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Psychomotor clumsiness as a factor affecting the social behavior of children with autism spectrum disorder

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Abstract

Introduction: The concern with the psychomotor clumsiness of children with ASD and the assessment of it by teachers is a result of the lack of relevant research, not only in Greece but more generally. That is, there is no research that examines the different parameters of psychomotor skill as a whole, and this gap is addressed by the present research.

Aim: The investigation of the current psychomotor clumsiness of children with ASD as a factor in their social behavior.

Methodology: The research questionnaire consists of 2 sections. The first section concerns the Motor Control Scale for measuring psychomotor skill (Movement Assessment Battery) and the second the Social Behavior Checklist in Symbolic Play (Sherrill, UVA-ARE). The research sample consists of 153 teachers who were selected using the convenience sample method.

Results: Psychomotor skill affects the social behavior of children with autism spectrum disorder.

Conclusions: The formulation of interventions is proposed in order to enhance the social behavior of children with autism spectrum disorder.

Keywords: Psychomotor Clumsiness; Autism Spectrum Disorder; Social Behavior; Digital Technologies; Rehabilitation

1. Introduction

The rates of autism spectrum disorder (ASD) appear to have increased in recent decades. This does not necessarily mean that there is an increase, but that their diagnosis and the attitude of families have improved. More specifically, ASD is now treated with new diagnostic tools due to the development in modern medicine and psychology as well as technology. This has resulted in disorders belonging to the autistic spectrum now being distinguished and better understood. Similarly, the fact that families are now speaking more openly about the problems they face also plays an important role. It is also an issue that has widely concerned the scientific community. ASD creates significant deficits and difficulties, some of which can be addressed with appropriate interventions. This is the reason why there is intense research activity regarding various interventions that can contribute both to the general development of children and to their better academic performance.

At the school level, teachers play an important role in addressing the deficits and difficulties of children with ASD. They are the ones who are called upon to identify the deficits that exist as well as the way they should manage them. This requires knowledge and skills on their part, while the way they perceive ASD is also important. Teachers who believe

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that the deficits of ASD are not manageable and treatable and have negative perceptions of the abilities of these children will not attempt to formulate and adopt interventions that contribute to their progress and development. On the contrary, teachers who believe that they can utilize the children's potential in order to compensate for their deficits and allow them to develop in line with their peers will attempt more and more interventions (Voulgaris, 2020; 2023; 2024; Voulgaris and Draga, 2023; Voulgaris, Draga, and Dragas, 2022). This is why the research activity focuses both on the perceptions of teachers and on the interventions that they can implement for children with ASD.

The concern with the psychomotor clumsiness of children with ASD and the assessment of this by teachers is a result of the lack of relevant research not only in Greece but in general. That is, there is no research that examines the different parameters of psychomotor skills as a whole and this gap is addressed by the present research. The purpose of the present research is to present the current psychomotor clumsiness of children in relation to their social behavior and in particular the sections on Autistic behavior, Exploratory behavior, Parallel behavior, Companion behavior and Cooperative behavior.

2. Theoretical background

Autism spectrum disorder (ASD) is a heterogeneous neurodevelopmental syndrome characterized by persistent deficits in social communication and social interaction across multiple contexts and restricted, repetitive patterns of behavior, interest, or activities (APA, 2013). Individuals with ASD exhibit great heterogeneity in phenotype, severity, and type and frequency of symptoms. Furthermore, symptoms may change within an individual over the course of development (Hill and Frith, 2003; Wing, 1997). However, as originally stated by Kanner, and still relevant today, the prominent, fundamental impairment is the inability of children to relate in the usual way to people and situations from the beginning of their lives. This statement is supported by recent research showing that of the triad of symptoms, social impairments are the most consistent symptom not only in children, but also in adolescents, adults, and the elderly, and across all developmental levels (Shattuck et al., 2007). As such, they are considered more central and persistent than the other core symptoms of autism (James et al., 2006; Seltzer et al., 2004; Shattuck et al., 2007). These social impairments are typically manifested in abnormalities in reciprocal interactions and difficulties in expressing and recognizing emotions (Budinger, 2002). Although social difficulties are independent of age and developmental level, their impact may increase disproportionately during adolescence (Nicpon et al., 2010; Pellicano, 2010). Compared to children, adolescents are more social and form more complex relationships with their peers. The creation of social networks contributes to the development of their identity and affects their self-esteem. Adolescents are also more sensitive to acceptance and rejection by their peers (Blakemore, 2008; Steinberg and Morris, 2001). That is, during this developmental period, the opinions and evaluations of peers become increasingly salient, and many adolescents with ASD begin to notice how they differ from their peers (Burnett et al., 2009; Crone and Dahl, 2012; Steinberg, 2005).

This is particularly notable in high-functioning adolescents with ASD, as they, more than their low-functioning peers, seek out and initiate social interaction with others (Budinger et al., 2003; Hauck et al., 1995). The results of this can be found in the development of anxiety or mood disorders and feelings of social isolation (the perceived lack of social engagement with peers) in high-functioning adolescents with ASD (Budinger, 2002; White et al., 2009; White and Roberson-Nay, 2009). Thus, despite the general assumption of social isolation in ASD, these reports of loneliness and the relatively high degree to which high-functioning adolescents with ASD initiate social interactions with peers (Budinger et al., 2003) indicate that they want to participate in more fulfilling social relationships. Despite the differential impact of social impairments at different stages of development, numerous studies have been conducted on the underlying mechanisms of social impairments in younger children with ASD or in adolescents with ASD with low to average levels of intelligence, but only limited research has been done on social-cognitive functioning in high-functioning adolescents with ASD with high average to above average intellectual functioning.

For social interaction to be successful, it is essential to understand another person’s emotions, intentions, beliefs, and knowledge (David et al., 2010). This information is required to predict another person's behavior and to adjust one's own behavior accordingly. The ability to attribute and understand the mental states of others and to recognize that these states may differ is called "mental thinking" or having a theory of mind (Baron Cohen et al., 1985; Vollm et al., 2006). This ability depends on a number of lower-level mechanisms, such as face and emotion processing, gaze direction, and vitality detection, as well as on higher-level executive functioning mechanisms such as attention and working memory (Stone and Gerrans, 2006). Of these, the human face and its emotional expressions in particular play an important role as they are a significant source of information about the person's internal state. Developmental trajectories reach near-adult levels around age eleven, with further improvement in these skills during adolescence and throughout adulthood (Baron-Cohen et al., 1985; Brune and Brune-Cohrs, 2006).

3. Methodology

3.1. Research design

This research was designed with the aim of systematically investigating children's psychomotor clumsiness and social behavior, through observation and evaluation in different units and environments.

3.2. Questionnaire

The survey questionnaire consists of 2 sections. The first section concerns the Movement Control Scale for measuring psychomotor skills (Movement Assessment Battery) and the second the Social Behavior Checklist in Symbolic Play (Sherrill, UVA-ARE). The Movement Control Scale includes 48 questions organized on a four-point Likert scale, which assess the ability of the individual to perform motor activities in various environments. The questions are divided into four sections that reflect different combinations of child movement and environmental stability: Child Still/Environment Stable, Child Moving/Environment Stable, Child Still/Environment Changing and Child Moving/Environment Changing. Each section aims at the detailed analysis and recording of psychomotor skills, such as coordination, balance and reaction to changing conditions.

The second section, Social Behavior in Symbolic Play, includes 35 questions organized into five sections. Each section examines different aspects of social interaction, which are fundamental to the development of play and cooperation skills. The sections include: Autistic Behavior (e.g., limited interaction or monotony in movements), Exploratory Behavior (exploratory and experimental behaviors), Parallel Behavior (observing other children without direct interaction), Companionship Behavior (exchange and coordination of actions with others), and Cooperative Behavior (teamwork and cooperation to achieve a common goal). The questions are formulated in a way that allows for the observation and assessment of the child's natural behavior in real-world settings.

3.3. Sample and data collection

The research sample consists of 153 teachers selected using the convenience sampling method. Participants come from various geographical regions of Greece, including Epirus, Macedonia, Central Greece and Peloponnese, the Ionian and Aegean Islands, as well as Crete. Data collection was carried out via an electronic questionnaire, which was distributed to teachers of various levels. The use of this specific distribution method allowed for quick and wide access to participants, while at the same time facilitating the completion of the questionnaire at a time and place convenient for each teacher. The choice of the convenience sample allows for direct access to teachers who were willing to participate in the research, although it may limit the generalizability of the findings. Nevertheless, the geographical range of participants provides a satisfactory distribution of opinions from different regions of the country.

The data collection process in this study was carried out through an electronic questionnaire, which was sent to the 153 teachers who participated in the study. The questionnaire was designed in such a way as to cover the main variables of the research, such as psychomotor clumsiness, social behavior and self-esteem of children. Participants were informed about the purpose of the research and the anonymity of their responses through an accompanying message. The questionnaires were completed in electronic format, allowing participants to complete it at a time and place that was convenient for them. This process ensured ease and comfort for the participants, while at the same time facilitating the collection of data on a large scale. The data were collected and stored securely, ensuring the confidentiality and anonymity of the participants. The data analysis was carried out using statistical methods to draw the appropriate conclusions regarding the research questions.

3.4. Data collection and ethical issues

The objectivity of the research was ensured through the systematic use of standardized tools, such as questionnaires for psychomotor clumsiness and social behavior, which are scientifically documented and reliable. Data were collected and analyzed with statistical tools, avoiding personal biases or interference by the researchers. The rules of ethics and deontology were observed throughout the research. Participants were fully informed about the purpose and procedure of the study through an information sheet and freely provided their consent before participation. Anonymity and confidentiality were ensured for all responses, while the data were used exclusively for research purposes. In addition, the study complied with the principles of research ethics, avoiding any burden or pressure on the participants. The research protocol was approved by a competent ethics body, ensuring compliance with all regulations. Thus, the research was conducted with respect for the participants and high ethical standards.

3.5. Statistical data analysis

Descriptive statistics were applied to summarize the characteristics of the sample and the main variables. Means, standard deviations, frequencies and percentages were calculated to provide a clear picture of the demographic and professional characteristics of the participants as well as the estimates for the research variables.

4. Results

4.1. Psychomotor clumsiness

4.1.1. Child Still/Environment Stable

Table 1 lists the questions that concern the child's psychomotor skills when he is stationary and the environment is stable. The results show that high levels of skill are observed in holding objects correctly (69.94%, M.O.= 1.95, T.A.= 0.79), in dressing himself (66.66%, M.O.= 1.89, T.A.= 0.91) and in holding small objects (cubes, etc.) correctly (68.63%, M.O.= 1.85, T.A.= 0.82). Moderate to high levels of psychomotor skills were observed in the recognition of body parts and the correct use of the left and right parts of the body (64.05%, M.O.= 1.84, T.A.= 0.88), in autonomy regarding personal hygiene (63.40%, M.O.= 1.84, T.A.= 0.85), in the use of cubes and puzzle pieces to achieve a goal (61.44%, M.O.= 1.80, T.A.= 0.83), in changing pages of the book and correctly holding an A4 piece of paper (62.74%, M.O.= 1.78, T.A.= 0.91) and in adopting a correct posture when standing (64.70%, M.O.= 1.76, T.A.= 0.75). Moderate levels of psychomotor skills were observed in the formation of letters, numbers and shapes (55.55%, M.O.= 1.65, T.A.= 0.92), in being able to stand on one leg while getting dressed (54.90%, M.O.= 1.56, T.A.= 0.89) and in accuracy in using and drawing on outlines (50.33%, M.O.= 1.54, T.A.= 0.87). Finally, lower levels of psychomotor skills were observed in the ability to tie shoelaces and button buttons correctly (31.37%, M.O.= 1.09, T.A.= 0.96).

Table 1 Child Still/Environment Stable

Questions	Mean	SD	Not at all	Fairly	Quite well	Very well
6. Holding objects correctly.	1.95	0.79	1.96%	28.10%	43.14%	26.80%
4. Can put on his/her own clothes.	1.89	0.91	7.19%	26.14%	37.25%	29.41%
12. Holding small objects correctly (blocks, etc.).	1.85	0.82	5.23%	26.14%	47.06%	21.57%
3. Recognizing body parts and using the left and right sides of the body correctly.	1.84	0.88	5.88%	30.07%	37.91%	26.14%
5. Autonomy regarding personal hygiene.	1.84	0.85	4.58%	32.03%	38.56%	24.84%
11. Using blocks and puzzle pieces to achieve a goal.	1.80	0.83	3.92%	34.64%	39.22%	22.22%
9. Turning pages of a book and holding an A4 piece of paper correctly.	1.78	0.91	8.50%	28.76%	38.56%	24.18%
7. Adopting correct posture when standing.	1.76	0.75	3.92%	31.37%	49.67%	15.03%
8. Forming letters, numbers and shapes.	1.65	0.92	10.46%	33.99%	35.29%	20.26%
1. Can stand on one leg while getting dressed.	1.56	0.89	13.07%	32.03%	40.52%	14.38%
2. Accuracy in use and drawing on outlines.	1.54	0.87	11.11%	38.56%	35.95%	14.38%
10. Tying laces and buttoning buttons correctly.	1.09	0.96	32.03%	36.60%	21.57%	9.80%

Source: Tsodoulos, 2024

4.1.2. Child Moving/Environment Stable

Table 2 lists the questions that concern the child's psychomotor skills, when the child is moving and the environment is stable. The results show that high levels of psychomotor skills were observed regarding movement in the classroom without "falling" on other students or objects (71.24%, M.O.= 1.92, T.A.= 0.84), understanding directional commands, such as inside-out, up-down, etc. (69.28%, M.O.= 1.89, T.A.= 0.81) and transporting objects within the classroom without "falling" on other students or objects (70.59%, M.O.= 1.85, T.A.= 0.84). Moderate to high levels of psychomotor skill were observed in running and stopping to avoid objects (63.40%, M.O.= 1.76, S.A.= 0.78). Moderate levels of psychomotor

skill were observed in moving comfortably between obstacles (55.55%, M.O.= 1.58, T.A.= 0.77), in running and kicking a large fixed ball (51.63%, M.O.= 1.55, T.A.= 0.84), in throwing an object, when moving above the shoulder (47.71%, M.O.= 1.52, T.A.= 0.80), in bouncing on each foot (50.98%, M.O.= 1.51, T.A.= 0.79), in throwing an object, when moving below the shoulder (46.40% M.O.= 1.48, T.A.= 0.79) and in the ability to limp for a few meters (42.49%, M.O.= 1.36, T.A.= 0.89). Moderate to low levels of psychomotor skills were observed in the ability to use gym equipment (balance beam, etc.) (39.87%, M.O.= 1.29, T.A.= 0.89), as well as to jump comfortably over obstacles (35.95%, M.O.= 1.24, T.A.= 0.87).

Table 2 Child Moving/Environment Stable

Questions	Mean	SD	Not at all	Fairly	Quite well	Verywell
23. Circulation in the classroom without "falling" on other students or objects.	1.92	0.84	5.23%	23.53%	45.10%	26.14%
17. Understanding directional commands such as in-out, up-down, etc.	1.89	0.81	3.92%	26.80%	45.75%	23.53%
22. Carrying objects within the classroom without "falling" on other students or objects.	1.85	0.84	7.19%	22.22%	49.02%	21.57%
24. Running and stopping to avoid objects.	1.76	0.78	3.92%	32.68%	46.41%	16.99%
18. Moving comfortably between obstacles.	1.58	0.77	7.19%	37.25%	45.75%	9.80%
13. Running and kicking a large, stable ball.	1.55	0.84	9.80%	38.56%	38.56%	13.07%
15. Throwing an object while moving over the shoulder.	1.52	0.80	7.19%	45.10%	35.95%	11.76%
16. Bouncing on each foot.	1.51	0.79	9.15%	39.87%	41.83%	9.15%
14. Throwing an object while moving under the shoulder.	1.48	0.79	8.50%	45.10%	36.60%	9.80%
20. Being able to limp for a few meters.	1.36	0.89	16.99%	40.52%	32.03%	10.46%
19. Using gym equipment (barbell, etc.).	1.29	0.89	19.61%	40.52%	30.72%	9.15%
21. Jumping over obstacles with ease.	1.24	0.87	20.26%	43.79%	27.45%	8.50%

Source: Tsodoulos, 2024

4.1.3. Child Still/Environment Changing

Table 3 lists the questions that concern the child's psychomotor skills when the child is stationary and the environment is changing. High levels of psychomotor skill were observed in the child's ability to give objects to children standing next to each other (79.09%, M.O.= 2.00, SD= 0.81). Moderate levels of psychomotor skills were observed in the child's ability to kick a ball with the bottom of the foot (not with a stick) (54.25%, M.O.= 1.61, T.A.= 0.82), to catch a moving ball with both hands (52.29%, M.O.= 1.56, T.A.= 0.78), to clap to the rhythm of music (49.67%, M.O.= 1.50, T.A.= 0.84), to maintain a stable position while exercising (49.68%, M.O.= 1.46, T.A.= 0.86), to throw a ball to a moving child (49.67%, M.O.= 1.43, T.A.= 0.83), to stop moving objects before they reach the child's feet (54.25%, M.O.= 1.61, T.A.= 0.82), to catch a moving ball with both hands (52.29%, M.O.= 1.56, T.A.= 0.78), to clap to the rhythm of music (49.67%, M.O.= 1.50, T.A.= 0.84), to hold a steady position while exercising (49.68%, M.O.= 1.46, T.A.= 0.86), to throw a ball to a moving child (49.67%, M.O.= 1.43, T.A.= 0.83), to stop moving objects before they reach the child's feet (54.25%, M.O.= 1.61, T.A.= 0.82), to catch a moving ball with both hands (52.29%, M.O.= 1.56, T.A.= 0.78), to catch a moving ball with both hands (52.29%, M.O.= 1.56, T. to their destination (44.44%, M.O.= 1.43, T.A.= 0.76) and dribbling a ball at rest (41.18%, M.O.= 1.24, T.A.= 0.89). Moderate to low levels of psychomotor skills were observed in the correct rolling of the ball so that the child who is in motion can catch it (37.26%, M.O.= 1.22, T.A.= 0.81). Finally, low levels of psychomotor skills were observed in hitting a ball with a racket as it moves (28.11%, M.O.= 1.07, T.A.= 0.82), in turning a rope correctly so that other children can jump over it and avoid it (26.80% M.O.= 1.05, T.A.= 0.85), as well as catching a moving ball with one hand (25.49%, M.O.= 1.03, T.A.= 0.87).

Table 3 Child Still/Environment Changing

Questions	Mean	SD	Not at all	Fairly	Quite well	Very well
33. Give objects to children standing next to each other.	2.00	0.81	5.88%	15.03%	52.29%	26.80%
27. Kick a ball with the bottom of the foot (not with a stick).	1.61	0.82	7.19%	38.56%	39.87%	14.38%
32. Catch a moving ball with both hands.	1.56	0.78	7.19%	40.52%	41.18%	11.11%
29. Clap hands to the beat of the music.	1.50	0.84	11.11%	39.22%	37.91%	11.76%
34. Maintain a steady position while exercising.	1.46	0.86	13.73%	36.60%	39.22%	10.46%
30. Throw a ball to a moving child.	1.43	0.83	14.38%	35.95%	41.83%	7.84%
26. Stop moving objects before they reach their destination.	1.42	0.76	9.15%	46.41%	37.25%	7.19%
25. Dribble a stationary ball.	1.24	0.89	23.53%	35.29%	34.64%	6.54%
36. Roll the ball correctly so that the moving child can catch it.	1.22	0.81	19.61%	43.14%	32.68%	4.58%
28. Hit a ball with a racket as it moves.	1.07	0.82	26.14%	45.75%	23.53%	4.58%
35. To turn a rope correctly so that other children can jump over it and avoid it.	1.05	0.85	27.45%	45.75%	20.92%	5.88%
31. To catch a moving ball with one hand.	1.03	0.87	29.41%	45.10%	18.95%	6.54%

Source: Tsodoulos, 2024

4.1.4. Child Moving/Environment Changing

Table 4 lists the questions that concern the child's psychomotor skills when the child moves and the environment changes. High levels of psychomotor skills were observed in moving around school without "falling" on other people (69.94%, M.O.= 1.90, S.D.= 0.83) and in pushing a stroller (67.33%, M.O.= 1.83, S.D.= 0.82). Moderate to high levels of psychomotor skills were observed in the use of moving vehicles (64.71%, M.O.= 1.78, T.A.= 0.84), in running to catch a ball (65.36%, M.O.= 1.75, T.A.= 0.85) and in the use of a swing or other moving instruments, without assistance (60.13%, M.O.= 1.73, T.A.= 0.92). Moderate levels of psychomotor skills were observed in participation in chasing (58.17%, M.O.= 1.63, T.A.= 0.98), in running to kick a ball (55.55%, M.O.= 1.62, T.A.= 0.84), in moving in various directions based on musical rhythm (47.06%, M.O.= 1.44, T.A.= 0.87) and in participation in group games (41.18%, M.O.= 1.36, T.A.= 0.91). Low levels of psychomotor skill were observed as they move while dribbling a ball (33.99%, M.O.= 1.17, T.A.= 0.86), run to block a ball approaching with a racket (33.34%, M.O.= 1.10, T.A.= 0.90), as well as when they move to play correctly on the rope (28.76%, M.O.= 1.05, T.A.= 0.84).

Table 4 Child Moving/Environment Changing

Questions	Mean	SD	Not at all	Fairly	Quite well	Very well
45.Movement in school without "falling" on other people.	1.90	0.83	4.58%	25.49%	45.10%	24.84%
38.Pushing a stroller.	1.83	0.82	5.23%	27.45%	46.41%	20.92%
44.Use of moving vehicles	1.78	0.84	6.54%	28.76%	45.10%	19.61%
42.Run to catch a ball.	1.75	0.85	8.50%	26.14%	47.71%	17.65%
46.Use of a swing or other moving instruments without help.	1.73	0.92	9.80%	30.07%	37.91%	22.22%
37.Participate in a chase.	1.63	0.98	15.69%	26.14%	37.91%	20.26%
43.Run to kick a ball.	1.62	0.84	8.50%	35.95%	40.52%	15.03%

41.Move in different directions based on the musical rhythm.	1.44	0.87	13.73%	39.22%	35.95%	11.11%
47.Participate in team games.	1.36	0.91	17.65%	41.18%	28.76%	12.42%
39.Movement while dribbling a ball.	1.17	0.86	23.53%	42.48%	27.45%	6.54%
48.Run to block a ball approaching with a racket.	1.10	0.90	29.41%	37.25%	26.80%	6.54%
40.Movement to play the rope correctly.	1.05	0.84	28.10%	43.14%	24.18%	4.58%

4.2. Social behavior scale

4.2.1. Autistic behavior

Table 5 lists the questions regarding the child's autistic behavior. The results show that most of the time or always they display stereotypical behaviors (72.55%, M.O.= 3.01, T.A.= 0.86), need motivation to play (64.70%, M.O.= 2.84, T.A.= 0.97) and move around for no reason (64.06%, M.O.= 2.78, T.A.= 0.94). In addition, slightly more than half of them frequently do things for no reason (hands, mouth, hitting, etc.) (58.17% M.O.= 2.73, T.A.= 0.94), while less than half show a lack of preference for people (40.52%, M.O.= 2.24, T.A.= 0.86). Finally, the minority shows a lack of response to stimuli (18.30%, M.O.= 1.95, T.A.= 0.71), self-irritation (26.80% M.O.= 1.94, T.A.= 0.94), as well as self-harm (14.38%, M.O.= 1.61, T.A.= 0.81).

Table 5 Autistic behavior

Questions	Mean	SD	Rarely-Never	Sometimes	More often	Always
6. Appearance of stereotypical behaviors.	3.01	0.86	4.58%	22.88%	39.87%	32.68%
9. Needs motivation to play.	2.84	0.97	10.46%	24.84%	35.29%	29.41%
7. Moves around for no reason.	2.78	0.94	10.46%	25.49%	39.22%	24.84%
10. Does things for no reason (hands, mouth, hitting, etc.)	2.73	0.94	9.80%	32.03%	33.99%	24.18%
8. Lack of preference for people.	2.24	0.86	22.22%	37.25%	35.29%	5.23%
2. Does not respond to stimuli.	1.95	0.71	25.49%	56.21%	16.34%	1.96%
5. Self-irritation.	1.94	0.94	39.87%	33.33%	19.61%	7.19%
1. Self-injures.	1.61	0.81	56.21%	29.41%	11.11%	3.27%

4.2.2. Exploratory behavior

Table 6 lists the questions that examine the child's exploratory behavior. The results show that most of the time or always they can perceive when an object is stable (68.62%, M.O.= 2.97, T.A.= 0.85), they react to stimuli that arise from other people (71.89%, M.O.= 2.92, T.A.= 0.76), they prefer specific people (66.01%, M.O.= 2.82, T.A.= 0.81) and they respond to stimuli (62.75%, M.O.= 2.80, T.A.= 0.78). Slightly more than half explore objects (57.52%, M.O.= 2.63, T.A.= 0.86) and less than half explore body parts. (41.83% M.O.= 2.32, T.A.= 0.87).

Table 6 Exploratory behavior

Questions	Mean	SD	Rarely-Never	Sometimes	More often	Always
13.Can perceive when an object is stationary.	2.97	0.85	3.27%	28.10%	37.25%	31.37%
14.Responds to stimuli from other people.	2.92	0.76	2.61%	25.49%	49.67%	22.22%
12.Prefers specific people.	2.82	0.81	4.58%	29.41%	45.75%	20.26%
11.Responds to stimuli.	2.80	0.78	2.61%	34.64%	43.14%	19.61%

3.Explores objects.	2.63	0.86	9.80%	32.68%	41.83%	15.69%
4.Explores body parts.	2.32	0.87	18.30%	39.87%	33.33%	8.50%

4.2.3. Parallel behavior

In this subsection, the questions concerning the child's parallel behavior are presented. Table 7 shows that some or most of the time they play with peers (65.36%, M.O.= 2.29, T.A.= 0.95) and imitate the team leader (65.36%, M.O.= 2.24, T.A.= 0.94). Also, rarely to sometimes they do not play with other children even though they know that they are next to them (61.44%, M.O.= 2.25, T.A.= 1.03), do not give their toys and play alone (62.09% M.O.= 2.23, T.A.= 1.05) and share their toys with other children (63.40%, M.O.= 2.22, T.A.= 0.99).

Table 7 Parallel behavior

Questions	Mean	SD	Rarely Never	Sometimes	More often	Always
16.Plays with peers.	2.29	0.95	20.92%	42.48%	22.88%	13.73%
17.Does not play with other children even though he knows they are next to him [R]	2.25	1.03	28.76%	32.68%	23.53%	15.03%
15.Imitates the team leader.	2.24	0.94	24.18%	37.91%	27.45%	10.46%
19.Does not give his toys and plays alone[R]	2.23	1.05	30.72%	31.37%	22.22%	15.69%
18.Shares his toys with other children.	2.22	0.99	27.45%	35.95%	24.18%	12.42%

Source: Tsodoulos, 2024

4.2.4. Companionship behavior

This subsection lists the questions that refer to the child's social behavior. Table 8 shows that from "sometimes" to "most of the time" they imitate other people (76.47%, M.O.= 2.42, S.A.= 0.85), communicate with other children (66.01%, M.O.= 2.33, S.A.= 0.95) and trust other children to play together (68.63%, M.O.= 2.33, S.A.= 0.92). Furthermore, they rarely to sometimes speak when it is their turn (64.05%, M.O.= 2.22, T.A.= 1.00), play with others (67.32%, M.O.= 2.18, T.A.= 0.93), want to share their toys with other children (66.02%, M.O.= 2.14, T.A.= 1.00), give objects to other children on their own initiative (69.93%, M.O.= 2.06, T.A.= 0.99), as well as take an object belonging to a friend from another, for the sake of their friend (70.59%, M.O.= 1.92, T.A.= 1.01).

Table 8 Companionship behavior

Questions	Mean	SD	Rarely-Never	Sometimes	More often	Always
21.Imitation.	2.42	0.85	13.73%	40.52%	35.95%	9.80%
26.Communicates with other children.	2.33	0.95	20.26%	40.52%	25.49%	13.73%
22.Trusts other children to play together.	2.33	0.92	18.95%	41.83%	26.80%	12.42%
24.Talks when it is his turn.	2.22	1.00	27.45%	36.60%	22.22%	13.73%
20.Plays with others.	2.18	0.93	24.84%	42.48%	22.22%	10.46%
23.Wants to share his toys with other children.	2.14	1.00	32.03%	33.99%	22.22%	11.76%
25.Gives objects to other children on his own initiative.	2.06	0.99	35.29%	34.64%	18.95%	11.11%
27.Takes an object from another that belongs to a friend for the sake of his friend.	1.92	1.01	46.41%	24.18%	20.92%	8.50%

Source: Tsodoulos, 2024

4.2.5. Cooperative behavior

The last sub-section lists the questions that examine the child's cooperative behavior. Table 9 shows that most of the time or always their child carries out simple instructions such as: stop, start, etc. (67.97%, M.O.= 2.95, T.A.= 0.90). In addition, sometimes or most of the time, the child plays a game for more than three minutes (67.97%, M.O.= 2.58, T.A.= 0.94), recognizes the formations that must be created in a game (65.35%, M.O.= 2.58, T.A.= 0.97) and obeys the rules (69.94%, M.O.= 2.53, T.A.= 0.93). Rarely to sometimes the child recognizes the terms used to play a game (63.39%, M.O.= 2.20, T.A.= 0.94), participates in games that require the creation of small groups (64.71%, M.O.= 2.20, T.A.= 0.96), changes roles to achieve a group goal (67.97% M.O.= 2.10, T.A.= 0.99) and takes part in games where everyone has a leading role (71.24%, M.O.= 2.00, T.A.= 0.99).

Table 9 Cooperative behavior

Questions	Mean	SD	Rarely-Never	Sometimes	More often	Always
33. Follows simple instructions such as: stop, start, etc.	2.95	0.90	5.23%	26.80%	35.29%	32.68%
31. Plays a game for more than three minutes.	2.58	0.94	14.38%	30.72%	37.25%	17.65%
34. Recognizes the formations that must be created in a game	2.58	0.97	13.07%	37.25%	28.10%	21.57%
32. Obeys the rules.	2.53	0.93	12.42%	39.87%	30.07%	17.65%
29. Recognizes the terms used to play a game.	2.20	0.94	26.14%	37.25%	26.80%	9.80%
30. Participates in games that require the creation of small groups.	2.20	0.96	26.80%	37.91%	24.18%	11.11%
35. Change roles to achieve a group goal.	2.10	0.99	32.68%	35.29%	20.92%	11.11%
28. Takes part in games where everyone has a leading role.	2.00	0.99	38.56%	32.68%	18.95%	9.80%

Source: Tsodoulos, 2024

4.3. Reliability analysis

Table 10 presents the results of the reliability analysis of the factors of the present study, where the Cronbach Alpha coefficient was used to measure reliability. Regarding the factors of the psychomotor clumsiness investigation, all factors showed excellent reliability, specifically “Child Still/Environment Stable” (α=0.922), “Child Moving/Environment Stable” (α=0.919), “Child Still/Environment Changing” (α=0.908) and “Child Moving/Environment Changing” (α=0.906). Furthermore, it appears that for the social behavior factors, "Friendly behavior" (α=0.902) and "Cooperative behavior" (α=0.913) have excellent reliability, "Autistic behavior" (α=0.819) is high, while "Exploratory behavior" (α=0.697) and "Parallel behavior" (α=0.652) have acceptable reliability. Finally, the "Self-esteem" factor has acceptable reliability (α=0.682).

Table 10 Reliability analysis

Scale	Factors	Questions	Cronbach Alpha	Reliability
Investigation of psychomotor clumsiness	Child Still/Environment Stable Child Moving/Environment Stable	1-12 13-24	0.922 0.919	Excellent Excellent
	Child Still/Environment Changing	25-36	0.908	Excellent
	Child Moving/Environment Changing	37-48	0.906	Excellent
Social behavior	Autistic behavior	1,2, 5-10	0.819	High

	Exploratory behavior	3,4, 11-14	0.697	Acceptable
	Parallel behavior	15,16,17R, 18, 19R	0.652	Acceptable
	Companionship behavior	20-27	0.902	Excellent
	Cooperative behavior	28-35	0.913	Excellent

5. Discussion

From the analysis carried out for psychomotor clumsiness which concerned four units, Child Still/Environment Stable, Child Moving/Environment Stable, Child Still/Environment Changing and Child Moving/Environment Changing, high levels of skill were initially found for the unit "Child Still/Environment Stable" in holding objects in the correct way, in dressing himself and in holding small objects (blocks, etc.) correctly. Moderate to high levels of psychomotor skill were observed in the recognition of body parts and the correct use of the left and right parts of the body, in autonomy, regarding personal hygiene, in the use of blocks and puzzle pieces, to achieve a goal, in changing pages of the book and correctly holding an A4 piece of paper and in adopting a correct posture when standing. Furthermore, moderate levels of psychomotor skills were observed in the formation of letters, numbers and shapes, in being able to stand on one leg while dressing, and in accuracy in using and drawing on outlines. Also, lower levels of psychomotor skills were observed in the ability to tie shoelaces and button correctly. The findings of the present study do not agree with those of Zikl et al. (2016) who identified significant problems in the motor skills of children with ASD, especially in the area of fine motor skills compared to gross motor skills and balance.

In the case of "Child Moving/Environment Stable", high levels of psychomotor skills were observed in terms of moving around the classroom without "falling" on other students or objects, understanding directional commands, such as inside-out, up-down, etc., and carrying objects within the classroom without "falling" on other students or objects. Moderate to high levels of psychomotor skills were observed in running and stopping to avoid objects. Furthermore, moderate levels of psychomotor skills were observed in moving comfortably between obstacles, running and kicking a large, stable ball, throwing an object while moving over the shoulder, bouncing on each foot, throwing an object while moving under the shoulder, and the ability to limp for a few meters. Also, moderate to low levels of psychomotor skills were observed in the ability to use gym equipment (balance beam, etc.), as well as to jump over obstacles with ease. This research also does not agree with the findings of the study conducted by Staples and Reid (2010), whose findings showed that children with ASD present deficits and delays in areas such as walking, jumping, etc.

Regarding the child's psychomotor skills, when the child is still and the environment changes, high levels of psychomotor skill were observed in the child's ability to give objects to children standing next to each other. Moderate levels of psychomotor skill were observed in the child's ability to kick a ball with the bottom of the foot (not with a stick), catch a moving ball with both hands, clap to the rhythm of music, maintain a stable position while exercising, throw a ball to a moving child, stop moving objects before they reach their destination, and dribble a stationary ball. In addition, moderate to low levels of psychomotor skill were observed in the correct rolling of the ball so that the moving child can catch it. Also, low levels of psychomotor skill were observed in hitting a ball with a racket as it moves, in turning a rope correctly so that other children can jump over it and avoid it, and in catching a moving ball with one hand. These findings are consistent with research by Whyatt and Craig (2012) who showed that motor skill deficits associated with autism may not be pervasive but more evident in activities that require complex, inhibitory actions or balance skills. In addition, for the questions that concern the child's psychomotor skills, when the child moves and the environment changes, high levels of psychomotor skill were observed in moving around school without "falling" into other people and in pushing a stroller. Moderate to high levels of psychomotor skill were observed in using moving vehicles, running to catch a ball, and using a swing or other moving objects without assistance. In addition, moderate levels of psychomotor skill were observed in participating in chasing, running to kick a ball, moving in different directions based on musical rhythm, and participating in group games. Also, low levels of psychomotor skill were observed in moving while dribbling a ball, running to block a ball approaching with a racket, and moving to play jump rope correctly. These findings are also consistent with the research of Chen et al. (2019) which argues that the motor difficulties present in children with ASD may arise from compromised sensorimotor integration in the planning and control of movements.

Finally, we stress the significance of all digital technologies in the field of psychomotor and social skills education which is highly effective productive, facilitates and improves assessment, intervention, and educational procedures via mobile devices that bring educational activities everywhere [38-41], various ICT applications that are the main supporters of education [42-48], and AI, STEM, and ROBOTICS that elevate educational procedures to new performance levers [49-

54]. Additionally, the development and blending of ICTs with theories and models of metacognition, mindfulness, meditation, and emotional intelligence cultivation, [55-71] accelerates and improves more than educational practices and results, particularly in psychomotor and social skills education, treating domain and its practices like assessment and intervention.

6. Conclusion

Regarding the social behavior scale that concerned 5 sections, Autistic behavior, Exploratory behavior, Parallel behavior, Sociable behavior and Cooperative behavior, it was found in the case of autistic behavior that most of the time or always they display stereotypical behaviors, need motivation to play and move here and there without reason. In addition, a little more than half do things with high frequency without reason (hands mouth, hitting, etc.), while less than half show a lack of preference for people. In addition, the minority shows a lack of response to stimuli, self-irritation, as well as self-injury. In the case of exploratory behavior, it emerged that most of the time or always they can perceive when an object is stable, react to stimuli that arise from other people, prefer specific people and respond to stimuli. A little more than half explore objects and less than half explore body parts. Additionally, for parallel behavior, it emerged that some or most of the time they play with peers and imitate the team leader. Also, rarely to sometimes I found them not playing with other children even though they know that he is next to them, they do not give his toys and play alone and share their toys with other children. For companionship behavior, it emerged that from "sometimes" to "most of the time" they imitate other people, communicate with other children and trust other children to play together. In addition, they rarely to sometimes talk when it is their turn, play with others, want to share their toys with other children, give objects to other children on their own initiative, as well as take an object from another that belongs to a friend of theirs, for the sake of their friend. For cooperative behavior, it emerged that most of the time or always their child carries out simple instructions such as: stop, start, etc. In addition, sometimes or most of the time, the child plays a game for more than three minutes, recognizes the formations that need to be created in a game, and obeys the rules. Rarely to sometimes, the child was found to recognize the terms used to play a game, participates in games that require the creation of small groups, changes roles to achieve a group goal, and takes part in games where everyone has a leading role. These results foster the idea that children with ASD participate in solitary and peripheral activities, demonstrate appropriate initiatives and reactions to peers, display self-stimulatory, motor behaviors more often during solitary activities, and often have a neutral effect on the playground. These findings indicate that intervention and support for children with ASD may be important for social interaction with their peers.

Compliance with ethical standards

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Disclosure of conflict of interest

The Authors proclaim no conflict of interest.

Statement of informed consent

Informed consent was obtained from all individual participants included in the study.

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