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The effect of physical activity programs on improving motor, social and attitude abilities of students with autism spectrum disorders in inclusive schools

Nanda Viorella [a,1], Siska Fedina Islamia [a,2], Robitul Umam Ramdani [a,3], Dewi Istianatusyahri [a,4], Ranti Novianti [a,5*]

[a] Universitas Negeri Malang, Malang, Jawa Timur, Indonesia
[1] Nanda.viorella.220154@students.um.ac.id; [2] Siska.ferdina.220154@students.um.ac.id; [3] Robitul.umam.220154@students.um.ac.id; [4] ewi.istianatusyahri.220154@students.um.ac.id; [5] ranti.novianti.fip@um.ac.id *
* corresponding author

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ABSTRACT

Children with Autism Spectrum Disorder (ASD) often experience motor skill challenges attributed to low muscle tone, impaired postural control, motor planning deficits, and impaired coordination. These difficulties can impede their participation in their surroundings, affecting their attitudes and social interactions. Physical activity programs serve as a method not only to enhance the physical abilities of students with ASD but also to mitigate inappropriate behaviors and foster social skills. The participant in this study was a 12-year-old child with mild autism attending Anak Saleh Inclusive Elementary School in Malang City. The study aims to investigate the impact of a physical activity program on improving motor, social, and attitudinal skills among children with autism spectrum disorder in an inclusive school setting. Data collection involved command tests including throwing a ball, kicking a ball, and jumping, each of which was assigned a score. The research utilized a Single Subject Research (SSR) experimental method with an A-B design, and descriptive statistical techniques were employed for data analysis. The results revealed a significant effect of the physical motor activity program on enhancing the motor, social, and attitudinal abilities of autistic students, particularly evident in improved social interaction and physical capabilities such as recognizing emotions and increasing hand and foot muscle strength. However, it's important to note that the findings of this study may not be generalizable to all ASD students due to the limited sample size. Nonetheless, this study contributes to the advancement of intervention methods for children with autism.

1. Introduction

Autism Spectrum Disorder (ASD) comprises a complex array of neurological developmental disorders affecting brain function, characterized by impaired social interaction, delayed and/or limited communication skills, and stereotyped behavior patterns [1]–[3]. Children diagnosed with autism spectrum disorder exhibit deficits in the social communication domain, such as reduced eye contact, challenges with social reciprocity, and delays in both verbal and nonverbal communication [4]–[6]. Beyond the core diagnostic impairments, they also manifest various deficits across behavioral, cognitive, and perceptual-motor domains. Studies indicate that 79-83% of children with autism spectrum disorder demonstrate motor skills below age-

appropriate levels [7], [8]. Motor impairments among ASD children encompass poor visuomotor and bilateral coordination, as well as postural impairments affecting static and dynamic balance, thereby hindering activities such as kicking or catching a ball, balancing, and jumping [7], [9]–[11]. These difficulties arise from factors such as low muscle tone, impaired postural control and motor planning, and impaired coordination [12]–[14].

Children with autism receive educational services in both special schools and inclusive settings. Inclusive education aims to provide equal opportunities for students with disorders or special needs [15], [16]. An example of a school implementing inclusion programs is Anak Shaleh Inclusive Elementary School in Malang City. Observations reveal that children with autism encounter challenges in applying motor, social, and attitudinal skills, limiting their participation in various activities including peer interaction and other developmental activities. Consequently, there is a need for a physical activity program that can concurrently foster motor, attitudinal, and social skills. Zhao *et al,* highlight the significant role of physical activity in influencing various aspects of individuals' lives, particularly pertinent for children with autism spectrum disorders as it aids not only physical conditioning but also social and behavioral skill development [17].

The Physical Activity Program (IPA) serves as an effective intervention tool for enhancing communication and social interaction, vital for children with ASD. As per the National Autism Center [18], IPA not only improves the physical fitness of students with ASD but also mitigates inappropriate behaviors such as anger and self-harm while promoting positive behaviors including appropriate responses and accountability. Research indicates that participation of children with ASD in IPA activities alongside peers facilitates activity implementation, supports social skill development [19], and fosters motor proficiency [20]–[22].

2. Method

This study employs the Single Subject Research (SSR) method. Within this design, the measurement of target behaviors or behavior changes occurs repeatedly over a period of 14 days. The baseline condition (A) represents the period before treatment, while the intervention condition (B) signifies the period during treatment administration. In single subject research, a comparison is consistently drawn between the baseline phase (A) and at least one intervention phase (B). The participant in this study is a 12-year-old boy diagnosed with mild category 6 autism, identified as F. Observations and interviews conducted with teachers indicate behavioral aspects of the subject, including sufficient eye contact, attention, and obedience. However, there is a tendency for rapid distraction and difficulty in maintaining concentration. In terms of motor skills, the student exhibits challenges, particularly in balance, attributed to the structure of the soles of their feet. Socially, the student encounters difficulties initiating interactions with classmates and struggles to comprehend emotions such as sadness and anger. Test techniques are employed to assess the motor skills, attitudes, and behaviors of children before and after intervention through the issuance of commands to the subjects whose data is required.

3. Results and Discussion

The presented data stems from a research endeavor spanning 12 sessions, encompassing 4 sessions for baseline (A) and 8 sessions for intervention (B). During the baseline phase (A), assessments of motor skills were conducted alongside continuous observations of behavioral and social abilities for four sessions, devoid of intervention. Execution entailed issuing commands and evaluating the scale of feasibility, effectiveness, or ineffectiveness. Throughout the intervention phase (B), assessments of motor skills and observations of attitudes and social skills were carried out continuously for eight sessions subsequent to intervention implementation. Similar procedures were followed, involving command issuance and scale evaluation for feasibility and effectiveness. The research duration spanned from Monday, November 13, 2023, to Tuesday, November 28, 2023. The research findings are presented in Table 1. As depicted in Fig. 1, there is observable progress across the twelve sessions, signifying significant enhancements in the three assessed abilities compared to the subject's baseline performance. Initial development scores are detailed in Table 1, elucidating variations in children's abilities, including increments, decrements, and stagnation. Declines were attributed to both external and internal factors. External factors encompassed an unsupportive

environment and the influence of the child's condition, whereas internal factors included instances of boredom or illness.

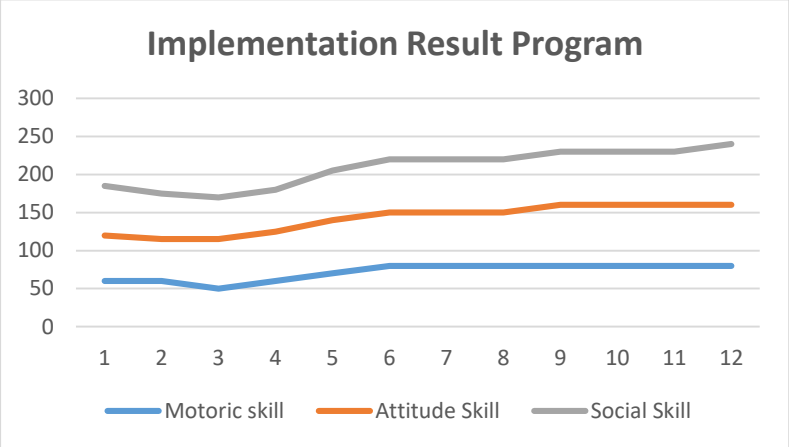

Fig. 1. Grafik Implementation Program

Based on Table 1 and Fig. 1, the data analysis results of motor skills, attitudes, and social conditions are presented for both the baseline phase (A) and intervention phase (B). The baseline phase comprises 4 sessions, while the intervention phase consists of 8 sessions. Directional trends depict changes in each dataset across sessions. In the baseline phase for motor skills (A), the trend line remains stagnant (=), indicating scores that tend to plateau from the initial to the final session. The stability trend calculation yields 75% for the baseline phase (A), indicating instability, and 87.5% for the intervention phase (B), indicating stability. The data trace confirms the stagnant trend in the baseline phase (A), followed by an upward trend in the intervention phase (B). Motor skill data in the baseline phase (A) steadily increases within a range of 50-60, while in the intervention phase (B), it rises consistently within a range of 70-80. The level of change in both phases displays a positive (+) sign, indicating improvement, yet the difference in results does not demonstrate a significant increase (remains stagnant).

Regarding attitude ability during the baseline phase (A), the trend line exhibits an increasing (+) trajectory, suggesting scores that escalate from the initial to the final session. Stability trend calculations indicate 75% instability for the baseline phase (A) and 87.5% stability for the intervention phase (B). The data trace confirms the increasing trend in the baseline phase (A), followed by a continued rise in the intervention phase (B). Attitude data in the baseline phase (A) steadily increases within a range of 60-65, while in the intervention phase (B), it climbs within a range of 70-80. The level of change in both phases demonstrates a positive (+) sign, indicating improvement, although the difference in results suggests a positive but insignificant change. In the baseline phase for social abilities (A), the trend line displays a decreasing (-) trend, implying scores that decline from the initial session to the final session. Stability trend calculations yield 75% instability for the baseline phase (A) and 87.5% stability for the intervention phase (B). The data trace confirms the decreasing trend in the baseline phase (A), followed by an upward trend in the intervention phase (B). Social ability data in the baseline phase (A) decreases steadily within a range of 55-65, while in the intervention phase (B), it increases within a range of 65-80. The level of change in the baseline phase (A) indicates a negative (-) sign, indicating a decrease, whereas in the intervention phase (B), it shows a positive (+) sign, suggesting an increase. However, the difference in results indicates that the effect of the change is positive but not significant.

Table 1. Development Score for Each Session

Aspects Of Ability	Baseline (A)				Interventiton (B)							
Motoric Ability	60	60	50	60	70	80	80	80	80	80	80	80
Attitude Ability	60	55	65	65	70	70	70	70	80	80	80	80
Social S Ability	65	60	55	55	65	70	70	70	70	70	70	80

Inter-condition analysis entails comparing two conditions, such as the baseline and intervention conditions. This analysis is conducted subsequent to achieving data stability. The results of the inter-condition analysis can be presented in the summary Table 2.

Table 2. Data Analysis Between Motor Ability Conditions

Data Changes Between Conditions	A/B
Number Of Variables Changed	1
Directional Trends And Effect	(=) (+)
Changes In Sabillity	Unstable to Stable
Level Change	(70-60) +10
Overlap Percentage	0%

In Table 2, depicting the results of the analysis between conditions of motor skills, it is evident that the directional trend, previously stagnant during the baseline (A) phase, increased upon transitioning to the intervention (B) phase. Moreover, the stability trend shifted from unstable to stable between the baseline (A) and intervention (B) phases. The level change from the baseline (A) to the intervention phase indicates an increase of +10. Notably, there is a 0% data overlap between the baseline (A) and intervention (B) phases, signifying a significant impact of the intervention on the target behavior. In Table 3, illustrating the analysis results between conditions of motor skills, the shift in direction between the baseline (A) and intervention (B) phases progresses from increasing to improving.

Table 3. Data Analysis Between Attitude Ability Conditions

Data Changes Between Conditions	A/B
Number Of Variables Changed	1
Directional Trends And Effect	(+) (+)
Changes In Sabillity	Unstable to Stable
Level Change	(70-65) +5
Overlap Percentage	0%

Additionally, the stability trend transforms from unstable to stable between the baseline (A) and intervention (B) phases. The level change from the baseline (A) to the intervention phase indicates an increase of +5. Notably, there is a 0% data overlap between the baseline (A) and intervention (B) phases, indicating that the intervention significantly influences the target behavior. In Table 4, illustrating the analysis results between conditions of motor skills, it is observed that the directional change between the baseline (A) and intervention (B) phases shifts from decreasing to increasing.

Table 4. Data Analysis Between Conditions of Social Ability

Data Changes Between Conditions	A/B
Number Of Variables Changed	1
Directional Trends And Effect	(+) (+)
Changes In Sabillity	Unstable to Stable
Level Change	(65-55) +10
Overlap Percentage	0%

Furthermore, the stability trend transitions from unstable to stable between the baseline (A) and intervention (B) phases. The level change from the baseline (A) to the intervention phase registers an increase of +10. Importantly, there is a 0% data overlap between the baseline (A) and intervention (B) phases, indicating a significant influence of the intervention on the target behavior.

3.1. Effect of Physical Activity Program on Motor Ability

Research investigating the impact of physical activity programs on the motor skills of students with autism indicates that such programs can enhance motor skills among students

with autism in inclusive school settings. This is evidenced by the assessment of motor skills tests conducted during baseline conditions (A) over 4 sessions, with scores recorded as 60, 60, 50, and 60. Subsequently, during the intervention phase (B) spanning 8 sessions, scores increased to 70, 80, 80, 80, 80, 80, 80, and 80. The stability percentage during the baseline phase (A) stands at 75%, indicating instability, while during the intervention phase (B), it increases to 87.5%, signifying stability. Moreover, the overlap percentage yields a result of 0%, indicating that the intervention of the physical activity program has a discernible influence on the motor skills of students with autism.

3.2. Effect of Physical Activity Program on Attitude Ability

Research on the impact of physical activity programs on the behavioral abilities of students with autism suggests that such programs can enhance the attitude abilities of students with autism in inclusive schools. This assertion is supported by the assessment of motor ability tests administered to students with autism during baseline conditions (A), where values obtained over 4 sessions were 60, 55, 65, and 65. Notably, during the intervention phase (B), there was an increase, with values of 70, 70, 70, 70, 80, 80, 80, across 8 sessions. The stability percentage during the baseline phase (A) was 75%, indicating instability, while during the intervention phase (B), it increased to 87.5%, indicating stability. Additionally, the overlap percentage yields a result of 0%, suggesting that the intervention of the activity program has an impact on the attitude abilities of students with autism.

3.3. Effect of Physical Activity Program on Social Ability

Research on the effect of physical activity programs on students' behavioral abilities among those with autism suggests that such programs can improve the attitude abilities of students with autism in inclusive schools. This improvement is evident in the assessment of motor ability tests for students with autism during baseline conditions (A) over 4 sessions, where the values obtained were 65, 60, 55, and 55. Subsequently, during the intervention phase (B), the values increased, with a sequence of 65, 70, 70, 70, 70, 70, and 80 across 8 sessions. The percentage of stability during the baseline phase (A) was 75%, indicating instability, while during the intervention phase (B), it increased to 87.5%, indicating stability. Additionally, the overlap percentage yields a result of 0%, signifying that the physical activity intervention program has an influence on the behavioral abilities of students with autism.

4. Conclusion

Based on the study results, it can be concluded that the physical activity program improves the motor skills, attitudes, and social abilities of students with autism spectrum disorders in inclusive schools. This conclusion is supported by the percentage increase observed in motor abilities from 75% in the baseline phase (A) to 87.5% in the intervention phase (B), with an overlap value of 0%. Similarly, attitude abilities increased from 75% in the baseline phase (A) to 87.5% in the intervention phase (B), with an overlap value of 0%. Social skills also showed improvement, increasing from 75% in the baseline phase (A) to 87.5% in the intervention phase (B), with a 0% overlap value. These findings suggest that the physical activity program could serve as an effective intervention method in learning to enhance motor, attitude, and social abilities among students with autism in the future.

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