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Impact of School Integration on Socio-Adaptive Behaviors in Students with Autism Spectrum Disorder (ASD): A Longitudinal Study

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Abstract: It has been shown that students with Autism Spectrum Disorder (ASD) present behavioural, communication, and socialisation difficulties that hinder their social adaptation. Fortunately, these obstacles may be overcome by integrating into a typical environment. The present study aims to determine, on the one hand, whether the schooling of children with ASD can modify their socio-adaptive behaviours, including communication, socialisation, motor skills, and daily living skills and, on the other hand, if the children's age, gender, ASD level of severity, and type of provided support can influence the changes that occur in these adaptive behaviours. To achieve these objectives, it was deemed appropriate to conduct a longitudinal study on a sample of 18 primary school students with ASD selected using a purposive sampling technique. The socio-adaptive behaviours of these students were assessed twice over one year using the Vineland Adaptive Behavior Scale (VABS) II. They were evaluated first at time T1 (the beginning of school integration, at the start of the school year) and then at time T2 (the end of school integration, after one school year). The study's findings indicated that socio-adaptive behaviours' subdomains were significantly improved at time T2. However, the play, leisure, and social adaptation subdomains showed no significant changes. According to the descriptive

analysis and effect size results, these changes can be influenced by the type of support, the severity level of autism spectrum disorder, and the age and gender of children, even though the statistical analysis did not show any significant differences. However, these results cannot be generalised because the student sample size considered in this study is not large enough.

Keywords: school integration, students, Autism Spectrum Disorder (ASD), socio-adaptive behaviour, change.

Introduction

Autism is defined as a neurodevelopmental spectrum disorder that is characterised by persistent impairment in social communication and the presence of restricted and repetitive behaviours, interests, or activities. It affects 1% of the global population (American Psychiatric Association, 2013), with an average of three boys affected for every one girl, according to the research conducted by Loomes et al. (2017).

According to statistics from the Ministry of Health, Population and Hospital Reform (Algeria), there are more than 450,000 people with autism in the country, with one million births per year. These figures are mentioned in a report about the current state of autism in Algeria, dated July 1st, 2021. Children with autism spectrum disorder (ASD) require specialised interventions and assistance to help them improve their skills. In addition, the educational environment should take care of these children seriously by offering them educational and specialised services that meet their care needs.

In Algeria, the schooling of children with ASD is still in its early stages. Despite the numerous laws enacted, the education of these children is provided either by private schools (in limited numbers) or through agreements between local associations and the national education system. Unfortunately, these structures remain very insufficient, which generally leads to the marginalisation of ASD children within our society. Based on the above observations, it was decided to carry out a study that focuses on these children and primarily investigates the effects of schooling on their socio-adaptive behaviours.

To the best of our knowledge, few international studies have been conducted to investigate the adaptive behaviours of ASD children in school. Researchers such as Mazon et al. (2019) and Antonova and Kostin (2023) have examined that topic. In this regard, Osborne and Reed (2011) found that inclusive education can promote positive outcomes for children with ASD by improving their social and academic development and offering them better professional prospects.

Furthermore, some other studies have mainly focused on the factors related to the development of adaptive behaviours in children with ASD. In this regard, Yianni-Coudurier et al. (2016) pointed out that the improvement of adaptive behaviours depends on the child's initial clinical characteristics and the intervention's duration. It was equally found that children who spent more time in a regular education environment exhibited more significant progress in their level of autonomy. At the same time, those who were provided with several hours of specialised intervention, such as day hospital care, demonstrated more significant improvement in their social skills. Similarly, Miranda et al. (2022), who followed the development of some children with ASD until their adolescence, indicated that individuals with ASD have different developmental trajectories depending on two types of autism spectrum disorders, i.e. Persistent ASD (ASD-P) and Remittent ASD (ASD-R). It turned out that the Remittent ASD (ASD-R) group showed better progress during adolescence in the areas of socio-adaptive behaviours and executive functions. They also exhibited behaviours better than those of children with ASD-P.

Moreover, Coffey and Horner (2012) provided empirical evidence that demonstrated that the implementation of school programs based on Positive Behavior Support (PBS), an intervention approach derived from Applied Behavior Analysis (ABA), had an impact on reducing behaviour disorders and developing academic and social skills in children with Autism Spectrum Disorder (ASD).

To the best of our knowledge, a limited number of research studies on the school inclusion of children with Autism Spectrum Disorder (ASD) have been carried out in Algeria until now. It is worth mentioning that only one Algerian study, which was conducted by Mecherbet and Azzouz (2012), has examined the effects of integrating two autistic children into a daycare centre (nursery) on their socio-adaptive behaviours. This study found that the inclusion of these children among their typically developing peers over seven months contributed to reducing the level of their autistic symptoms from severe to moderate. A slight improvement in their academic and behavioural skills was also observed. However, in contrast to results reported in international research, this study did not reveal any significant improvements in these two children's communicative and social skills.

The findings documented in the previous study are relatively different from those reported in other international investigations. They attracted our interest and prompted us to undertake a similar study in which a larger sample was considered within a different educational context, specifically within primary schools.

Literature Review

The integration of children with Autism Spectrum Disorder (ASD) at school has gained significant attention in recent years. This literature review explores the impact of school integration on the socio-adaptive behaviours of children with ASD, focusing on their communication, socialisation, motor skills and daily living skills. Additionally, the review will examine the impact of factors such as age, gender, severity of ASD and type of support on these outcomes.

The Concept of Adaptive Skills: An Elusive Term

The adaptive behaviour concept, which was initially introduced by the American Association on Mental Retardation (AAMR) in the definition of intellectual disability to define maturation, learning and social adjustment (Heber, 1959), as mentioned by Bouchan (2013, p. 172), remains a subject of ongoing debate. Over time, the adaptive behaviour concept has proven pertinent theoretically and practically; hence, adaptive behaviour became a second diagnostic criterion for intellectual developmental disorders. Further, the 9th edition of AAMR replaced this criterion with ten social skill domains. It was then stipulated that the diagnosis of intellectual disability requires deficits in at least two domains: communication, personal care, domestic skills, social skills, use of community resources, self-reliance, health and safety, academic skills, leisure, and work.

In the context of autism, adaptive behaviours refer to all skills and competencies that individuals with autism spectrum disorder ought to develop to adapt to their environment and interact appropriately with others (Paolo et al., 2023). These behaviours may be assessed using the Vineland Adaptive Behavior Scales-2 (VABS-2), a standardised assessment tool divided into four domains: communication, socialisation, daily living, and motor skills. Although the VABS-2 was initially designed to describe the adaptive profile of children with intellectual developmental disorders, it is widely used to describe the adaptive profile of individuals with autism (Zaghzi et al., 2022).

Are There Any Differences Between Mainstreaming, Inclusive Education, and Integrated Education?

It is worth highlighting that three primary models of schooling for children with ASD are generally reported in the literature, namely inclusive education, integrated education, and mainstreaming. Inclusive education recommends placing children with special needs in a regular classroom in schools located near their homes, regardless of their disabilities (Pry, 2012). The concept of mainstreaming emerged in the 1970s when the Council for Exceptional Children (CEC) in the United States adopted this term to promote a more balanced and inclusive education for children requiring specialised schooling. It is noteworthy that mainstreaming advocates minimal pedagogical adaptations within regular classes and insists on educating the child in the most typical environment alongside neurotypical people, as Hayek (2015, p. 69) reported. In contrast, integrated education for children with special needs emphasises several specialised supports, such as extensive pedagogical aids, adapted materials in all subjects, educational assistants, and part-time attendance in regular classrooms (Hayek, 2015; Oyan et al., 2024).

Furthermore, relevant literature generally distinguishes between the three schooling models for children with ASD: inclusive education, which places children in regular classrooms close to their homes; mainstreaming, which prioritises inclusive education with minimal adaptations; and integrated education, which combines specialized support with part-time attendance in regular classrooms.

Schooling for Children with ASD and Adaptive Behaviors

Children with ASD are characterised by several challenges in adaptive behaviours that limit their ability to interact with their environment and hence lead to communication difficulties (Schneider et al., 2022). Attending school can have a positive impact on these children's adaptive behaviours (Echeita et al., 2021; Balbino et al., 2021; Ressa, 2022).

In this regard, Zukerman et al. (2022) carried out a year-long longitudinal study. They concluded that students with ASD who attended university showed improved communication levels and reduced symptoms of depression despite experiencing some social anxiety and obsessive-compulsive disorders. Nevertheless, Tsou et al. (2024) have recently conducted a study to compare social connections and feelings of loneliness in normal children and children with ASD. They then revealed that children with ASD had fewer reciprocal friendships than their neurotypical peers. Interestingly, these children exhibited loneliness levels similar to those of neurotypical children, although the total duration of social contacts and number of partners were comparable. The researchers found that neurotypical children felt lonelier when they had few social contacts during breaks. However, children with ASD experienced heightened feelings of loneliness when their peers refused to play with them.

Furthermore, recent research has indicated that adaptive behaviour levels play a crucial role in academic adaptation and navigating daily life independently (Castro & Puente, 2023; Zaghzi et al., 2022). While inclusive education is identified as a reinforcement for the development of adaptive behaviours, particularly social relationships (Crosland & Dunlap, 2012; Daniel & Billingsley, 2010; Nistor and Dumitru, 2021; Khatab et al., 2024; Watkins et al., 2019), communication and autonomy (Bombińska-Domżał, 2022; Botelho et al., 2020; Hummerstone, 2018; Klefbeck, 2021; Moraiti et al., 2023), young age, and male gender are considered as potential risk factors for their development (Castro & Puente, 2023). Additionally, Botelho et al. (2020) conducted a study to highlight the importance of collaboration between parents and educational professionals in coping with children with ASD to improve and enhance their communication, learning, and autonomy skills. Moreover, targeted interventions within the school setting can strengthen several of their motor skills, including movement skills and object

control skills, as well as the children's ability to throw a ball underhand, hit a stationary ball, and kick a ball, but not to launch it overhand or to hit the ball at rest (Cao et al., 2024).

It is essential to understand that this literature review shows the pivotal role of schooling for children with ASD, as it enhances their communication and autonomy skills in their daily lives as well as their social interaction and motor abilities. Consequently, cooperation between educational professionals and parents and targeted interventions is essential to maximise these competencies (McClain et al., 2020; Moura, 2024; Petersson-Bloom & Holmqvist, 2022).

Research Problem and Hypotheses

International research has demonstrated that schooling for children and students with ASD has highly beneficial effects on their adaptive behaviours and communication skills. In particular, schooling helps to reduce and prevent symptoms of *depression* and *anxiety*. However, while inclusive education is recognised for fostering the development of adaptive behaviours, other factors, such as young age and male gender, may pose some risks to their optimal development. Hence, the lack of national research on this topic prompted us to address the above research problem in the Algerian context. For this, the following question may therefore be asked:

Does the integration of children with ASD into the school environment in Algeria improve their socio-adaptive skills? Or, otherwise stated:

Are there any differences between the socio-adaptive behaviours of children with ASD before and during their school integration?

This problem allows the formulation of the following research hypotheses:

Hypothesis 1: There is a difference in the development of communication skills in children with ASD before and after their school integration.

Hypothesis 2: There is a difference in the development of socialisation skills in children with ASD before and after their school integration.

Hypothesis 3: There is a difference in the development of daily living skills in children with ASD before and after their school integration.

Hypothesis 4: There is a difference in the development of motor skills in children with ASD before and after their school integration.

Hypothesis 5: There is a difference in the adaptive behaviour scores in children with ASD, depending on their age, gender, ASD severity, and type of intervention.

Materials and Methods

It is worth reminding that this is a longitudinal quasi-experimental study in which the researcher followed a group of children enrolled in a special class for children with ASD in a primary school for a one-year period. These children followed a school curriculum to improve their competencies in different developmental domains, including cognitive, communicative, and behavioural skills. These children were placed alongside neurotypical children during the recreation and physical education sessions.

Sample and Participants

The present study was conducted on a sample of 18 children with ASD, including 7 girls and 11 boys, aged between 84 and 159 months. A purposive sampling technique was employed to select primary school students with a confirmed diagnosis of ASD.

These children's clinical characteristics at the study's beginning are presented in Table 1.

Table 1

Description of Clinical Characteristics of Children with ASD in T1

		Mean (Std. deviation)	Min-Max
Age (in months)		122.61(19,67)	84-159
Severity level of ASD		34.19(3.28)	30-40
		N	%
Gender	Boy	11	61.1
	Girl	7	38.9
Grade level	Preschool-2 years	12	66.7
	3-5 years	6	33.3
Type of support	School	10	55.6
	Mixed	8	44.8

Table 1 shows that over half of the children with ASD are boys, which is consistent with the fact that the prevalence of ASD is more significant in boys than in girls (a ratio of approximately 4 girls to 1 boy). Most of these children (66.7%) are enrolled in the first three grades of primary school. Notably, in these early grades, children often advance to the next level regardless of their academic performance. In addition, nearly half of the children with ASD (44.8%) received a combination of therapies, including speech therapy, psychology therapy, and psychomotor therapy, which suggests that parents are becoming increasingly aware of the importance of multidisciplinary intervention in supporting the development of their children.

Instrument and Procedure

To accurately answer the previously mentioned research questions, it was deemed appropriate to apply two assessment tools, Vineland-II and CARS, to evaluate the severity level of autism spectrum disorder and the socio-adaptive behavior in children with ASD at the beginning of their schooling (time T1) and after one year of schooling (time T2).

Vineland-II. Also called Vineland Adaptive Behavior Scales (VABS-II), it is a revised version of the first Vineland version initially developed and proposed by Doll in 1936 as the Vineland Social Maturity Scale (VSMS). This assessment tool version underwent several revisions in 1965 and 1984, and then in 2015 by Sparrow et al. This assessment tool was translated into French and then published by the Applied Psychology Center (Sparrow et al., 2015). The Vineland Scale is commonly used in clinical adaptive behaviour assessments. This scale is highly relevant to the longitudinal monitoring of individuals with developmental disorders at all ages. There are two VABS-II scale versions: the VABS II-parents/caregiver form and the VABS II-interview form. The two forms assess adaptive behaviours in four main areas: communication, socialisation, motor skills and daily living skills. These two VABS-II

scale forms can also be used to evaluate behavioural disorders. The VABS II interview form requires 20 to 60 minutes of semi-structured discussion between the psychologist and the person who knows the subject to be assessed very well, depending on that person's age and level of development.

In the present study, the interview form was used. Its items were rated according to the frequency of the activity described below:

- 2: When the activity is customarily performed satisfactorily.
- 1: When the action is observed occasionally or partly, without assistance or reminders.
- 0: The activity is rarely or never performed without assistance or reminders.
- NA (Not Applicable): When the activity cannot be performed due to external or circumstantial factors.
- NSP (I don't know): When the respondent has no idea whether the individual being evaluated performs the activity.

The total score is then converted into a scaled score, a standard score, a developmental age, and a developmental level within each subdomain. Afterwards, the psychometric properties of the VABS-II were studied, and the results showed excellent reliability, internal consistency, construct validity, and inter-rater reliability (Sparrow et al., 2015). These findings indicate that the Vineland Adaptive Behavior Scales (VABS-II) can be used for assessing adaptive behaviours and screening psychopathologies in individuals with neurodevelopmental disorders.

The Childhood Autism Rating Scale. The Childhood Autism Rating Scale (CARS) is a tool that was initially developed by Schopler et al. in 1980 to assess the severity of Autism Spectrum Disorders (ASDs) through the clinical observation of children aged 2 years and above. It is worth emphasising that the CARS form may require about 20 to 50 minutes to observe and rate the subjects on a scale from 1 to 4 in each of the 15 domains, including verbal communication, nonverbal communication, social relationships, imitation, auditory responses, emotional responses, visual responses, sensory responses to taste, smell, touch, use of object, use of body, activity level, intellectual level, and finally the overall rating and estimation of the autism spectrum disorder level. Score 1 alludes to borderline normal behaviour, while score 4 refers to severely disordered behaviour. Scoring by half a point may be chosen for a more detailed assessment of the child's behaviour. Scoring by 2.5, for example, means slightly to moderately abnormal behaviour compared to normal children of the same age. For instance, a score of 2.5 indicates this behaviour may be considered average among children of the same age group but is still in the borderline area. The total score may then be calculated by accumulating the scores from all domains utilised in the evaluation. The total score then serves to evaluate the severity of ASD.

It is worth adding that Schopler et al. (2012) found that the CARS is a rapid assessment tool with strong psychometric properties, making it highly practical for clinical evaluations.

Data Analysis

To test the research hypotheses, it was deemed necessary to use the Wilcoxon signed rank test in the SPSS program to compare the adaptive behaviour scores of subjects between two assessment time points, i.e. T1 and T2, in the communication, socialisation, and daily living, and motor skill areas. In addition, it is essential to emphasise that the Shapiro-Wilk test results guided the decision to perform the non-parametric Wilcoxon test. Moreover, Cohen’s d was calculated to evaluate the effect size.

Furthermore, the Mann-Whitney U test was carried out between the independent variables (age, gender, severity, and type of intervention) and the deltas (Δ) scores of the dependent variables (subdomains of communication, socialisation, daily living, and motor skills) using the SPSS software, because of verifying hypothesis 5. These deltas were calculated between the scores recorded at Time 1 and 2 for the different subdomains of adaptive behaviours.

Moreover, a descriptive analysis was conducted by calculating the mean ranks to compare the children's scores in the subdomains of socio-adaptive behaviours between times T1 and T2.

Results

Results of the Shapiro-Wilk Normality Test

Table 2

Shapiro-Wilk Normality Test for the Sum of Standard Scores of Adaptive Behaviors at Time Points T1 and T2

	Statistic	df	Sig.
Sum standard scores T1	,897	18	,052
Sum standard scoresT2	,726	18	,000

The Results indicate significant departures from normality for the sum of standard scores of adaptive behaviours at times T1 ($p < 0.05$) and T2 ($p < 0.001$). Since our significance level was set at .05, parametric tests were deemed inappropriate.

Descriptive and Statistical Analysis of Results

Hypothesis 1: There is a difference in the development of communication skills in children with ASD before and after their school integration.

Figure 1

Distribution of Mean Ranks for Communication Skills at Time Points T1 and T2

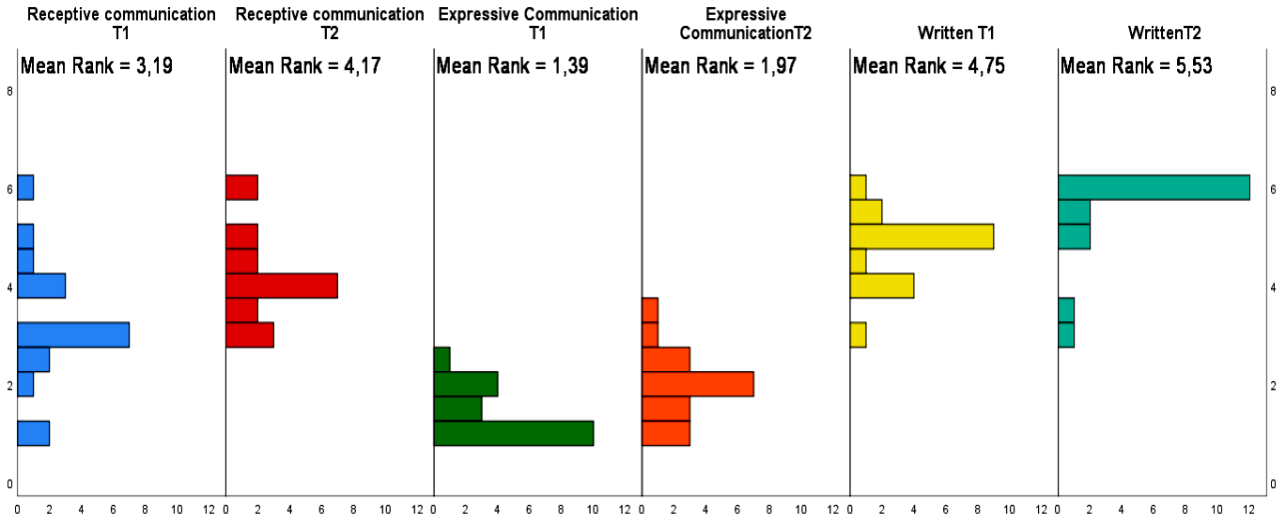

Table 3

Wilcoxon Test for Communication Skills at Time Points T1 and T2

	Receptive communication (T2 - T1)	Expressive communication (T2 - T1)	Written (T2 - T1)
Wilcoxon test value	-2,87[b]	-2,21[b]	-2,61[b]
P-value	,004	,03	,009
Cohen's d	,23	,13	,18

b. Based on opposing ranks. The significance level is .05.

The results of the descriptive analysis indicate improvement in children's skills after one year of schooling in receptive communication (Mean Rank on T1 = 3.19 and T2 = 4.17) and writing communication (Mean Rank at T1 = 4.75 and T2 = 5.53), but a less pronounced improvement in expressive communication (Mean Rank on T1 = 1.39; T2 = 1.97). These findings align with the statistical analysis results, revealing significance in all three assessed sub-domains. The calculated Cohen's d for receptive communication (0.23), expressive communication (0,13) and Written communication (0,18) suggests a small effect size, indicating a slight improvement for all three subdomains.

Hypothesis 2: There is a difference in the development of socialisation among children with ASD before and during school integration.

Figure 2

Distribution of Mean Ranks for Socialisation Skills at Time Points T1 and T2

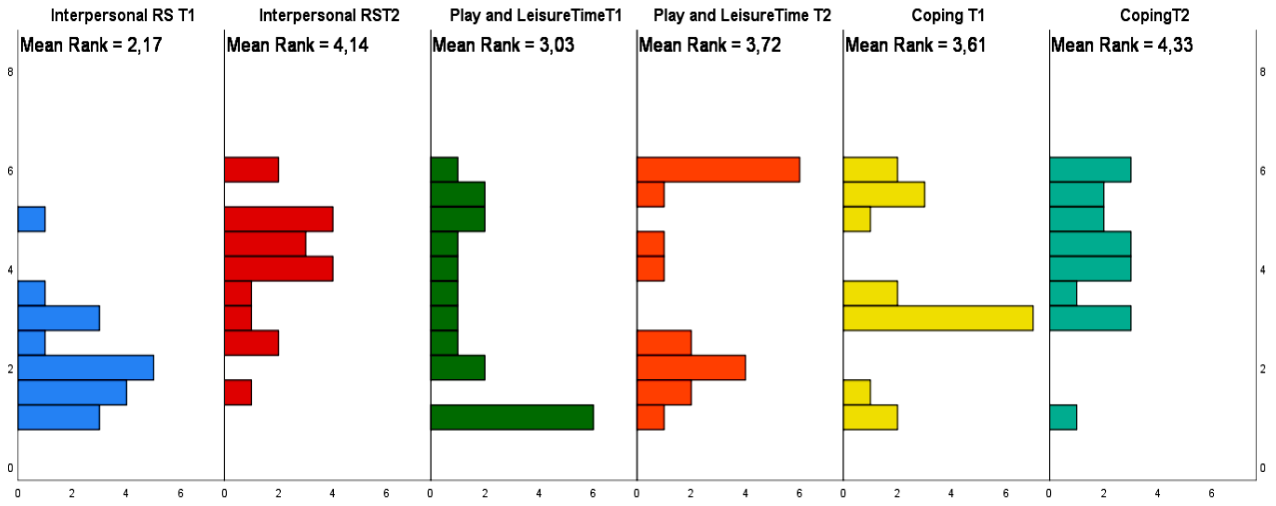

Table 4

Wilcoxon Test for Socialization Skills at Time Points T1 and T2

	Interpersonal relationships T2 - T1	Play and leisure time T2 - T1	Coping T2 – T1
Wilcoxon test value	-3,52[b]	-1,31[b]	-1,60[b]
P-value	,001	,19	,11
Cohen's d	,46	,16	,16

b. Based on opposing ranks. The significance level is .05.

A comparison of mean ranks at T1 and T2 revealed a significant improvement in children's interpersonal relationships following school integration (Mean Rank on T1 = 2.17; T2 = 4.14).

A slight increase in the scores of play and leisure activities (mean rank on T1=3.03; T2=3.72) and in coping(Mean Rank on T1=3.61; T2=4.33). The descriptive results concur with the findings of some statistical analyses that are significant in interpersonal relationships and contradict others which are not substantial in play, free time and social adaptation. The calculated Cohen's d for interpersonal relationships (0.46), play, and leisure activities (0.16) suggests a medium effect size for interpersonal relationships and small effect sizes for the rest of the sub-domains of socialisation skills. These results indicate a substantial improvement in interpersonal relationships and less pronounced changes in coping, play, and leisure time skills.

Hypothesis 3: There is a difference in the daily lives of children with ASD before and during school integration.

Figure 3

Distribution of Mean Ranks for Daily Living Skills at Time Points T1 and T2

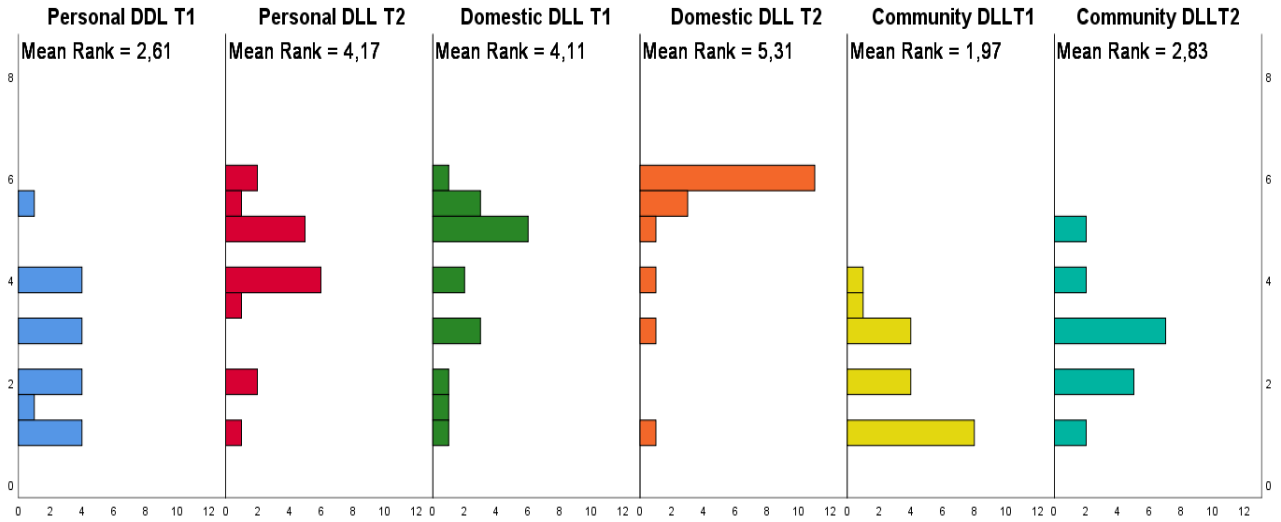

Table 5

Wilcoxon Test for Daily Living Skills at Time Points T1 and T2

	Personal DL T2 - T1	Domestic DL T2 - T1	Community DL T2 – T1
Wilcoxon test value	-2,77[b]	-2,64[b]	-2,18[b]
P-value	,006	,008	,03
Cohen's d	,36	,28	,20

b. Based on opposing ranks. The significance level is .05.

The data presented in Table 5 and Figure 3 clearly show a significant improvement in daily living skills (DL) among children with ASD following one year of school integration. In particular, the outcomes suggest a remarkable improvement in personal daily life skills (Mean Rank at T1 = 2.61 and T2 = 4.17), a notable enhancement in domestic daily life skills (Mean Rank at T1 = 4.11 and T2 = 5.31) and in community life skills (Mean Rank at T1 = 1.97 and T2 = 2.83). These results justify the statistical significance of the Wilcoxon test, as shown in Table 5. Moreover, the calculated Cohen's d values for personal daily life (0.36) and domestic daily life (0.28) suggest moderate effect sizes, indicating substantial improvements in these sub-domains. However, the calculated Cohen's d for Community DL (0.20) suggests a small effect size, indicating a less pronounced change in community DL skills.

Hypothesis 4: There is a difference in the development of motor skills in children with ASD before and after their school integration.

Figure 4

Distribution of Mean Ranks for Motor Skills at Time Points T1 and T2

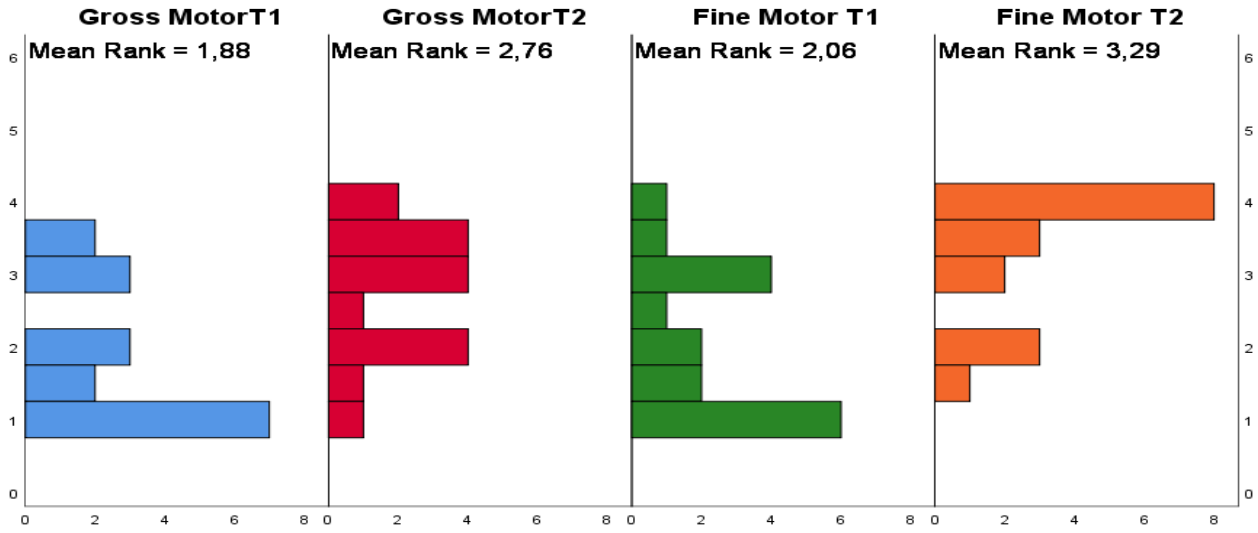

Table 6

Wilcoxon Test for Motor Skills at Time Points T1 and T2

	Gross motor T2 - T1	Fine motor T2 - T1
Wilcoxon test value	-2,92[b]	-3,05[b]
P-value	,003	,002
Cohen's d	,20	,28

b. Based on opposing ranks. The significance level is .05.

Results of descriptive and statistical analyses indicate a significant improvement in children's skills after one year of schooling in gross motor skills (Mean Rank at T1 = 1.88 and T2 = 2.76) and in fine motor skills (Mean Rank at T1 = 2.06 and T2 = 3.29). The data in Table 6 represent the statistical analysis results that revealed significant improvement in the two motor skills sub-domains assessed. Likewise, the calculated Cohen's d for gross motor skills (0.20) suggests a small effect size, which implied modest improvements. On the other hand, Cohen's d was equal to 0.28 for fine motor skills, which denoted a moderate effect size, meaning a more substantial improvement.

Hypothesis 5: There is a difference in the adaptive behaviour scores in children with ASD, depending on their age, gender, ASD severity, and type of intervention.

Table7

Mean Ranks for Adaptive Behavior Domains by Type of Support, Intensity of ASD, Gender, and Age

Mean Rank	Age		Gender		Severity of ASD		Type of intervention	
	Child	Preteen	Boy	Girl	Mild to moderate	Severe	School	Mixed
N	11	7	11	7	12	6	10	8
Receptive communication	8,94	10.06	9,21	9,68	10,19	7,70	11,05	7,58

Expressive communication	8,11	10.89	6,71	11 ,27	10,60	9,08	10,60	8,13
Written	8,94	10.06	8	10,45	10,81	6,10	11,15	7,44
Personal daily living	9.33	9,67	9,14	10,07	10,90	8,96	9,35	9,69
Domestic daily living	8.50	10,50	9,18	10	11,08	5,40	7,90	11,5
Community daily living	8.33	10,67	8,29	10,27	10	8,20	10,80	7,88
Interpersonal relationships	8,06	10.94	6,43	11,45	9,69	9	10,40	8,38
Play and leisure time	8,39	10.61	8,29	10,27	11,30	8,81	12,60	5,63
Coping	8,11	10.89	8,93	9,86	9,54	9,40	10,60	8,13
Gross motor	7,22	11.78	7,71	10,64	10,15	7,80	10,70	8
Fine motor	7,89	11.11	6	11,73	9,90	9,35	10,60	8,13

The descriptive analysis data revealed a slight trend towards higher scores in the adaptive behaviour subdomains among preadolescents compared to children. However, these statistical analysis results did not show any significant differences between the two age groups regarding the overall adaptive behaviours, except for the gross motor skills, with data tending towards statistical significance ($p = 0.08$). The calculated Cohen's d indicated that preadolescents outperformed children in most subdomains. This was particularly noticed in expressive communication, interpersonal relationships, play and leisure time, coping, and motor skills. However, children performed slightly better than preadolescents in receptive communication and personal daily living skills. Note that these differences were relatively small. Finally, preteens were marginally better in domestic daily living skills, while they were much better in community daily living skills.

Furthermore, the mean ranks for communication, socialisation, daily living, and motor skills were generally higher for girls than boys. The calculated effect sizes were the same for both girls and boys. In addition, girls typically outperformed boys in most adaptive behaviour subdomains. Likewise, the calculated Cohen's d suggested that girls performed better than boys in most subdomains. The most pronounced differences were observed in interpersonal relationship skills and gross motor skills. And fine motor skills, while some differences in favour of girls were observed in other domains. It should be noted that the effect sizes were generally smaller for girls than boys. However, the statistical analysis results were not significant except for interpersonal relationship skills ($p = 0.05$), fine motor skills ($p = 0.03$), and expressive communication skills, with data tending towards statistical significance ($p = 0.07$).

Regarding ASD severity, although the descriptive analysis data suggested that individuals with mild to moderate ASD performed better than those with severe ASD, the statistical analysis results confirmed this difference solely in personal daily living and domestic daily living skills. Indeed, domestic daily living approached significance ($p = 0.04$). The calculated Cohen's d values indicated a small effect size for coping, with small effect sizes favouring mild to moderate ASD for expressive communication, interpersonal relationships, and fine motor skills. These values also suggested moderate and positive effect sizes, favouring mild to moderate ASD for receptive communication, personal daily living, community daily living, play and leisure time, activities, and gross motor skills, and substantial effect sizes favouring mild to moderate ASD for written skills and personal daily living skills.

Table7

Mann-Whitney U Tests for Differences in Adaptive Behavior Subdomains by Type of Support, Intensity of ASD, Gender, and Age

	Type of support			Intensity			Sex ratio			Age		
	Cohen's d	**P-Value**	**U Mann Whitney**	**Cohen's d**	**P-Value**	**U Mann Whitney**	**Cohen's d**	**P-value**	**U Mann Whitney**	**Cohen's d**	**P-value**	**U Mann Whitney**
Receptive communication	0,8	0,168	24,5	0,6	0,39	23,5	-0,11	0,86	36,5	-0,26	0,66	35,5
Expressive communication	0,57	0,32	29	, 35	0,63	38	-0,36	0,07	19	-0,65	0,3	28
Written	0,84	0,14	23,5	1,07	0,5	39,5	-0,57	0,34	28	-0,26	0,66	45,5
Personal daily living	0,08	0,89	38,5	0,45	0,09	15,5	-, 21	0,72	34,5	-0,08	0,93	42
Domestic daily living	0,81	0,15	24	1,3	0,04	12	-, 19	0,75	35	-0,47	0,44	49,5
Community daily living	0,67	0,25	27	0,42	0,56	26	-, 46	0,44	30	-0,76	0,39	51
Interpersonal relationships	0,47	0,42	31	0,16	0,84	30	-1,17	0,05	17	-0,67	0,26	27,5
Play and leisure time	1,62	0,006	9	0,58	0,39	41	-, 46	0,44	30	-0,58	0,39	30,5
Coping	0,57	0,33	29	0,03	0,8	32	-, 26	0,72	34,5	-0,68	0,3	28
Gross motor	0,6	0,28	28	0,57	0,44	24	-, 93	0,25	26	-1,06	0,08	20
Fine motor	0,57	0,33	29	0,12	0,85	34,5	-, 76	0,02	14	-0,76	0,22	26

Note. The significance level is .05.

Moreover, the descriptive analysis of the type of intervention (conventional or mixed intervention) yielded inconsistent results. Indeed, while children who received mixed interventions outperformed those with ordinary interventions in personal and domestic daily living skills, a statistically significant difference was found only in play and leisure time activities, favouring ordinary interventions ($p = 0.006$) over mixed interventions. In addition, the calculated Cohen's d values indicated small effect sizes for personal daily living skills and moderate effect sizes for expressive communication skills, hence favouring school intervention for expressive communication skills, community daily living skills, interpersonal relationship skills, coping skills, gross motor skills, fine motor skills, and large effect sizes for receptive communication skills, written communication skills, domestic daily living skills, and play and leisure time skills, hence favouring school intervention.

Discussion

There is a Difference in the Development of Communication Skills in Children with ASD, Before and After Their School Integration

After one year of schooling, the results of the statistical and descriptive analyses demonstrated a notable improvement in receptive, expressive and written communication skills in children with ASD. These findings are consistent with those reported in the study that was carried out by Zukerman et al. (2022), who pointed out that the inclusion of students with ASD improves their ability to communicate and reduces their anxiety levels. However, these observations contrast with those mentioned in the research conducted by Mecherbet and Azzouz (2012), who did not notice any significant evolution in communication in two children with ASD who were included in a nursery alongside normal children. It is important to note that this research was carried out on a restricted sample over a limited period (7 months). The encouraging results of the present study demonstrate that schooling children with ASD can contribute to improving their communication skills as this provides them with an environment that encourages the practice of the necessary skills on an ongoing basis.

There is a Difference in the Development of Socialization Skills in Children with ASD, Before and After Their School Integration

The scholastic integration of children with ASD significantly ameliorated their interpersonal relationships. However, according to the results of the descriptive analysis, this was not true in the domains of game, leisure and social adaptation, where a slight improvement was recorded. These results are partially consistent with those found in the studies conducted by Coffey and Horner (2012) and Khatab et al. (2024). In this regard, Coffey and Horner (2012) showed that the implementation of school programs based on supporting positive behaviours positively impacted academic and social skills in children with ASD. Concerning Khatab et al. (2024), they highlighted the importance of inclusive environments in which children with ASD can play alongside normal children. They said that this could remarkably favour their social development.

Furthermore, the slight improvement in the domains of game, leisure and social adaptation can be explained by a lack of stimulation at school, particularly during playtime, where neurotypical children avoid playing with their autistic peers due to differences in communication, social interaction and play styles. In this context, some studies indicated that children with ASD are less inclined to participate in games intended for groups of neurotypical children of the same age, which leads to social exclusion and a feeling of loneliness for both groups of children because, indeed, these neurotypical children avoid their peers with ASD because they see them as less socially integrated (Tsou et al., 2024). The acceptance of children with ASD in a group of neurotypical peers is highly essential. Moreover, recognising the differences and needs of these children can help create a more inclusive and welcoming school climate for all students.

There is a Difference in the Development of Daily Living Skills in Children with ASD, Before and After Their School Integration

The results of the descriptive and statistical analyses suggested significant and remarkable progress in personal, domestic daily life, and community skills in children with ASD after one year of schooling. These findings agree with those previously reported by other authors who highlighted the importance of the school environment in increasing the autonomy of children with ASD in their daily lives (Yianni-Coudurier et al., 2016). They asserted that this may also ensure the professional integration of people with ASD in the future (Osborne & Reed, 2011). It is worth emphasising that collaboration between parents, teachers and psychologists is essential. Indeed, this collaboration played a critical role in improving the competencies of children with ASD so they can become autonomous in their everyday lives. The observations made in the present research align with those reported in previous studies, which showed that the development of self-government skills in schools for children with ASD requires close collaboration between families and teachers. Great emphasis should also be placed on children's strong points and interests to enhance their active participation and reinforce their autonomy (Botelho et al., 2020).

There is a Difference in the Development of Motor Skills in Children with ASD, Before and After Their School Integration

It was also noticed that both gross and fine motor skills showed significant improvement after one year of schooling. The improvement of motor competencies in children with ASD was due to numerous fine motor activities, such as drawing, folding, using scissors, doing manual work, and practising sports. It should be noted that these children perform sports activities alongside neurotypical peers under the supervision of a sports teacher. In this regard, Cao et al. (2024) showed that targeted interventions enhance many specific motor skills indispensable for participating in physical activities and becoming active in the school environment.

There is a Difference in the Adaptive Behavior Scores in Children with ASD, Depending on Their Age, Gender, ASD Severity Level, and Type of Intervention

The results suggested slight differences in socio-adaptive behaviours, depending on the age of the children and the type of intervention. In addition, a slight superiority was observed in girls and preteenagers. Note also that most results were not statistically significant. Further, children with mild to moderate ASD showed better performances than those with severe ASD, particularly regarding some aspects of daily life skills (personal and domestic skills). Finally, schooled children performed better than those with mixed care in adaptive behaviours, especially in play and free time, except in personal and domestic daily life skills, in which these children showed better results. The results of the descriptive analysis are consistent with those found by Castro and Puente (2023), who indicated that age and male gender could be considered potential risks for the development of socio-adaptive behaviours. It should be emphasised that the results of the present study do not agree with those reported by Yianni-Coudurier et al. (2016), who demonstrated that, first, specialised intervention in day hospitals improves social skills in children with ASD and, second, schooling in a mainstream environment strengthens their autonomy in daily life.

However, one should note that this last study focused primarily on the number of hours of intervention, while ours concentrated on the type of care, knowing that the children in our sample spend more time in school than in specialised care.

Limitations of the Research

Although this study emphasises valuable insights about the impact of school integration on the socio-adaptive behaviours of children with ASD, it is essential to mention some limitations that may affect the generalizability of the findings:

Sample Size. The small sample size of the present study (18 students with ASD) limits the generalizability of the results. Surveying a more prominent and representative sample of the community would increase the statistical power of the study.

Subjectivity of Assessment. Since the Vineland-2 scale used in the current study relies on a semi-structured interview with parents, the assessment of adaptive social behaviors, especially in areas such as social skills and emotional regulation, can be subjective and influenced by the assessor's judgment. Using multiple assessments can provide a more comprehensive and reliable evaluation of adaptive functions.

Lack of a Control Sample. The absence of a control group limits the ability to compare the results of integrated education with those of other educational models.

Conclusion

The present study essentially aimed to show that school integration plays a fundamental role in the development of socio-adaptive behaviours in children with ASD. The findings indicated significant improvements in socio-adaptive behaviours, including receptive, expressive, and written communication, interpersonal relations, daily life (personal, domestic, and community), and gross and fine motor skills. However, slight improvements were observed in some sub-domains, such as playing games and leisure and social adaptation. A lack of stimulation from neurotypical children could explain these results. Therefore, neurotypical peers are expected to be more active in helping and motivating children with ASD to overcome their difficulties.

In this same respect, it was shown that the study that examined the different factors that can influence the schooling of children with ASD did not show statistically significant results. However, the descriptive analysis findings and the calculated effect sizes showed slight differences in socio-adaptive behaviours, depending on the age, gender, ASD severity level, and type of support provided. These observations are comparable to those reported in other works that were carried out by numerous researchers who highlighted the importance of inclusive schools in enhancing the autonomy of children with ASD in their everyday lives and in ameliorating the well-being of these children and their families as well.

Suggestions for Future Research

Though this study showed the beneficial impact of school integration on the development of adaptive competencies in children with ASD, the results cannot be generalised due to the limited size of the study sample. Notably, the domains of game, leisure and social adaptation did not exhibit significant evolutions. Consequently, it is highly recommended to carry out additional research in the future to examine the impact of targeted interventions, such as those related to game and leisure activities, on the socio-adaptive behaviours of children with ASD. A study with a larger sample size and a more extended follow-up period ought to be conducted to corroborate and validate our results. In conclusion, improving the socio-adaptive behaviours of children with ASD should remain the central objective of schooling and precocious interventions. This should be done with a view of ameliorating the quality of life of people with ASD in general and helping them acquire greater independence in their everyday lives.

Annexes

Annexe 1

Results of Descriptive Analyses of Shapiro-Wilks for Normality Test

			Statistic	Std. Error
The sum of scores T1	Mean		120,67	12,557
	95% Confidence Interval for Mean	Lower Bound	94,17	
		Upper Bound	147,16	
	Std. Deviation		53,276	
	Minimum		62	
	Maximum		235	
Sum of scoresT2	Mean		30,50	3,559
	95% Confidence Interval for Mean	Lower Bound	22,99	
		Upper Bound	38,01	
	Std. Deviation		15,101	
	Minimum		20	
	Maximum		64	

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Conflict of Interest

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