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# Gross motor development of children with autism spectrum disorders aged 6-10 years and children with normal development

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**Abstract**: Developmental disorders in autistic children are one of the problems that require early detection so that developmental deviations do not occur. This study aims to determine the gross motor conditions of autistic students and children developing at the same age using the TGMD-2 (Test of Gross Motor Development-2) instrument.(Ulrich, 2000). This study uses a quantitative approach using a survey method. Sampling used with purposive sampling technique through certain considerations including age and demographic conditions of the same area. The sample in this study consisted of 10 SLB students and 17 regular students with data analysis techniques in this study using quantitative descriptive. The results of this study indicate that autistic children have a "Very Low" gross motor condition which is generally lower than normal children with the same age range as a reference. The results of this study are expected to help educators and health workers in providing an overview in order to transmit the gross motor skills of autistic children and provide appropriate program in the future.
**Keywords**: Gross Motor Skills; autism; TGMD-2

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## INTRODUCTION

Autism is a condition that affects communication, behavior, cognition, learning, socialization, and sensory development. The cause of autism is not yet certain. Some experts believe that autism is caused by various factors such as pregnancy, genetic factors, and environmental factors that interfere with a child's development.brain development(Hodges et al., 2020)Some autistic children exhibit antisocial behavior, behavioral disorders, and gross motor disabilities.(Nurfadhillah et al., 2021)Behavioral characteristics of autistic children include hyperactivity, self-injurious behavior, and obsessive behavior.(Sitimin et al., 2016)Developmental disorders in autistic children tend to be greater in the motor aspect.(Kurniawan et al., 2022)Suboptimal motor development in autistic children has the potential to influence the behavior of autistic children, namely not being directed, behaving as they please, not wanting to be controlled, being aggressive, hurting themselves, having tantrums, having difficulty concentrating, and engaging in repetitive behavior.(Damanik and Al-Idrus, 2023).

Children's behavior is closely related to motor skills that play an important role in children's ability to interact with the environment, understand the world around them, and achieve important milestones in their development. The development process in children includes physical, emotional, cognitive, and psychosocial development as well as motor or movement development.(Mayar and Sriandila, 2021)Gross motor development in children is the main foundation for their physical growth and physical abilities. Gross motor skills have an important meaning, because they can affect the development of fine motor skills.(Desiana and Khan, 2022)In addition, gross motor development is closely related to the child's cognitive and social development. This is in accordance withHasanah (2016), the development of children's gross motor skills is closely related to the maturation of the muscles and nerves of the brain. The resulting movements are the result of the interaction of various nervous systems controlled by the brain. For autistic children, gross motor development has the potential to be an early predictor(Wang et


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al., 2022). In addition, motor development in autistic children is very important because it helps physical, cognitive, and social development.(Chen et al., 2022)If there is a delay in handling developmental disorders in children, it has the potential to cause gaps that impact the development of intelligence, motor skills, socialization, and emotions that are not optimal.

Gross motor development is an important aspect in the growth and development of every child, including autistic children. The increasing number of autistic children has the potential to greatly increase the condition of motor delays in children. Prevalence data according to the World Health Organization (WHO) shows that globally there has been a significant increase in autistic children. In 2023, the prevalence of 1% or 1 in 100 children in the world will experience autistic developmental disorders. In Indonesia, based on data from the Statistics Data Center (Pusdatin) of the Ministry of Education and Culture (Kemendikbud) in 2020, the number of autistic children reached 16,987 children. The high number of cases of developmental disorders, especially autism in Indonesia, occurs because it is influenced by various factors that also cause the development process in children to experience obstacles. According toLiu and friends (2014), autistic children showed motor delays in overall gross motor intelligence scores, and locomotor and object control standard scores when compared to normal ages. This study is in line withSari et al (2016), which states that some children with autism disorders indirectly show poor gross motor conditions. This research is supported byHedgecock and friends (2018), children with ASD showed significant gross motor delays compared to children without disabilities of the same age. This study is also supported byKetcheson and friends (2018), that gross motor delays in autistic children will continue as they grow older. Developmental disorders in autistic children are one of the problems that need to be detected early so that there are no developmental deviations according to the age of the child in general. One area of development that is often overlooked in the adaptive behavior of school-age children with autism is the condition of their gross and fine motor skills.(Bremer and Cairney, 2018)This research needs to be done as an effort or initial step in helping to understand the level of gross motor skills of autistic children. So that it can be a reference or guideline for providing appropriate interventions in overcoming delays in gross motor development of autistic children.

According toDowns and friends (2020), research on motor development in autistic children can use various instruments such as TGMD-2, TGMD-3, or Bruininks-Oseretsky Test of Motor Proficiency-2 (BOTMP-2). BOT-2, followed by TGMD-2, has the strongest proportion of measurements to support the use of assessment in autism to date as an instrument that focuses on gross motor development at the age of 6-10 years. This statement is proven in a study byKaplanova et al. (2023), with the result that in autistic children, physical education teachers trained through TGMD-2 showed significant improvement in motor performance, especially movement and gross motor skills in autistic children between the ages of 5 and 10 years. The effectiveness of TGMD-2 as a reference in providing interventions in autistic children is supported by the results of research byŠišková and colleagues (2020), which stated that 8 weeks of 30-minute weight training twice a week using TGMD-2 showed significant improvements in gross motor skills in children with autism. This evidence suggests that TGMD-2 can be implemented in gross motor skills in children with autism. Based on previous studies, there are various findings related to gross motor skills in children with autism. Research byPusponegoro et al. (2016), shows that the low gross motor skills of autistic children have the potential to cause low socialization skills. Furthermore, research conducted byPhytanza et al (2021), showed that the gross motor skills of autistic children aged 8-12 years who used TGMD-2 were in the low category, namely 80%. Meanwhile, research conducted byAyuningtyas et al (2024)in autistic children aged 8-12 years using different instruments, namely pre-test and post-test. The test consists of five parts, namely: (1) walking on tiptoes (2) walking on a pedestrian bridge (3) jumping 15 cm from a block, (4) throwing a ball as far as possible (5) jumping on one leg which shows improvement after being given treatment.(Taftazani & Kurniawan (2024), using TGMD-2 as the initial test and the final test showed an improvement in the gross motor skills of autistic children after treatment.

Based on ideal conditions where the TGMD-2 instrument is one of the most psychometrically appropriate motor instruments for children with special needs. Several studies in Indonesia, including those that focus on measuring gross motor skills in autistic children using the TGMD-2 instrument, are still lacking. The new thing in this study will focus on the TGMD-2 which is used as an instrument to measure the gross motor skills of autistic children aged 6-10 years with different demographic conditions


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from previous studies. One of the previous studies focused on changes resulting from a certain treatment, while this study is more specific to determine the level of gross motor conditions of autistic students. In terms of movement development through descriptive presentation, namely seeing the development of the extent of the gross motor skills of autistic children with children without disabilities as a reference.

The motor development of autistic children needs special attention. Motor difficulties in childhood can have significant consequences, potentially leading to decreased engagement with peers in play and sports activities which in turn may hinder social interaction and overall social development (Stin & Emck, 2018). Children with ASD encounter more numerous and complex barriers to physical activity compared to their typically developing (TD)peers (Must, et.al., 2015). Gross motor skills are an important target for early intervention in children with ASD. Recognizing motor impairments as a key diagnostic criterion or specifier for ASD is essential, highlighting the need for appropriate motor screening and assessment (Bhat, 2021). However, this area is still rarely explored, so research related to motor conditions can provide a more specific picture of the disorders experienced by children with ASD (Wang et al., 2022). This study aims to determine the gross motoric condition of autistic students concerning children without disabilities as an illustration. Therefore, it is necessary to conduct research as an early detection effort to determine the level of gross motoric condition of autistic children which can later be used as evaluation material for the gross motoric condition of autistic children for parents and educators so that they can provide appropriate intervention and support to maximize the child's potential..

## METHOD

This study is a type of non-experimental research that aims to determine the gross motoric condition of autistic students involving children without disabilities as an illustration. This study uses a quantitative descriptive research approach in the form of a survey conducted on students with special needs autism at SLB Tunas Bangsa, SLB Negeri Talun, and SLB Muji Utomo aged 6-10 years. The variables in this study are the gross motoric abilities of students with special needs autism. This study uses a quantitative descriptive method using the Test of Gross Motor Development-2 (TGMD-2) instrument to measure motoric conditions in children aged 3-10 years.

The population in this study were all autistic students from three SLB schools in Blitar Regency and all regular students of SDN Satriyan 01 as a group describing the gross motor conditions of children without disabilities and autism. In this study, the population of all students was 252 people, the sampling technique used to determine the sample in this study was the purposive sampling technique. The criteria determined include an age range of 6-10 years with the same demographic conditions. The research sample consisted of 27 students, in collecting data the results of the study were divided into 10 SLB students with mild, moderate, and severe autism classifications and 17 elementary school students.

The instrument used in this study is a standard instrument for measuring gross motor skills, namely the Test of Gross Motor Development-2 (TGMD-2).for children aged 3-10 years.(Ulrich, 2000)Research byApriyani et al. (2018)shows that the validity and reliability of TGMD-2 have significant validity (t count 2.27 > t table 1.65), which indicates its ability to measure gross motor development of children aged 3-10 years accurately. Furthermore, statistical analysis shows high reliability (reliability correlation coefficient of 0.765), which supports the consistency of TGMD-2 in producing stable scores on repeated measurements. The combined reliability scores of the locomotor and control object subscales are 0.75 and 0.67, respectively.(Songs and Friends, 2022).

The use of TGMD-2 instruments for autistic children requires an individual approach. One of the main challenges in implementing TGMD-2 in autistic children is the limitation in following directions or instructions to perform movements. Therefore, autistic children require special attention and individual assistance and support during the process of using the TGMD-2 instrument. The use of TGMD-2 in autistic children requires assistance because of developmental obstacles related to motor skills so that in carrying out activities it requires assistance. Specifically, autistic children with mild classifications require assistance through individual assistance during the process of using TGMD-2. Meanwhile, children with moderate to severe autism require assistance in making movements through interventions by helping to lift the legs and hands during the process of using TGMD-2

This study used descriptive analysis in the form of a survey to process the data from the gross motor skills test Test of Gross Motor Development-2 (TGMD-2). TGMD-2 evaluates 12 gross motor skills


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which are grouped into 2 subtests, namely locomotor movements and manipulative movements. Locomotor movements are divided into 6, namely running, sprinting, jumping, long jump, horizontal jump, and side steps. Manipulative movements are divided into 6, namely hitting a stationary ball, bouncing, catching, kicking, throwing with an upward arm swing, and rolling the ball with a downward swing. The motor skills test assessment was carried out twice. In each trial, the researcher observed and scored the child's performance in performing each motor skill. A score of 1 was given if the movement indicator was met, and a score of 0 was given if the movement indicator was not met. The assessment score consists of two tests, the scores are added together to produce a total criterion score. The criterion scores are then added together to produce a raw subtest score (0-48). The raw scores are then converted into standard scores (1-20) and percentiles (<1 to >99) according to the age provisions in the norm table. The standard scores obtained from the results of locomotor and manipulative movements are added up and converted into gross motor quotient (GMQ). This gross motor quotient is a number that indicates the level of a child's gross motor skills. Higher scores indicate better gross motor skills. From the (GMQ) scores, subjects can be categorized into several categories, namely very superior, superior, above average, average, below average, low, and very low.

## RESULTS AND DISCUSSION

### Results

This study aims to determine the extent of the gross motoric condition of autistic special needs students in 3 SLBs in Blitar Regency. The results of the study on the level of gross motoric condition of autistic special needs students in SLB Tunas Bangsa, SLB Negeri Talun, and SLB Muji Utomo and regular students of SDN Satriyan 01 as a reference for the level of motoric condition according to the same age range were obtained through data collection survey of the level of gross motoric condition using the Test of Gross Motor Development (TGMD-2) instrument test. The number of subjects in this study was 27 students consisting of 10 SLB students and 17 elementary school students who had different gross motoric abilities, especially as a reference for the motoric condition of autistic students with regular students.

The following are the results of the analysis of students' gross motor skills tests which are presented in the form of scores, presentations, diagrams, and descriptions of SLB and SD students and overall.

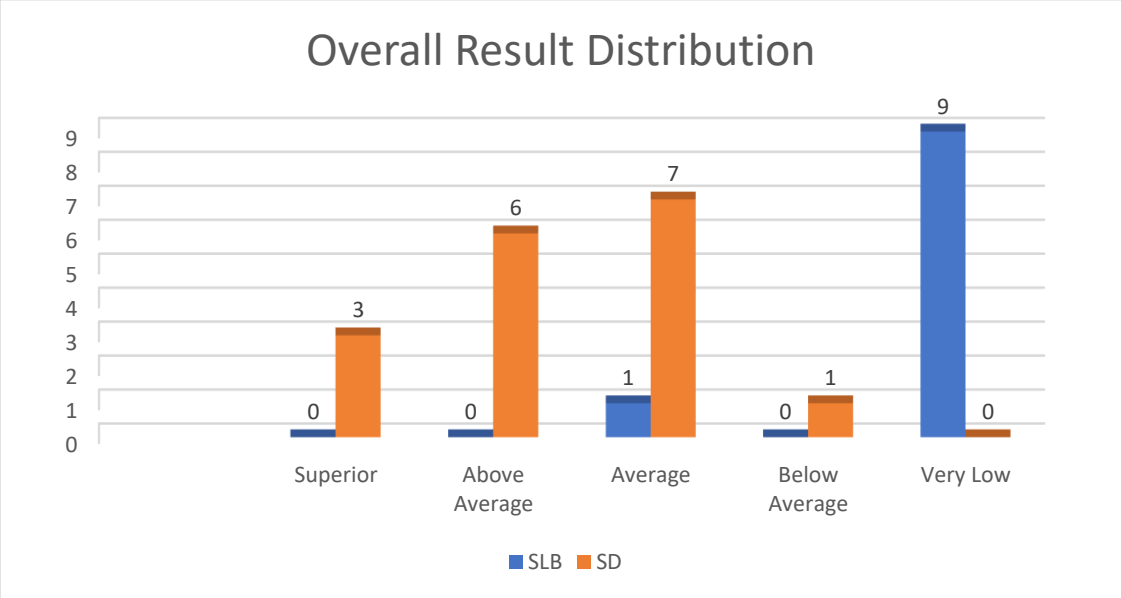


**Figure 1.** Overall Results Distribution

From the diagram above, it can be seen that the distribution of overall results in elementary school and special needs children is significantly different. Elementary school children generally have better results than special needs children. In special needs children, the highest results in the "Very Low"


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category were 9 students, while in elementary school children, the "Above Average" category was 6 students and "Average" was 7 students. The distribution of these results shows a gap in gross motor skills, this needs serious attention and handling from various parties in order to achieve optimal development.

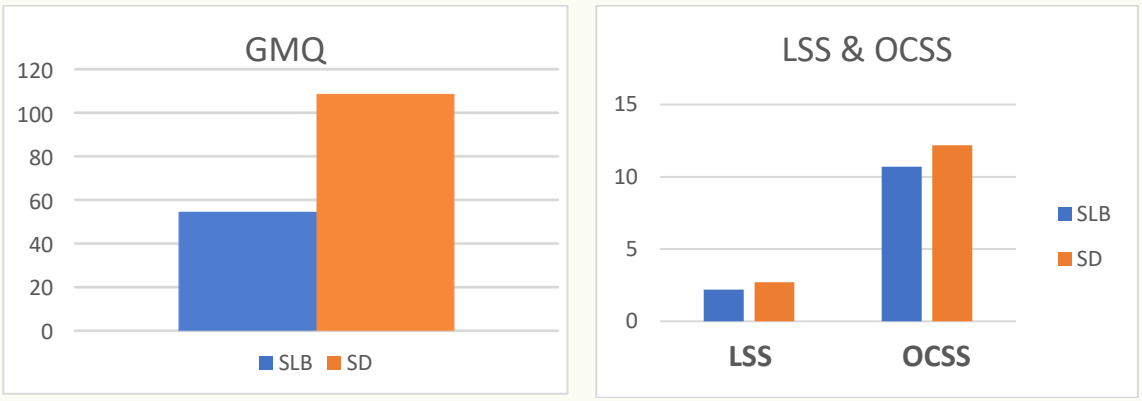


**Figure 2.** GMQ Diagram, Locomotor Standard Score (LSS) & Object Control Standard Score (OCSS)

Based on the GMQ score, autistic children are lower than children without disabilities. This is also based on the results of the standard scores of autistic children who have lower scores compared to children without disabilities. The GMQ score of special education students is an average of 54.6 while elementary school students are 108.6. The LLS score of SLB students is an average of 2.2 and SD 10.7 and the OCSS of SLB is an average of 2.7 and SD 12.1. Specifically, autistic SLB students with mild classification have an average LSS of 1.8 and OCSS of 2.4, with the lowest score of 16 and the highest score of 28. Autistic students with moderate classification have an average LSS of 1 and OCSS of 1.3, with the lowest score of 10 and the highest score of 13. Meanwhile, students with severe classification have an average LSS of 1 and OCSS of 1, with the lowest score of 8 and the highest score of 14. This indicates that there are clear obstacles and delays in the gross motor development of autistic children.

**Distribution of Gross Motor Skills Assessment Results for SLB Students**

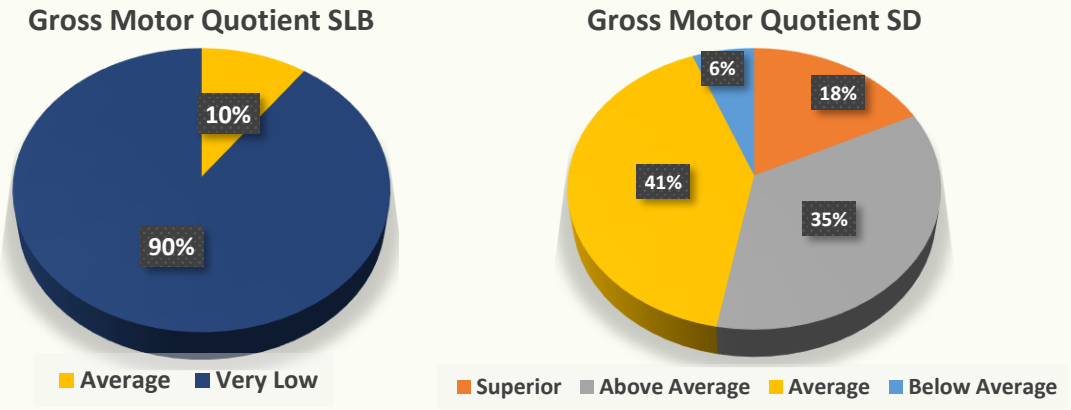


**Figure 3.** GMS percentage result diagram

Based on the presentation of tabular data and diagrams above, through the results of descriptive analysis of 10 students in 3 SLBs, namely SLB Tunas Bangsa, SLB Negeri Talun, and SLB Muji Utomo, the highest percentage is at the "Very Low" level (90%), the score range <70 there are 9 students. The proportion of "Moderate" (10%), the score range of 90-110 there is 1 student. While in elementary school students, through the results of descriptive analysis of 17 students in SD Negeri Satriyan 01 the highest percentage is at the "Moderate" level (41%), the score range of 90-110 there are 7 students. The proportion of "Above Average" (35%), the score range of 111-120 there are 6 students. The proportion


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of "Very Good" (18%), the score range of 121-130 there are 3 students. The lowest proportion is "Below Average" (6%), the score range of 80-89 there is 1 student.

## Discussion

This study focuses on the GMS level between special education students and regular school students with an age range of 6-10 years and the same regional demographic conditions as a reference. The importance of this study lies in a deeper understanding of the development of GMS levels in autistic children. Autism is a neurodevelopmental disorder that affects a person in interacting and communicating well and tends to have repetitive behavior.(Nordin et al., 2021).Kurniawan et al. (2022)Developmental disorders in autistic children tend to be greater in the motor aspect. Motor development involves coordinating the activity of the nerve center, nerves, and muscles in controlling physical movement.(Fitriani, 2018)Based on the overall distribution results, it shows that the gross motoric condition of SLB students is lower when used as a reference for regular students. Based on the overall distribution of SLB students, the gross motoric condition is predominantly in the "Very Low" category, while regular students are more dominant in the "Average" category. The results of this study are in line withChen and friends (2022), The gross motor scores of ASD children are much lower compared to children without disabilities. This indicates that there are obstacles that affect the gross motor skills of special education students compared to regular students who are used as a reference. The overall analysis of the results shows that the average gross motor skills of SLB students are much lower compared to regular students in the same age range (6-10 years). This difference indicates that there are significant conditions in the gross motor skills of SLB and regular students.

In this study, the presence of regular students as a reference in describing gross motor skills is an important element to strengthen the research results and clarify the conditions found. According toLiu and friends (2014)To determine the gross motor skills of autistic children aged 5-10 years, a comparison is needed with children without disabilities in the same age range based on chronological age matching, motor skill performance, and mental age matching. Gross motor skills are the basis for mastering more complex skills, in order to improve the quality of an active lifestyle in the future.(Supriyadi, 2020)The results of the average standard value test show that the standard values of locomotor and control objects of SLB students tend to be lower when referring to regular students of the same age as a reference. The analysis of the standard value shows that the average is in the low category, according to the norm reference. On the other hand, regular students show standard values that are in line with children without disabilities in the same age range (6-10 years).

The fact of data analysis of SLB and SD has quite striking differences in results. Judging from the overall analysis results, it is stated that the gross motoric condition of SLB students aged 6-10 years refers to 2 criteria contained in TGMD-2, namely "Very Low" and "Average". The results of the study showed a difference between the level of autism classification and gross motor skills. And children with mild autism on average showed better gross motoric conditions than autistic students with moderate categories, followed by the results of the study which also showed that autistic students with moderate categories on average showed better motoric conditions than students with severe classifications. Specifically, it was found that the gross motoric conditions of autistic children with each classification were different. This finding shows that the severity of autism can affect the development of gross motor skills in children. These results are inversely proportional to the results of the analysis of gross motoric conditions in elementary school students aged 6-10 years which refer to 4 criteria contained in TGMD-2, namely "Very Good", "Above Average", "Average" and "Below Average". Based on the four criteria obtained, there is one student who is in the "Below Average" criteria. The gross motor condition of children without obstacles is in line with research conducted on students aged 7-9 years at SDN Se-Kecamatan Pujon, Malang Regency with gross motor movement abilities reaching an average value (Kurniawan et al., 2024). Meanwhile, the gross motor skills of SLB students, 9 out of 10 students get the criteria of "Very Low". The results of the study conducted showed that the low motor skills of autistic children are also in line with the results of research in Indonesia, namelyPhytanza et al (2021), almost all children with special needs autism have gross motor skills, classified as low. This study strengthens previous studies that show that autistic children experience delays in motor development compared to children without disabilities, autistic children have gross motor delays and have very significant fine motor delays.(Nordin et al., 2021)The low gross motor condition in autistic children found in the results


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of this study is in line with previous research. Mof and friends (2023)which shows that the ability of autistic children with special needs in controlling fine and gross motor skills is still very low. In addition, the low motor skills of autistic children when compared to children without disabilities show great significance.(Kruger and friends, 2019)Based on the results of previous research, the results of research that has been carried out show that the gross motor skills of autistic children are in the low category, even very low, when referring to children without disabilities as a reference.

Differences in motor conditions reflect the various challenges that autistic children face in developing their motor skills.Prabowo et al (2021), classification of autism according to the Childhood Autism Rating Scale (CARS) theory, autism levels include mild autism with limited ability to interact, showing little social response and two-way communication; moderate autism has an aggressive or hyperactive attitude and limitations in eye contact and social response; and severe autism children do unusual things, such as banging their heads against walls repeatedly. The condition of autistic children is in line with research stating that autistic children experience neurodevelopmental disorders that have the potential to affect basic psychological processes (especially perception and concentration) and motor skills (fine motor skills, gross motor skills, sensory integration of eye and limb coordination) so that they require special attention in carrying out activities.(Imaniyah, 2019).Hutomo & Wulandari (2023)Autistic children tend to need help from others to do self-help activities. The inability of autistic children to do activities independently is caused by impaired development of the brain stem and cerebral cortex structures that play a role in the function of attention and receiving stimuli.(Daulay, 2017).Ranieri et al (2023), sensory disorders in autistic children can have difficulty modulating tactile, auditory, visual, and vestibular input, with hyporeactivity or hyperreactivity to stimuli, and show comorbid systemic conditions such as digestive problems, food sensitivities, obesity, diabetes, and cardiovascular. Low motor development in autistic children has the potential to hinder children in carrying out daily activities, so that they require significant assistance in movement behavior. This condition is an important basis for applying gross motor measurements in autistic children. This makes the basis for applying gross motor measurements in autistic children using TGMD-2 requires a special individual approach to ensure that autistic children can follow instructions correctly.

Obstacles to gross motor development in autistic children can be influenced by several things such as cognitive function, emotional behavior and movement.(Timansah & Nurhadiyati, 2023)Low motor conditions in autistic children can be associated with impaired coordination, walking, social and balance.(Pusponegoro et al., 2016)Several factors that support the level of gross motor skills include the development of the nervous system, physical condition, motivation, and a supportive environment.(Asfinolia and Jafar, 2023).Kurniawan et al. (2022), that autistic children show poor motor and balance abilities compared to children without disabilities in general. According toGlass & Yuill (2023), poor gross motor skills in ASD have been shown to correlate with poor coordination with others. Children with poor coordination skills participate in fewer activities, engage in less social play, and prefer socially isolated activities than children without disabilities. Social barriers have the potential to reduce activities that impact ongoing motor development.(Noel et al., 2018)This motor delay can limit physical activity in autistic children. Physical activity in children increases the involvement of child development, one of which is a factor in the plasticity (adaptive ability) of the child's brain which is expressed through neurogenesis (formation of new nerve cells) and neuroreorganization (rearrangement of connections between nerve cells) which can support various abilities including gross motor development.(Taftazani & Kurniawan, 2024)Poor motor skills are a barrier to physical activity and prevent good opportunities for the development of motor functions.(Ceccarelli et al., 2020)Therefore, if children with autism spectrum disorders do not receive appropriate intervention, it will increasingly become an obstacle to their growth and development in living their daily lives.(Kurniawan et al., 2022).

The process of child growth and development, especially in basic motor skills, is very important in forming motor skills in the future.(Kurniawan, 2018)Efforts to optimize motor development need to be encouraged to hone physical motor development.(Nurlaili, 2024)The differences in the development of each child's motor skills are a challenge for educators to provide innovation in learning programs according to the child's developmental stage (developmentally appropriate program). So that it can help children maximize their motor development potential.(Kurniawan, 2018).Indirectly, games can increase simple motor activities which have a positive impact on the body, especially for autistic students in performing various locomotor movements.(Kurniawan et al., 2022)According toThe Last Supper


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(2017)Basic competency of gross motor achievement in autistic children can be achieved through optimization of physical activity learning in physical education. PJOK has an important role in efforts to improve affective, psychomotor, social, and cognitive abilities. Therefore, physical education for special needs students with autism disorders is needed as a medium and stimulation to improve gross motor skills for daily activities such as walking, jumping, hopping, and running.(Kurniawan et al., 2022)The application of gross motor skills in physical education can be applied through martial arts to improve emotional, social, and executive functions.(Kurniawan et al., 2022)According to research conducted byKurniawan et al. (2022)Indonesian: Kurniawan et al. (2022), the use of teaching modules for educators and parents can facilitate the achievement of gross motor development.

Through the description above, between special needs students with autism and regular students there is a difference or gap in the level of gross motor conditions in the same age range. This study aims to provide knowledge about the gross motor conditions of autistic students at SLB Blitar Regency regarding the acquisition of categories in the gross motor skills of autistic students. This study can be used as a preliminary assessment and screening for teachers to determine why an appropriate program needs to be developed for their class.

## CONCLUSION (CONCLUSION)

Based on the results of the study, it can be concluded that the use of the TGMD-2 instrument in autistic children can be used with the note that autistic children require assistance due to developmental disabilities. The results of the study showed that the motoric conditions of autistic children vary greatly and can be categorized into five criteria, namely very low, below average, average, above average, and superior. This study shows that autistic children have a "Very Low" gross motor condition which is generally lower than the description of children without disabilities with the same age range as a reference. Differences in the level of motoric conditions can be caused by various influencing factors. Early detection of gross motoric conditions is very useful for educators and parents in facilitating the provision of appropriate and structured interventions to maximize the potential for child development. The limitations of this study are the age range that only focuses on autistic children aged 6-10 years and the different characteristics of autistic children and their various classifications. For further research, research can be conducted with ages below and above 6-10 years and focus research on one classification of autistic children.

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