnal Fisioterapi dan Rehabilitasi*, *7*(2), 212–219. https://doi.org/10.33660/jfrwhs.v7i2.249

Ramadhani, H. S., Lestiawati, E., & Wahyuningsih, M. (2016). Pengaruh Terapi Bermain Puzzle Terhadap Konsentrasi Belajar Anak Kelas I Di SD Negeri Pokoh 1 Ngemplak, Sleman, D.I. Yogyakarta. *Jurnal Medika Respati*, *11*, 37–43.

Rasam, F., Sari, A. I. C., & Karlina, E. (2019). Peran Kompetensi Dalam Meningkatkan Kinerja Guru Di Sma Jakarta Selatan. *Research and Development Journal of Education*, *6*(1), 41. https://doi.org/10.30998/rdje.v6i1.4371

Republik Indonesia. (2016). *Undang-Undang Republik Indonesia Nomor 8 Tahun 2016 Tentang Penyandang Disabilitas*. Jakarta.

Saripudin, A. (2019). Analisis Tumbuh Kembang Anak Ditinjau Dari Aspek Perkembangan Motorik Kasar Anak Usia Dini. *Equalita: Jurnal Pusat Studi Gender dan Anak*, *1*(1), 114–130. https://doi.org/10.24235/equalita.v1i1.5161

Sasminto, H. S., & Teguh Hari Wiguno, L. (2024). Survei Status Gross Motor Skill pada Siswa Kelas Rendah Sekolah Dasar Negeri Se-Kecamatan Tajinan Kabupaten Malang. *Journal Sport Science Indonesia*, *3*(1), 329–341. https://doi.org/10.31258/jassi.3.1.329-341

Setiawan, A., Yudiana, Y., Ugelta, S., Oktriani, S., Budi, D. R., & Listiandi, A. D. (2020). Hasil Belajar Pendidikan Jasmani dan Olahraga Siswa Sekolah Dasar: Pengaruh Keterampilan Motorik (Tinggi) Dan Model Pembelajaran (Kooperatif). *Journal of Teaching Physical Education in Elementary School*, *3*(2), 59–65. https://doi.org/https://doi.org/10.17509/tegar.v3i2.24513

Sheppard, D. P., Bruineberg, J. P., Kretschmer-Trendowicz, A., & Altgassen, M. (2018). Prospective memory in autism: theory and literature review. *Clinical Neuropsychologist*, *32*(5), 748–782. https://doi.org/10.1080/13854046.2018.1435823

Siswantoyo, & Oktavia, R. (2018). *Terapi Aktivasi & Relaksasi Olahraga Untuk Autisme*. Yogyakarta: ANDI.

Ulrich, D. A. (2000). *Test Of Gross Motor Development-2 (TGMD-2)* (2 ed.). Texas: Shoal Creek Boulevard.

Veldman, S. L. C., Jones, R. A., Chandler, P., Robinson, L. E., & Okely, A. D. (2020). Prevalence and risk factors of gross motor delay in pre-schoolers. *Journal of Paediatrics and Child Health*, *56*(4), 571–576. https://doi.org/10.1111/jpc.14684

Yusdianto, Y., & Teguh Hari Wiguno, L. (2024). Survei Status Gross Motor Skill pada Siswa Kelas Rendah Sekolah Dasar Negeri Se-Kecamatan Tajinan Kabupaten Malang. *Journal Sport Science Indonesia*, *3*(1), 329–341. https://doi.org/10.31258/jassi.3.1.329-341

Zikl, P., Holoubková, N., Karásková, H., & Veselíková, T. B. (2013). Gross Motor Skills of Children with Mild Intellectual Disabilities. *International Journal of Social, Behavioral, Educational, Economic, Business and Industrial Engineering*, 7(10).