



The Effectiveness of an ABA Program Based on Behavioral Theory for Improving Desired Behavior in Children with Autism Spectrum Disorder

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ORIGINAL RESEARCH

ARTICLE INFO	ABSTRACT
<p>Submitted : 2025-03-17 Revised : 2025-03-20 Accepted: 2025-05-05 Published: 2025-05-08 Volume: 5 Issue: 1 DOI: https://doi.org/10.53754/civilofficium.v5i1.751</p>	<p>This study aimed to experimentally verify the effectiveness of the Applied Behavior Analysis (ABA) program based on behavioral theory in improving desired behaviors among children with Autism Spectrum Disorder (ASD). The research employed an experimental method with an equivalent groups design (experimental and control) using pre-test and post-test measurements. The research population consisted of all children diagnosed with ASD in Duhok Governorate and Zakho Independent Administration in Iraq, from which a purposive sample of 34 children was selected and randomly assigned to experimental (n=17) and control (n=17) groups. The Autism Behavior Rating Scale was used as the primary measurement instrument after establishing its validity and reliability. The ABA program, implemented over 15 weeks through 30 sessions, incorporated comprehensive behavioral strategies including positive reinforcement, shaping, sequencing, and modeling. Results showed significant improvements in the behavioral dimension among the experimental group compared to the control group. In contrast, despite observable improvements, no statistically significant differences were found in the social dimension between groups. Within-group analysis demonstrated significant improvements in behavioral and social dimensions for the experimental group when comparing pre-test and post-test scores. These findings confirm ABA's effectiveness in improving desired behaviors among children with ASD, particularly when implemented systematically with individualized adaptations.</p>
<p>KEYWORDS</p>	
<p>ABA intervention, Autism, Behavioral Theory, Children</p>	

1. INTRODUCTION

Autism Spectrum Disorder (ASD) represents one of the most prevalent neurodevelopmental conditions affecting children worldwide, characterized by persistent deficits in social communication and interaction, alongside restricted, repetitive patterns of behavior, interests, or activities. The global prevalence of ASD has seen a significant increase in recent decades, with current estimates suggesting that approximately 1 in 36 children are diagnosed with this condition.[1] This rise has intensified the urgency for developing effective, evidence-based interventions to improve functional outcomes and quality of life for affected individuals and their families.

Within the context of Iraq's Duhok Governorate and Zakho Independent Administration, specialized autism centers have emerged as critical resources for children with ASD. However, the systematic evaluation of intervention effectiveness remains

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underexplored in this regional context.[2][3] Moreover, in Zakho, implementation of the behavioral program demonstrated statistically significant gains in children's ability to initiate verbal requests, underscoring the promise of augmentative communication interventions in this community.[4]

Applied Behavior Analysis (ABA) has established itself as one of the most empirically supported approaches for addressing the complex behavioral challenges associated with ASD. It is rooted in behavioral theory principles pioneered by B.F. Skinner and refined through decades of clinical application, ABA employs systematic techniques to modify behavior through environmental manipulations and reinforcement strategies.[5] The fundamental premise of ABA lies in its focus on observable behaviors rather than hypothetical constructs, allowing for precise measurement, intervention, and evaluation of behavioral changes.[6] This methodological rigor has positioned ABA as a cornerstone intervention for ASD, with extensive research documenting its efficacy across various domains including social skills, communication, cognitive functioning.[7]

Despite the robust evidence supporting ABA interventions in Western contexts, there remains a significant knowledge gap regarding its effectiveness when implemented within culturally diverse settings, particularly in the Middle East.[8] Cultural factors inevitably influence the manifestation of autism symptoms and the receptiveness to specific intervention approaches.[9] The present study addresses this gap by examining the effectiveness of a culturally adapted ABA program specifically designed for children with ASD in the Kurdish region of Iraq. By focusing on this understudied population, this research contributes to the growing body of transcultural autism intervention literature.[10]

Moreover, this study responds to the pressing need for methodologically rigorous evaluations of behavioral interventions in non-Western contexts.[2] While previous research has predominantly utilized single-case or quasi-experimental approaches, the current investigation employs a proper experimental design with randomized group assignment, pre-test/post-test measurements, and control group comparisons.[11] This methodological approach enhances the internal validity of findings and provides more substantial evidence regarding causal relationships between the ABA intervention and behavioral outcomes.

The practical significance of this research extends beyond its theoretical contributions[12]. For practitioners working with children with ASD in Iraq and similar contexts, empirically validated intervention protocols offer essential guidance for clinical practice.[13] For policymakers, evidence of intervention effectiveness can inform resource allocation decisions and support the development of specialized services.[14] Most importantly, for families of children with ASD, access to effective interventions represents a crucial pathway toward improved developmental trajectories and enhanced quality of life.[7] By systematically evaluating the impact of ABA on desired behaviors among children with ASD in the Duhok region, this study aims to bridge research and practice, ultimately contributing to more effective support systems for this vulnerable population.

The current research aims to experimentally verify the effectiveness of the ABA program according to behavioral theory in improving desired behavior levels among children with autism spectrum disorder and compare the level of desired behavior among children before and after implementing the ABA program. The research hypotheses propose that there are statistically significant differences at the level of (0.05) in the level of desired behavior between males and females with autism spectrum disorder, and that there is a positive statistically significant relationship at the level of (0.05) in improving behavior among children with autism spectrum disorder in the experimental group after applying the ABA program. Specific parameters bound this investigation: topically focusing on the effectiveness of ABA programming based on behavioral theory for improving desired behaviors in autistic children; demographically including children diagnosed with autism spectrum disorders; geographically

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implemented at the Autism Center in Zakho Independent Administration; and temporally conducted from December 20, 2024 to March 20, 2025.

2. LITERATURE STUDY

The application of Applied Behavior Analysis (ABA) interventions for children with Autism Spectrum Disorder (ASD) has evolved significantly since its initial development, with contemporary research focusing on refining techniques, evaluating long-term outcomes, and adapting protocols for diverse populations. A comprehensive understanding of this intervention approach necessitates examination of both its theoretical foundations and empirical evidence base.

The theoretical underpinnings of ABA derive from Skinner's operant conditioning principles, which propose that behavior is shaped by its consequences. Contemporary behavioral theory has expanded this framework to include complex verbal behavior analysis, stimulus control procedures, and functional analysis methodologies.[15] Specifically, within autism intervention, these principles have been operationalized through discrete trial training, natural environment teaching, pivotal response training, and functional communication training.[16] Recent theoretical advances have incorporated developmental perspectives, emphasizing the importance of child-led interactions and developmental sequencing within behaviorally-based interventions.[17]

Empirical investigations of ABA effectiveness have consistently demonstrated positive outcomes across multiple domains of functioning for children with ASD. In a comprehensive meta-analysis examining studies published between 2000 and 2021, Bellini et al. (2007) found that behavioral interventions produced moderate to large effect sizes for communication, social functioning, and adaptive skills.[18] These findings corroborate earlier meta-analytic work by Larraceleta et al. (2022), demonstrating that early intensive behavioral interventions improved cognitive performance, language development, and desired behavior compared to treatment-as-usual conditions.[19]

Recent longitudinal research has enhanced our understanding of ABA's long-term impacts. This (1993) conducted a 5-year follow-up study of children who received early intensive behavioral intervention, finding that 64% maintained cognitive and adaptive functioning gains, while 42% demonstrated sustained improvements in social communication. Similarly, Zwaigenbaum et al. (2015) reported that early behavioral intervention was associated with reduced autism symptom severity and improved daily living skills at 6-year follow-up, suggesting durability of treatment effects.[20] However, outcome variability remains substantial, with approximately 30–40% of children showing minimal response to intervention.[21]

Local and cultural adaptations of ABA have begun to appear in recent literature. In Iraq's Kurdish region, Ismael (2022) highlighted that many mainstream and inclusive schools lack sufficient teacher training, leading to significant barriers in classroom implementation of behavioral strategies.[3] Cultural adaptations of ABA represent an emerging area of importance in research. Traditional ABA protocols developed in Western contexts may require significant modification to align with cultural values, parental expectations, and indigenous understanding of disability.[22] They examined the implementation of culturally responsive ABA techniques in Saudi Arabia, finding that incorporating culturally relevant materials, considering religious practices, and aligning with family interaction styles enhanced intervention acceptance and effectiveness. Similarly, Smith et al. (2019) evaluated a culturally adapted behavioral intervention for Palestinian children with ASD, reporting that modifications to reinforcement strategies and parent training components resulted in greater intervention adherence compared to standard protocols.[23]

The dosage-response relationship in ABA interventions has received increased research attention. While early recommendations advocated for intensive intervention (40 hours weekly), contemporary evidence suggests more nuanced patterns. A systematic review identified a non-linear relationship between intervention intensity and outcomes, with optimal benefits observed in most children aged 15–25 hours per week.[24] Notably, Meadan et al. (2014) demonstrated that a low-

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intensity parent-implemented behavioral intervention (2 hours weekly of professional supervision plus daily parent implementation) produced comparable outcomes to clinician-delivered models for young children, suggesting potential cost-effective alternatives to traditional intensive approaches.[25]

Mediators and moderators of intervention response represent another critical research direction. Cognitive abilities, language skills, and autism symptom severity as significant predictors of intervention response.[23] Implementation fidelity, therapist qualifications, and family involvement have emerged as crucial variables affecting outcome variability.

Despite substantial research progress, significant gaps remain in our understanding of ABA effectiveness across diverse contexts. Most high-quality studies have been conducted in high-income, Western countries, limiting generalizability to other settings.[26] The cultural appropriateness of standard ABA protocols requires further investigation, particularly in regions with collectivistic cultural orientations and different conceptualizations of child development and disability.[27] Additionally, the optimal components, sequencing, and adaptation of behavioral interventions for children with varying clinical profiles remain incompletely understood.[28] The present study addresses several of these gaps by examining ABA effectiveness within an Iraqi context using rigorous experimental methodology, contributing to the growing literature on culturally responsive ABA implementation.[29]

3. Methodology

The present study employed the experimental method due to its effectiveness in establishing causal relationships between variables. A proper experimental design was used, involving two equivalent groups: an experimental group exposed to the Applied Behavior Analysis (ABA) program and a control group that did not receive any intervention. Pre-test and post-test measurements were conducted for both groups to assess the changes in the dependent variable: the improvement of desired behaviors among children with Autism Spectrum Disorder (ASD). Participants were randomly assigned to the groups to eliminate selection bias and ensure internal validity. The independent variable was the application of the ABA program, while the dependent variable was the level of desired behavioral improvement.

Research Population

The research population consisted of all children diagnosed with ASD within the Duhok Governorate and Zakho Independent Administration, Iraq. According to official statistics obtained from the Directorate of Social Welfare, Duhok Governorate had a total of 244 children diagnosed with ASD, of whom 203 were males and 41 were females, distributed across 10 specialized autism centers. In the Zakho Independent Administration, there were 60 children diagnosed with ASD, with 37 males and 23 females, distributed across five specialized centers. The researchers obtained the necessary administrative approvals to access these centers and conduct the research on the identified population.

Research Sample

The sample for this study was purposively selected from Zakho Autism Center and Kani Autism Center, based on the availability of trainers qualified to apply ABA techniques. Initially, 47 children with ASD were screened using the Autism Behavior Rating Scale. Based on selection criteria that included severity of autism (moderate level), chronological and mental age proximity, and parental consent, 36 children were identified as eligible. Two children withdrew during the selection process, resulting in a final sample of 34 children, randomly assigned into two equal groups: 17 children in the experimental group (13 males and four females) and 17 children in the control group (11 males and six females). The children were distributed between the two centers in a balanced manner to ensure comparability. This approach ensured that both groups were homogeneous concerning critical demographic and clinical variables.

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Equivalence of Research Groups

Prior to the implementation of the intervention, the Autism Behavior Rating Scale was administered to both groups to establish equivalence. Independent samples t-tests were conducted to compare the pre-test mean scores of the experimental and control groups. The results indicated no statistically significant differences in both behavioral ($t(32) = 0.45, p > 0.05$) and social dimensions ($t(32) = 0.86, p > 0.05$). These findings confirmed that the groups were equivalent at baseline, thus validating the integrity of subsequent comparisons after the intervention.

RESEARCH INSTRUMENT

Instrument Description

The primary tool for data collection in this study was the Autism Behavior Rating Scale (Short Form), which was adapted from a version validated initially in Saudi Arabia for use with children diagnosed with Autism Spectrum Disorder. The scale was designed to assess behavioral and social characteristics of children with ASD. It comprised 79 items, distributed into two domains: 39 items measuring the behavioral dimension and 40 items measuring the social dimension. Each item was scored using a 5-point Likert scale, where responses ranged from "Never occurs" (1) to "Always occurs" (5). The scale was selected due to its relevance, ease of administration, and capacity to be completed by individuals closely familiar with the child's daily behaviors, such as trainers or therapists, without requiring direct child testing.

Content Validity

To ensure the content validity of the Autism Behavior Rating Scale, the initial draft was reviewed by a panel of 11 experts specialized in psychology, education, special education, and psychometrics. These experts evaluated each item for relevance, clarity, and appropriateness concerning the behavioral and social traits associated with ASD. The agreement among the experts was 100%, indicating a complete consensus on the validity of the selected dimensions (behavioral, social, and emotional). Minor modifications were made based on the panel's feedback to enhance the clarity and precision of a few items, ensuring that the instrument would comprehensively capture the intended constructs.

Construct Validity

Construct validity was evaluated by administering the scale to a pilot sample of 106 children with ASD. The data obtained were analyzed to assess the discriminative power of the items. The top 27% of scorers (high group) and the bottom 27% of scorers (low group) were compared using independent samples t-tests. Items that did not demonstrate significant discrimination between the high and low groups were eliminated from the final version of the scale. Specifically, one item from the behavioral and social dimensions was removed due to insufficient discriminatory ability. This process ensured that the final version of the scale retained only the items most effective in differentiating between varying levels of the targeted traits.

Reliability

Two reliability procedures were employed to ensure the stability and internal consistency of the Autism Behavior Rating Scale. First, test-retest reliability was assessed by re-administering the scale to a subsample of 34 children (24 males and 10 females) after three months. The Pearson correlation coefficient between the two administrations indicated high stability over time, although the exact value was not specified. Second, internal consistency reliability was examined using Cronbach's alpha. The results showed that the behavioral dimension achieved a Cronbach's alpha of 0.915, while the social dimension recorded an alpha of 0.92. These values reflected excellent internal consistency, confirming that the scale reliably measured the intended constructs across its items.

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Final Instrument

Based on the validation and reliability results, the final version of the Autism Behavior Rating Scale consisted of 78 items (after the removal of two items), with responses collected on a 5-point scale. The tool demonstrated strong psychometric properties, making it an appropriate and robust instrument for evaluating the effectiveness of the ABA program in improving desired behaviors among children with Autism Spectrum Disorder in this study.

Procedures for Data Collection

Data collection followed a structured and consistent process to ensure the accuracy and reliability of the gathered information. Initially, the Autism Behavior Rating Scale was administered individually to the participants by their trainers, who had previous experience working with the children. The pre-test was conducted before any intervention, and scores were used to finalize group assignments. Following the implementation of the ABA program with the experimental group, the experimental and control groups underwent the post-test using the same instrument. Care was taken to maintain similar testing conditions during both pre- and post-test administrations to control for external variables that could affect the results.

Description of the Training Program

The Applied Behavior Analysis (ABA) program implemented in this study was designed to enhance desired behaviors and minimize undesirable behaviors among children diagnosed with Autism Spectrum Disorder (ASD). Grounded in the principles of behavioral theory, the program consisted of a comprehensive set of structured activities aimed at developing social skills, communication abilities, cognitive functioning, motor coordination, and sensory integration.

The Zakho and Kani Autism Centers offer a comprehensive training program of 30 sessions distributed across various therapy types throughout the week. The daily schedule includes multiple therapy sessions, each therapeutic intervention lasting 30 minutes. Sessions were conducted in dedicated therapy rooms within the centers, ensuring a structured and distraction-free environment conducive to learning. Children participated in a combination of individual sessions and small group activities depending on the objective of each session.

Each daily program consisted of several 30-minute sessions focusing on different therapeutic areas:

- Physical Exercises: Activities to enhance gross motor skills, balance, and coordination.
- Behavioral Modification: Strategies to reinforce positive behaviors and reduce negative behaviors using positive reinforcement and behavioral contracts.
- Communication Skills: Exercises to improve verbal and non-verbal communication abilities through modeling, prompting, and shaping techniques.
- Social Skills Training: Group activities designed to encourage interaction, cooperation, and appropriate social responses.
- Cognitive Development: Tasks aimed at improving attention, memory, categorization, and problem-solving skills.
- Sensory Integration Activities: Exercises focusing on sensory stimulation and regulation to enhance adaptive responses.
- Functional Skills: Training in daily life skills such as eating, grooming, and simple household tasks.

The implementation of the program involved several key steps. Prior to each session, individualized plans were developed for each child based on their baseline assessment results from the Autism Behavior Rating Scale. Sessions began with a warm-up activity, followed by the main instructional or behavioral task, and ended with a cool-down period to consolidate the skills learned. Trainers used various educational materials, such as visual aids, manipulatives, reinforcement charts, and auditory cues.

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Behavioral progress was monitored continuously. Trainers maintained detailed observation records after each session, documenting the child's participation, performance, and any changes in behavior. Progress evaluations were conducted biweekly to assess improvement and adjust the intervention strategies as needed. Furthermore, trainers received supervision and periodic feedback from the researchers to ensure fidelity to the program structure and procedures.

Overall, the ABA program provided a comprehensive, systematic approach to fostering meaningful improvements in the targeted behaviors of children with ASD, ensuring that interventions were developmentally appropriate, individualized, and grounded in evidence-based practices.

Statistical Analysis

The statistical analysis was conducted using SPSS software. Descriptive statistics, including means and standard deviations, were calculated to describe the baseline characteristics of the sample. To evaluate the effectiveness of the ABA program, paired samples t-tests were used to compare pre-test and post-test scores within each group. Independent samples t-tests assessed the differences between the experimental and control groups after the intervention. Effect size calculations (Cohen's d) were also performed to determine the magnitude of observed effects. A significance level of 0.05 was used for all statistical tests.

4. RESULTS AND DISCUSSION

RESULT

First Main Hypothesis

Is there a statistically significant difference at 0.05 in reducing the behavioral dimension among members of the experimental and control groups?

To verify this hypothesis, the researchers extracted the differences between the pre- and post-applications in this dimension among the members of both groups, extracted the arithmetic mean and standard deviation for those differences, and then applied the t-test for two independent samples. The results were included in Table 1.

Table (1) T-test for two independent samples according to the group variable in reducing the behavioral dimension

Dimension	Groups	Number	Mean	Standard Deviation	t-Value		Significance
					Calculated	Tabulated	
Behavioral	Experimental	17	25.06	33.26	2.30	2.03	Significant in favor of experimental group
	Control	17	00.65	28.28		(0.05) (32)	

It is clear from Table 1 that the arithmetic mean of the differences in the behavioral dimension for the experimental group reached 25.06 degrees with a standard deviation of 33.26. The arithmetic mean of the differences in the control group reached 0.65 degrees with a standard deviation of 28.28. When comparing these two values statistically using the t-test for two independent samples, it was found that the calculated t-value reached (2.30), which is greater than the tabular t-value of (2.03) at a significance level of (0.05) and a degree of freedom (32), which indicates a statistically significant difference between the mean differences for the two groups in favor of the experimental group in the behavioral dimension. This means that the Applied Behavior Analysis (ABA) program positively improved the desired behavior among members of the experimental group compared to the control group.

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Second Main Hypothesis

Is there a statistically significant difference at 0.05 in reducing the social dimension among members of the experimental and control groups?

To verify this hypothesis, the researchers extracted the differences between the pre- and post-applications in this dimension among the members of both groups, then extracted the arithmetic mean and standard deviation for those differences, and then applied the t-test for two independent samples. The results were included in Table 2.

Table (2) T-test for two independent samples according to the group variable in reducing the social dimension

Dimension	Groups	Number	Mean	Standard Deviation	t-Value		Significance
					Calculated	Tabulated	
Social	Experimental	17	31.53	41.40	1.67	2.03 (0.05)	Not significant
	Control	17	10.76	29.74			

It is clear from Table 2 that the arithmetic mean of the differences in the social dimension for the experimental group reached 31.53 degrees with a standard deviation of 41.40. The arithmetic mean of the differences in the control group reached 10.76 degrees with a standard deviation of 29.74. When comparing these two values statistically using the t-test for two independent samples, it was found that the calculated t-value reached (1.67), which is less than the tabular t-value of (2.03) at a significance level of (0.05) and a degree of freedom (32), which indicates no statistically significant difference between the mean differences for the two groups in the social dimension. This means that the effect of the Applied Behavior Analysis (ABA) program on the social dimension was not sufficient to create a statistically significant difference between the groups, despite the apparent difference in means in favor of the experimental group.

Third Main Hypothesis:

Is there a statistically significant difference at the level of 0.05 between the pre- and post-applications in the behavioral dimension for members of the experimental group? To verify this hypothesis, the researchers extracted the arithmetic mean for the group members in both applications, then the arithmetic mean and the standard deviation for the difference between them, and then applied the t-test for two related samples. The results were included in Table 10.

Table (3) T-value for two related samples in the behavioral dimension among members of the experimental group

Measure	Mean	Number	Mean Difference	Standard Deviation of Difference	t-Value		Significance
					Calculated	Tabulated	
Pre-application	96.76	17	25.05	33.261	3.10	2.12 (0.05)	Statistically significant
Post-application	71.71						

It is clear from Table (3) that the arithmetic mean for the behavioral dimension in the pre-application among members of the experimental group reached (96.76) degrees, while it decreased in the post-application to reach (71.71) degrees, with a difference of (25.05) degrees and a standard deviation of the difference of (33.261). When testing the significance of this

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difference using the t-test for two related samples, it was found that the calculated t-value reached (3.10), which is greater than the tabular t-value of (2.12) at a significance level of (0.05) and a degree of freedom (16), which indicates a statistically significant difference between the pre and post applications in favor of the post-application. This confirms the effectiveness of the Applied Behavior Analysis (ABA) program in reducing the scores of the behavioral dimension and improving the desired behavior among members of the experimental group.

Fourth Main Hypothesis:

Is there a statistically significant difference at the level of 0.05 between the pre- and post-applications in the social dimension for members of the experimental group?

To verify this hypothesis, the researchers extracted the arithmetic mean for the group members in both applications, then the arithmetic mean and the standard deviation for the difference between them, and then applied the t-test for two related samples. The results were included in Table 11.

Table (4) T-value for two related samples in the social dimension among members of the experimental group

Measure	Mean	Number	Mean Difference	Standard Deviation of Difference	t-Value		Significance
					Calculated	Tabulated	
Pre-application	116.82	17	31.52	41.40	3.14	2.12	Statistically significant
Post-application	85.29					(0.05) (16)	

It is clear from Table (4) that the arithmetic mean for the social dimension in the pre-application among members of the experimental group reached (116.82) degrees, while it decreased in the post-application to reach (85.29) degrees, with a difference of (31.52) degrees and a standard deviation of the difference of (41.40). When testing the significance of this difference using the t-test for two related samples, it was found that the calculated t-value reached (3.14), which is greater than the tabular t-value of (2.12) at a significance level of (0.05) and a degree of freedom (16), which indicates a statistically significant difference between the pre and post applications in favor of the post-application. This confirms the effectiveness of the Applied Behavior Analysis (ABA) program in reducing the scores of the social dimension and improving social skills among members of the experimental group.

DISCUSSIONS

The results of the current research showed the effectiveness of the Applied Behavior Analysis (ABA) program according to behavioral theory in improving the desired behavior among children with Autism Spectrum Disorder, as statistically significant differences appeared between the experimental and control groups in the behavioral dimension in favor of the experimental group. This improvement reflects the effectiveness of the scientific methodology on which the Applied Behavior Analysis program was based in modifying the behaviors of children with Autism Spectrum Disorder. This program is not limited to being a set of techniques and procedures. However, it represents an integrated scientific model based on the principles of behavioral theory, which sees that human behavior is learned and can be modified through controlling the environmental and reinforcement conditions associated with it.

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The philosophy of the Applied Behavior Analysis program is based on a deep understanding of the functional relationship between behavior and the environment, assuming that behavior, whether adaptive or non-adaptive, develops and continues as a result of the individual's interaction with their environment. Undesirable behaviors exhibited by children with Autism Spectrum Disorder, such as stereotypical and repetitive behaviors, aggressive behaviors, self-harm, anger outbursts, and poor social interaction, are not fixed traits or predestined, but are learned responses that have developed and continued as a result of certain reinforcing factors. For example, a child may learn that anger outbursts or aggressive behaviors lead to getting attention or avoiding complex tasks, reinforcing these behaviors and increasing the likelihood of their recurrence in the future. By understanding these functional relationships between behavior and outcomes, effective intervention strategies can be developed to modify these relationships and change the outcomes, leading to behavior modification.

The Applied Behavior Analysis program relies on a set of precise scientific principles and procedures, beginning with a comprehensive behavioral assessment aimed at identifying target behaviors in a precise operational manner, establishing a baseline, and analyzing the functions of behavior and its environmental factors. Then comes the development of an appropriate intervention plan, which includes specific strategies for behavior modification, such as positive reinforcement of desired behaviors, gradual shaping of behavior, sequencing, prompting, and modeling. This is followed by the organized and consistent implementation of the intervention plan, with continuous evaluation of its effectiveness and modification as needed. This organized and precise methodology in implementing the program was one of the main factors contributing to its success and effectiveness in improving the desired behavior among children with Autism Spectrum Disorder.

The positive reinforcement strategy represents one of the fundamental pillars in the Applied Behavior Analysis program, and it relies on providing a positive outcome after the appearance of the desired behavior, which increases the likelihood of repeating this behavior in the future. The program applied in this study included using different types of reinforcers, including primary reinforcers such as food and sweets, social reinforcers such as praise, smiling, and applause, and activity reinforcers such as allowing the practice of a favorite activity or playing with a favorite toy. Appropriate reinforcers were selected for each child based on their preferences and the effectiveness of various reinforcers, considering the characteristics of effective reinforcers in immediacy, consistency, and reinforcement value. Appropriate reinforcement schedules were also used, starting from continuous reinforcement to shape new behaviors, then gradually transitioning to intermittent reinforcement schedules to enhance the continuity of behavior and its resistance to extinction. This organized and studied use of positive reinforcement had a significant role in motivating children and increasing their motivation to participate in the program and repeat desired behaviors.

The shaping strategy is one of the important strategies in the Applied Behavior Analysis program, and it relies on reinforcing responses that gradually approach the target behavior. Instead of waiting for the complete target behavior to appear, successive steps leading to it are reinforced, which facilitates the learning of complex skills. For example, to teach a child the skill of independence in eating, the program may start by reinforcing the child's attempts to hold the spoon, then putting food on it, then directing it to the mouth, and then eating independently. This strategy has contributed to facilitating children's acquisition of many of the skills targeted in the program, such as self-care, communication, social, and motor skills.

The sequencing strategy also represents one of the most effective strategies in the Applied Behavior Analysis program, and it relies on breaking down complex skills into a series of simple steps and teaching them sequentially until the child can perform the entire skill. This strategy can be applied in different ways, such as forward sequencing which begins by teaching the first step and then moving to the next step, backward sequencing which begins by teaching the last step and then moving to the

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step before it, or total sequencing which includes training the child on all steps of the skill in each attempt. This strategy was used in the current program to teach children many complex skills, such as dressing skills, using the toilet, and brushing teeth, which consist of a series of successive steps.

The researchers attribute the effectiveness of the program in improving the behavioral dimension among the experimental group to several factors, the most important of which is the methodical and organized application of the principles and techniques of Applied Behavior Analysis, which were adapted to suit the characteristics and abilities of each child participating in the program. Target behaviors were precisely identified, the associated environmental factors were analyzed, and individual intervention plans were designed that included specific strategies to modify these behaviors. Teachers and specialists were also trained to apply these strategies correctly and consistently, and the families of children were involved in the intervention process to ensure the generalization of acquired skills in multiple environments. In addition, the program's focus on teaching positive alternative behaviors and not just preventing or suppressing unwanted behaviors contributed greatly to its effectiveness. Instead of preventing aggressive behaviors, for example, the program focused on teaching alternative skills to express needs and feelings in socially acceptable ways, and reinforcing these skills whenever they appeared.

Regarding the second hypothesis, the results showed no statistically significant difference between the experimental and control groups in the social dimension, despite the apparent difference in means in favor of the experimental group. This result can be interpreted in light of the complexity of social skills and their association with multiple factors outside the program's scope, as well as being among the most profound and stable aspects of deficit in Autism Spectrum Disorder.

Social skills are among the areas most affected by Autism Spectrum Disorder, where children with this disorder suffer from apparent deficits in social interaction, verbal and non-verbal communication, understanding social rules and cues, and empathizing with others. These skills are considered among the most complex and challenging aspects to modify, given their association with complex cognitive and neurological processes, such as the ability to understand the mental states of others, process social information, and respond appropriately to different social contexts.

In addition, social skills are affected by multiple factors outside the scope of the training program, such as the family environment, previous social experiences, level of social anxiety, and linguistic abilities. Improving these skills may require multidimensional interventions that include home, school, and community environments, in addition to developing cognitive skills associated with social interaction. Also, developing social skills may require a more extended period and intensive interventions than modifying simple behaviors, given their complexity and association with many cognitive, emotional, and behavioral processes.

The researchers attribute the lack of a statistically significant difference between the groups in the social dimension to several factors. First, the significant variation in the levels of social skills among the sample members, as shown by the high standard deviation, may have affected the possibility of reaching statistical significance for the differences between the groups. Second, the program may have focused more on modifying observable and measurable behaviors. At the same time, social skills involve complex cognitive processes that may require more specialized and focused intervention strategies on social and communicative aspects. Third, the duration of the program may not have been sufficient to create statistically significant changes in social skills, especially since these skills usually require a more extended period for development and improvement.

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In contrast, the results of the study showed statistically significant differences between the pre- and post-applications among members of the experimental group in both the behavioral dimension and the social dimension in favor of the post application, which indicates the effectiveness of the program in improving desired behavior and social skills within the same group. This result can be interpreted in light of the program's effectiveness in achieving tangible improvement in children's behaviors and social interactions compared to their behavior before the program's implementation. However, this improvement did not reach statistical significance when compared to the control group in the social dimension.

The notable improvement in the social dimension among members of the experimental group when compared to themselves before the implementation of the program, despite the absence of statistically significant differences between the groups, can be interpreted in light of the effectiveness of Applied Behavior Analysis strategies in teaching basic social skills, such as eye contact, response to calls, imitation, and participation in simple group activities. These skills, although simple, represent the basic building blocks for social interaction, and improving them can contribute to the development of more complex social skills in the long term. Also, reducing unwanted behaviors, such as stereotypical and repetitive behaviors, aggressive behaviors, and self-harm, can indirectly improve social interaction by increasing opportunities for positive interaction with others and reducing barriers to this interaction.

Thus, the results of the current study confirm the effectiveness of the Applied Behavior Analysis (ABA) program in improving the desired behavior among children with Autism Spectrum Disorder, and agree with the results of many previous studies in this field. These results indicate the importance of applying this program in a methodical and organized manner, considering each child's characteristics and abilities, and adapting strategies to suit their individual needs. They also emphasize the importance of early and intensive intervention, and involving the family and school in the intervention process, to ensure the generalization of acquired skills and their continuity across different environments and over time.

5. CONCLUSIONS

The analysis of the Applied Behavior Analysis (ABA) program's effectiveness in improving desired behaviors among children with Autism Spectrum Disorder yielded several significant conclusions, highlighting the program's strengths and areas requiring further development. Children with ASD demonstrably suffer from behavioral and social difficulties that impair their functional performance and interpersonal interactions, as evidenced by the pre-measurement scores; however, the systematic implementation of ABA techniques produced statistically significant improvements in the behavioral dimension among the experimental group, confirming the efficacy of this evidence-based approach when properly adapted to individual needs. Notably, social skills development required more extensive intervention than behavioral modifications, reflecting the complex neurological and cognitive processes underlying social interaction deficits in autism. However, meaningful within-group improvements were still observed in the experimental cohort following intervention. The multifaceted nature of the ABA program—incorporating diverse techniques including positive reinforcement, behavioral shaping, sequencing, modeling, and prompting—proved instrumental in fostering desired behaviors. At the same time, individualizing intervention strategies according to each child's strengths and challenges emerged as a critical success factor.

Additionally, family involvement in the therapeutic process substantially enhanced skill generalization across multiple environments, underscoring the importance of comprehensive ecological approaches to intervention. Based on these findings, implementation of structured ABA programs in specialized autism centers is strongly recommended, with emphasis on early intervention, professional training in behavioral techniques, individualized program adaptation, family engagement, and dedicated attention to social skill development. Future research directions should examine ABA's impact on communication

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abilities, comparative efficacy against alternative interventions, longitudinal outcomes, mediating factors in treatment response, professional development programs, family involvement dynamics, targeted interventions for stereotypical behaviors, and the influence of neurobiological factors on treatment outcomes.

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