Articles

Adapted Motor Activities for Hand-Eye Coordination in Level III Autism Spectrum Syndrome

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Abstract: Introduction: Hand-eye coordination is a relevant functional skill for the autonomy of people with level III autism spectrum syndrome because of their support needs in visuomotor integration, object manipulation, and participation in daily activities. Objective: To determine the observed changes in hand-eye coordination in an adolescent with level III autism spectrum syndrome after an adapted motor activity program. Materials and methods: A longitudinal case study with descriptive follow-up was conducted over 23 weeks. The participant was a 17-year- old adolescent. Measurements were applied before the intervention, at week 12, and at the end of the program using indicators of visuomotor precision, manual dexterity, and object coordination derived from the Bruininks-Oseretsky Test of Motor Proficiency, Second Edition; systematic observation of motor and socio-emotional performance was also recorded. Results: Manual dexterity increased from 14 to 21 points, and hand-eye coordination increased from 11 to 19 points. Progressive improvements were also observed in tracing, connecting dots, bouncing, throwing, and catching a ball, together with reduced external assistance, greater movement continuity, and better willingness to participate. Conclusions: The program documented descriptive progress in manual precision, visuomotor control, and functional autonomy. These findings support the relevance of structured and progressive adapted motor activities in individualized psychomotor interventions.

Keywords: Adapted physical activity; Autism spectrum disorder; Case study; Fine motor skills; Hand-eye coordination; Psychomotor skills

Introduction

Autism spectrum disorder is a neurodevelopmental condition characterized by heterogeneous support needs in communication, social interaction, adaptive behavior, and participation in daily activities. In cases requiring very substantial support, such as Level III, the difficulties are not limited to communication or behavior but may also compromise motor performance, functional autonomy, and interaction with the environment. Within this framework, eye-hand coordination acquires scientific and practical relevance because it enables the integration of visual information with manual action to reach, grasp, throw, catch, trace, manipulate objects, and engage in educational, recreational, and therapeutic tasks.

Eye-hand coordination involves visual perception, motor planning, postural control, temporal adjustment, and manual precision. Its development supports the execution of basic and school-related activities, while its limitations can restrict the active participation of children and adolescents with special educational needs. In individuals with Level III autism spectrum disorder, these difficulties often manifest as low grip precision, poor movement continuity, limited visual anticipation, problems regulating force, and a frequent need for physical or verbal support. Therefore, its assessment and intervention are relevant for adapted physical activity, psychomotor development, and special education. Previous studies have indicated that motor impairments are common in the population with autism spectrum disorder, affecting balance, coordination, manual dexterity, aiming, catching, and object control. A recent systematic review identified that the most commonly used instruments to assess motor coordination in this population include the Movement Assessment Battery for Children, the Bruininks-Oseretsky Test of Motor Proficiency, the Peabody Developmental Motor Scales, the Test of Gross Motor Development, and the Alberta Infant Motor Scale, highlighting the need for objective measurements tailored to individual characteristics (Piccolo et al., 2025). Furthermore, research on adapted physical activity, fine motor skills, and play-based activities in individuals with autism has shown that structured motor interventions can improve motor performance, task engagement, self-confidence, social interaction, and adaptation to routines. (Inamagua & Zambrano, 2024; Luarte, 2021; Martínez Díaz & Cañizares Hernández, 2023; Suárez-Manzano et al., 2024; Peñafiel, J. L. R., Valarezo, K. E. L., Medina, G. E., & Amable, N. H. (2026).

Despite these contributions, there remains an applied gap in the description of individualized programs specifically aimed at eye-hand coordination in adolescents with level III autism spectrum disorder. Much of the available evidence focuses on group samples, general physical activity interventions, or populations with lower support needs; therefore, case studies are still needed to document in detail the intervention process, activity content, methodological adjustments, and observed functional changes. This need is especially important in special education contexts, where planning must respond to the participant's learning pace, safety, motivation, emotional regulation, and communication. (Pardo-Guayanay, M. Y., & Arroyo-Vera, Z. J. (2026))

The present research is justified by its contribution to professional practice and the scientific community in the field of adapted physical activity. From a practical standpoint, it offers an organized proposal of motor activities that can guide teachers, therapists, and area professionals in the individualized care of adolescents with substantial support needs. From a scientific perspective, it provides descriptive evidence on the evolution of a real case, allowing recognition of which dimensions of eye-hand coordination show changes and which require greater emphasis in future interventions. In methodological terms, the study adopts a single-case longitudinal approach, with pre-intervention measurements, intermediate follow-up, and final evaluation, complemented by systematic observation of motor and socioemotional performance.

This study analyzes the impact of an adapted motor activities program on the eye-hand coordination of an adolescent with level III Autism Spectrum Disorder (ASD) at the Arnoldo Schwimmer Center, based on an initial diagnosis of severe limitations in object manipulation and motor persistence. Through a methodology based on initial assessment, the design of an organized and progressive intervention, and the evaluation of final performance, the research aims to determine the quantitative and qualitative changes in the participant's visuomotor precision. The results aim to validate the effectiveness of individual and adapted interventions to improve functional participation and the development of complex motor skills in individuals with high-dependency special educational needs.

Material and Method:

A longitudinal case study with a descriptive scope was developed, including pre-intervention, intermediate, and final measurements. The choice of this design responded to the need to understand the individual evolution of a participant with substantial support requirements, without formulating experimental hypotheses or making generalizable statistical inferences. The study combined ordinal quantitative records of motor performance with qualitative systematic observation, used to describe the level of assistance, continuity of movement, functional autonomy, and socioemotional response during sessions.

The participant was a 17-year-old male with a clinical diagnosis of level III autism spectrum disorder. He had a height of 176 cm and a weight of 81.6 kg. His primary needs were associated with limited verbal communication, reduced eye

contact, fluctuations in sustained attention, stereotyped behaviors, and the need for close support to participate in structured tasks. At the motor level, difficulties were observed in fine motor skills, eye-hand coordination, motor planning, manual precision, grip, throwing, and catching objects. The inclusion criterion was availability to participate in the program with family and institutional authorization; exclusion criteria included acute musculoskeletal injuries, medical contraindications for adapted physical activity, or repeated absence from sessions.

Techniques and instruments

The evaluation of eye-hand coordination was conducted through structured manual dexterity and upper limb coordination tasks, taken as a reference from the Bruininks-Oseretsky Test of Motor Proficiency, Second Edition. Indicators of visuomotor precision, tracing, dot-to-dot, paper folding, throwing, catching, and ball bouncing were recorded. The scores were interpreted descriptively, due to the nature of the case study.

Complementarily, a systematic observation guide was used to record the need for physical or verbal assistance, execution accuracy, continuity of movement, functional autonomy, social interaction, emotional expression, and disposition toward the task.

The procedure was organized into four phases. First, initial observation and pretest administration were carried out to establish the baseline of motor performance. Second, the adapted motor activities program was designed based on the identified needs and the principle of progression of complexity. Third, the intervention was implemented for 23 weeks, with three weekly sessions of 45 minutes each. Fourth, follow-up assessments were conducted at week 12 and at the end of the program, recording both performance scores and qualitative observations of motor and socioemotional evolution. During the assessment, brief pauses, verbal redirections, and demonstrations were allowed, when necessary, while striving to maintain the structure of the tasks and the participant's safety

Table 1

Structure of the adapted motor activities program

Phase	Weeks	Purpose	Main Activities	Applied Adaptations
Adaptation	1-6	Promote familiarization, task attention, and motor safety	Free and guided manipulation of soft balls; grasping and releasing large objects; moving hoops; fitting pieces; short-distance throwing; catching with balloons or lightweight balls	Brief instructions; visual demonstration; partial physical support; large, soft, high-contrast materials; sensory breaks
Consolidation	7-18	Increase visuomotor precision, bilateral coordination, and movement continuity.	Filling in figures; tracing straight, wavy, and curved paths; dot-to-dot; paper folding; one-handed ball bouncing; alternating bouncing; catching with both hands	Gradual reduction of assistance; increased distance; use of visual targets; structured repetition; immediate positive reinforcement

Maintenance and autonomy	19-23	Strengthen functional autonomy, temporal control, and transfer to more complex tasks	Throwing and catching circuits; aiming at targets; sequences of bouncing, passing, and catching; manipulation of small objects; combined precision and movement tasks	Greater independence; sequential instructions; controlled variation of materials; recording of achievements; gradual increase in demands

Note. The program was developed over 23 weeks, with three weekly sessions of 45 minutes each. Activities were individualized according to the participant's response.

Ethical considerations

The intervention was carried out with institutional authorization and informed consent from the participant's legal guardian. The confidentiality of personal data was protected, and the publication of information that would allow direct identification of the adolescent was avoided. Activities were adapted to minimize physical risks, respect individual pace, and suspend or modify tasks upon signs of fatigue, anxiety, or refusal. The study was oriented toward educational and therapeutic purposes, with no invasive procedures.

Data analysis

Quantitative data were analyzed through descriptive comparison of scores between the pretest, intermediate posttest, and final posttest. No statistical significance tests were applied, as the sample corresponded to a single case. Qualitative information was organized by dimensions of motor and socioemotional performance, identifying changes in level of assistance, precision, continuity, autonomy, participation, and interaction.

5) Results

The results are presented in a logical sequence: first the baseline of motor performance, then the changes recorded in the follow-up assessments, and finally the behavioral and socioemotional evolution observed during the program. To avoid duplication of information, the use of descriptive tables was prioritized, and the graph that repeated the data from the scores table.

Table 2

Descriptive scores in manual dexterity and eye-hand coordination

Evaluated dimension	Pretest	Final posttest	Observed change
Manual dexterity	14 points	21 points	+7 points
Eye-hand coordination	11 points	19 points	+8 points

Note. Scores are interpreted descriptively as this is a case study. No statistical inferences were made.

In the initial assessment, the participant showed low performance in precision tasks, object manipulation, and ball coordination. After the intervention, manual dexterity increased from 14 to 21 points, and eye-hand coordination from 11 to 19 points. These changes suggest an observable improvement in the ability to direct the hand based on visual information, regulate movement trajectory, and perform catching, throwing, and manipulation tasks with greater control.

Table 3

Follow-up of eye-hand coordination indicators

Indicator	Pretest	Week 12 posttest	Final posttest
Circle filling	1	1	3
Star filling	1	1	2
Tracing along a winding path	2	3	4
Tracing along a curved path	2	2	4

Dot connection	1	2	3
Paper folding	3	3	3
Releasing and catching a ball with both hands	3	5	10
Catching a thrown ball with both hands	3	6	9
Releasing and catching a ball with one hand	5	5	10
Catching a thrown ball with one hand	2	6	4
Bouncing a ball with one hand	4	7	8
Bouncing a ball alternating hands	3	6	8
Throwing a ball at a target	3	3	3

Note. The notation of the original table was standardized to facilitate reading. The target throwing indicator remained stable, suggesting a need to reinforce aiming and force control in future interventions.

The progression by indicator showed gradual improvements. At week 12, initial improvements were observed in tracing, dot connection, catching, and ball bouncing. In the final posttest, increases were more evident in curved and winding tracings, figure filling, and ball handling with one and both hands. Paper folding and target throwing remained stable, indicating that some fine precision and aiming tasks require longer intervention time or more specific difficulty-grading strategies.

Table 4

Behavioral and socio-emotional changes during the intervention

Dimension	Initial Sessions	Final Sessions	Observed Change
Social interaction	Little interaction, avoided eye contact, and did not initiate communication.	Greater eye contact, spontaneous attempts at communication, and better response to adults.	Improvement in functional interaction.
Participation	Minimal participation, insecurity, and need for constant guidance.	Active participation, greater willingness, and execution with reduced support.	Increase in motivation and autonomy.
Emotional Expression	Shyness, anxiety with new exercises, and low expressiveness.	Greater calmness, confidence, and tolerance for new tasks.	Improved emotional regulation.
Following instructions	Difficulty with complex instructions and need for frequent repetition.	Better response to short sequences and familiar routines.	Greater adaptation to session structure.
General Attitude	Passive and withdrawn attitude.	Collaborative, active, and motivated attitude.	Positive change in general disposition.

Note. The qualitative information comes from systematic observation conducted during the sessions.

The socio-emotional changes accompanied the motor development. During the initial sessions, the participant required frequent physical and verbal guidance, avoided new exercises, and showed anxiety with coordination tasks. In the final sessions, greater confidence, better tolerance of instructions, a positive attitude, and reduced need for support were observed. These findings are relevant because motor intervention, in addition to stimulating manual skills, can become a means of behavioral organization and social participation when applied with predictable routines, positive reinforcement, and individualized progression. Among the study's limitations are the inclusion of a single participant, the absence of a control group, the descriptive interpretation of scores, and the possible influence of contextual factors such as familiarity with the evaluator, motivation, emotional state, and attendance at sessions.

Also identified as a limitation is the need to strengthen indicators that remained stable, especially throwing at a target. As a future perspective, it is recommended to apply the program in case series or quasi-experimental designs, extend the follow-up duration, incorporate maintenance assessment, and compare results with complementary standardized instruments and records of functional participation in activities of daily living.

Conclusions

The participant's initial level of eye-hand coordination showed limitations in visuomotor precision, object manipulation, catching, bouncing, and throwing, which justified the need for an adapted and individualized motor intervention.

The adapted motor activities program was characterized by a progressive three-phase structure, use of safe and high-contrast materials, brief instructions, visual supports, and gradual reduction of assistance. These features allowed tasks to be adjusted to the participant's learning pace and favored their continuity within the sessions.

During program implementation, improvements were observed in tracing, dot connection, figure filling, ball bouncing and catching, as well as a progressive decrease in the required physical and verbal support. Advances were also recorded in participation, self-confidence, emotional regulation, and functional interaction.

The final assessment showed descriptive increases in manual dexterity, from 14 to 21 points, and in eye-hand coordination, from 11 to 19 points.

These results allow concluding that the program was associated with positive and observable changes in the motor performance of the case studied**,** although they do not authorize causal generalizations because it involves a single participant.

The developed experience provides a practical route for physical education, psychomotor, and special education professionals interested in designing individualized interventions aimed at eye-hand coordination in individuals with autism spectrum disorder level III.

References

Inamagua, S., & Zambrano, W. (2024). Las actividades lúdicas en el desarrollo de la motricidad fina en los niños con trastorno del espectro autista en el nivel de inicial II. LATAM *Revista Latinoamericana de Ciencias Sociales y Humanidades,* 5(2). https://doi.org/10.56712/latam.v5i2.2009

Luarte, C. (2021). Desarrollo motor en niños escolares de 5-12 años con trastornos del espectro autista: Una revisión sistemática. *Revista Peruana de Ciencia de la Actividad Física y del Deporte*, 8(3), 10. https://doi.org/10.53820/rpcafd.v8i3.151

Llivichuzhca, P. C., & Gómez, J. A. (2026). Coordinación visomotriz: factores que predisponen la disgrafía en niños de siete años. Mamakuna: revista de divulgación de experiencias pedagógicas, (26), 56-67 https://revistas.unae.edu.ec/index.php/mamakuna/article/view/1240

Martínez Díaz, Y., & Cañizares Hernández, M. (2023). La motricidad fina en niños con trastorno del espectro autista. *Cuerpo, Cultura y Movimiento,* 14(1). https://doi.org/10.15332/2422474X.9875

Pardo-Guayanay, M. Y., & Arroyo-Vera, Z. J. (2026). Sistema de actividades recreativas para fortalecer el desarrollo de la motricidad gruesa en niños de 3 a 4 años. *Revista científica multidisciplinaria arbitrada YACHASUN*-ISSN: 2697-3456, 10(18), 1219-1241. https://www.editorialibkn.com/index.php/Yachasun/article/view/931

Peñafiel, J. L. R., Valarezo, K. E. L., Medina, G. E., & Amable, N. H. (2026). Uso de dispositivos móviles en el desarrollo de la coordinación visomotora en niños de 4 años. Ciencia y Educación, 7(1), 186-201. https://cienciayeducacion.com/index.php/journal/article/view/2203

Piccolo, A., Raciti, C., Scarcara, M., Monaco, S., Muratore, R., De Domenico, C., Fulgenzi, A., Settimo, C., Quartarone, A., Cucinotta, F., & Alito, A. (2025). Motor coordination assessment in autism spectrum disorder: A systematic review. Diagnostics, *MDPI* 15(17), 2118. https://doi.org/10.3390/diagnostics15172118

Rizzo, J. R., Beheshti, M., Naeimi, T., Feiz, F., Fatterpekar, G., Balcer, L. J., Galetta, S. L., Shaikh, A. G., Rucker, J. C., & Hudson, T. E. (2020). The complexity of eye-hand coordination: A perspective on cortico-cerebellar cooperation. *Cerebellum & Ataxias*, 7, 1. https://doi.org/10.1186/s40673-020-00121-1

Suárez-Manzano, S., Ruiz-Ariza, A., Marques de Loureiro, N. E., & Martínez-López, E. J. (2024). Effects of physical activity on cognition, behavior, and motor skills in youth with autism spectrum disorder: A systematic review of intervention studies. *Behavioral Sciences,* 14(4), 330. https://doi.org/10.3390/bs14040330

Tomalá, S. L. V., Montenegro, J. A. C., & Burgos, S. A. T. (2026). El juego de lanzar y atrapar pelotas como mediador del desarrollo de la coordinación óculo-manual en niños de 5 años. Ciencia y Educación, 7(4), 138-155. https://cienciayeducacion.com/index.php/journal/article/view/2603

Statement of conflicts of interest

The authors declare that there are no conflicts of interest related to the content of this article.

Statement of author contributions

Rous Anahi Huanca Callejas participated in the conception of the study, design and implementation of the adapted motor activities program, data recording, descriptive analysis, and initial drafting of the manuscript. Daniel Omar Ajhuacho Chambi participated in the methodological guidance, critical review of the content, organization of results, academic revision of the manuscript, and approval of the final version.