

INVESTIGATION ARTICLE

## Evaluating an Asynchronous Training Program for Latin American Parents of Autistic Children

Evaluación de un Programa de Entrenamiento Asincrónico para Padres Latinoamericanos de Niños Autistas

Yors García<sup>1\*</sup> , Diana Vergara<sup>2</sup> , Cristian Yesid Urbano Mejía<sup>3</sup> , Fabian Ramírez Velasquez<sup>1</sup> 

<sup>1</sup> Pontificia Universidad Javeriana, Bogotá, Colombia.

<sup>2</sup> Diversidad LLC, Colombia.

<sup>3</sup> Universidad Nacional de Colombia.

\* Corresponding author.

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### Abstract

The present pilot study evaluated the effects of an asynchronous parent training program on reducing parenting stress, enhancing knowledge acquisition, and improving children's problem behaviors among Latin American parents of children with autism spectrum disorder. Fifteen parents were randomly assigned to either an intervention group or a waitlist control group. The intervention group accessed five bi-weekly modules covering autism, behavioral principles, prevention strategies, functional communication, and naturalistic teaching. Pretest and posttest assessments of parenting stress and child problem behaviors were administered, along with quizzes to measure knowledge acquisition. Results showed that participants in the intervention group demonstrated reductions in parenting stress and improvements in children's problem behaviors, though not statistically significant between-group differences were found. Individual-level analyses revealed reliable improvement for several participants in the intervention group, while others exhibited mixed patterns of change across outcome measures. Significant positive correlations were observed between parent-reported child behavior problems and parenting stress at both time points. Quiz results indicated knowledge gains in the intervention group, particularly in behavioral principles and communication. These findings suggest asynchronous interventions may offer benefits but highlight the need for additional support and larger studies to enhance effectiveness and generalizability.

**Keywords:** parent training; autism; asynchronous; behavior analysis; Latin America.

### Resumen

Este estudio piloto evaluó los efectos de un programa de entrenamiento a padres en formato asincrónico en la reducción del estrés parental, la adquisición de conocimientos sobre autismo, y la mejora de las conductas problemáticas en niños con trastorno del espectro autista en familias de América Latina. Quince padres fueron asignados al azar a un grupo de intervención o a un grupo control en lista de espera. El grupo de intervención completó cinco módulos quincenales que abordaron diversos temas: autismo, principios de conducta, estrategias de prevención, comunicación funcional y enseñanza naturalista. Se realizaron evaluaciones antes y después de la intervención para medir el estrés parental y las conductas problemáticas, y se aplicaron cuestionarios para evaluar la adquisición de conocimientos en autismo. Los resultados mostraron que los participantes del grupo de intervención reportaron una disminución del estrés parental y mejoras en las conductas problemáticas de sus hijos, aunque no se encontraron diferencias estadísticamente significativas entre los grupos. Los análisis individuales mostraron mejoras confiables en algunos participantes en el grupo de intervención, mientras que otros presentaron resultados mixtos. Se encontraron correlaciones positivas significativas entre las conductas problemáticas percibidas por los padres y el estrés parental en ambas evaluaciones. Los resultados de los cuestionarios indicaron un aumento en los conocimientos sobre autismo en el grupo de intervención, especialmente en los principios de

conducta y comunicación funcional. Estos hallazgos sugieren que las intervenciones asincrónicas pueden ser útiles, aunque se resalta la necesidad de evidencia adicional y de llevar a cabo estudios con muestras más grandes para optimizar su efectividad y generalización.

**Palabras clave:** entrenamiento para padres; autismo; asincrónico; análisis de la conducta; Latinoamérica.

## Introduction

Autism spectrum disorder (ASD) is a neurodevelopmental condition characterized by persistent deficits in social communication and social interaction across multiple contexts, as well as restricted, repetitive patterns of behavior, interests, or activities (American Psychiatric Association [APA], 2022). ASD typically manifests before the age of three and may lead to challenges such as self-injury, aggression, and difficulty forming peer relationships, which can significantly diminish quality of life (Hirota & King, 2023). Moreover, parents of children with ASD often encounter heightened emotional, financial, and social burdens, contributing to elevated levels of stress and mental health concerns (Karst & Van Hecke, 2012). Globally, the prevalence of ASD is estimated to be around 1%, although this rate varies across regions (Zeidan et al., 2022). For example, in Colombia, a recent study using national health system data estimated a prevalence of 13.79 per 10,000 children aged 4 to 14 years (0.138%), with higher rates—up to 17.9 per 10,000—observed in economically stronger regions such as Bogotá, Atlántico, and Valle del Cauca (García-Zambrano & Pinto-Ocampo, 2024). In Venezuela, one of the few available studies reported a prevalence of 17 per 10,000 children (0.17%) (Montiel-Nava & Peña, 2008). In Chile, a Bayesian estimate based on school enrollment and clinical data projected a national prevalence of 1.31% among children aged 6 to 18 (Roman-Urrestarazu et al., 2024).

Given the high prevalence and wide-ranging challenges associated with ASD, it is critical to identify effective interventions that support both individuals with autism and their families. One of the most widely adopted and extensively researched approaches to meet these needs is applied behavior analysis (ABA). Defined as a scientific approach that applies principles of learning and behavior to systematically improve socially significant behaviors (Ringdahl et al., 2023), ABA has demonstrated substantial benefits for individuals with autism and their caregivers (Gitimoghaddam et al., 2020). Research consistently highlights ABA as the most effective intervention for autism, fostering improvements in social, cognitive, and language skills across diverse age groups (Yu et al., 2020). By focusing on the identification and modification of environmental variables, ABA enhances academic, behavioral, and social-emotional functioning. Moreover, its structured yet adaptable nature makes ABA-based interventions highly valued by parents, educators, and practitioners alike (McPhilemy & Dillenburger, 2013).

Building on the foundations of ABA, several specific strategies have been developed to target the diverse needs of individuals with ASD and their families. Among these, antecedent interventions, functional communication training (FCT), and naturalistic teaching approaches have shown particular promise in improving both child outcomes and family quality of life (Eckes et al., 2023; Gitimoghaddam et al., 2020). Antecedent interventions focus on proactively modifying environmental factors to reduce the likelihood of problem behaviors while promoting adaptive responses. Procedures such as offering choices, providing prompts or cues, implementing visual or activity schedules, and modifying environmental arrangements are commonly employed to facilitate more appropriate behavior (Radley et al., 2022). Complementing these preventive strategies, FCT aims to replace challenging behaviors with functional, socially acceptable forms of communication. By teaching alternative responses and reinforcing their use, FCT equips individuals with ASD to express needs and preferences more effectively across contexts (Carr & Durand, 1985; Gerow et al., 2018).

While traditional approaches such as discrete trial training (DTT)—a structured, table-based method that breaks down learning into clear, repeated instructional units—are widely used, they may have limitations in promoting skill generalization to natural settings (Smith, 2001). In contrast, naturalistic interventions aim to address this gap by embedding learning opportunities into the child's daily activities and routines. These interventions are child-led, occur in natural environments (e.g., home or playground), and use naturally occurring reinforcers (e.g., receiving a toy after requesting it; Dufek et al., 2024). Common naturalistic strategies include incidental teaching,

the mand-model procedure, time delay techniques, naturalistic environment teaching, and peer-mediated interventions (Dubin & Lieberman-Betz, 2020). Evidence suggests that children with ASD can acquire and generalize prelinguistic communication, academic, and daily living skills through these methods, particularly when they involve active caregiver or peer participation and align with the child's interests (Douglas et al., 2024; Schreibman et al., 2015).

As ABA methods continue to evolve, the use of telehealth has emerged as a promising avenue for expanding access to these services. Recent studies underscore the potential of online parent training for effectively disseminating ABA services to parents of children with ASD. Reviews indicate that telehealth services for delivering ABA-based interventions to individuals with disabilities and their caregivers are effective, resulting in significant behavior changes in both children and caregivers (Ferguson et al., 2019; Pan et al., 2023; Unholz-Bowden et al., 2020). Telehealth services have successfully reached diverse participant groups, including those with various disabilities and from different countries, highlighting the broad applicability of telehealth in ABA service delivery (Sivaraman & Fahmie, 2020). Additionally, telehealth using ABA procedures has led to significant improvements in emotional identification, social communication, and language outcomes, along with high procedural fidelity among parents (Pan et al., 2023). Online parent training has also enhanced parent self-efficacy, reduced parental stress, and increased acceptance and satisfaction with the interventions (Ferguson et al., 2019; Unholz-Bowden et al., 2020).

However, despite the growing interest and success of telehealth in regions like North America, its application in Latin America remains limited (DuBay, 2022). This gap emphasizes the need for more research and broader implementation of telehealth ABA services in these areas to support parents and children with ASD. In Latin America, children with ASD face significant barriers to accessing quality services (Paula et al., 2020). Caregivers report needs for addressing communication and social deficits, obtaining educational support, enhancing socialization, and fostering independence. They also highlight a lack of evidence-based treatments and infrastructural barriers such as long waiting lists, high costs, and a shortage of specialized services (Hughes et al., 2022; Montenegro et al., 2022; Paula et al., 2020). While children often receive speech and occupational therapy, ABA services typically begin in preschool and continue through adolescence, with most receiving between one and 10 hours per week, which is less than the recommended standard (Montiel-Nava et al., 2020; Paula et al., 2020). Families also face delays in obtaining a diagnosis due to environmental factors, cultural norms, public health coverage issues, national policies, and implementation of protective laws. Limited inclusive legislation and inconsistent protocols further compound these challenges (Montiel-Nava et al., 2020, 2024). These issues are further intensified by the absence of regulation and formal credentialing pathways for behavior analysts in most Latin American countries, as well as the lack of local training programs and ethical oversight (see, de los Santos et al., 2024).

Despite these limitations, initial efforts to train parents in ABA techniques within Latin America have shown encouraging results. Several studies have focused on equipping parents with ABA skills to address their children's core ASD symptoms (DuBay, 2022). For example, Magaña et al. (2019) conducted a six-day training program in Colombia with four participants, using evidence-based strategies to build children's skills. Participants valued the practical techniques for reducing problem behaviors and reported improvements in their children's communication and behavior. Similarly, Magaña et al. (2021b) compared student-led and professional-led group trainings on topics such as child development, ASD diagnosis, evidence-based interventions, advocacy, and stress reduction. The study revealed significant gains in parents' understanding of their children's strengths and needs, greater use of evidence-based practices, and reductions in depressive symptoms. Reviews of culturally adapted, parent-mediated ASD interventions for Latin American families also show promising outcomes, including improved caregiver mental health, enhanced advocacy knowledge, and reductions in children's maladaptive behaviors, along with gains in social communication and sensory processing (DuBay, 2022).

While these early initiatives highlight the potential of parent-focused ABA interventions in Latin America, they also point to a critical need for scalable and accessible delivery models. The limited reach and intensity of in-

person programs suggest that alternative methods—particularly those leveraging digital technology—may be essential for expanding services to underserved or remote regions. There is growing interest in online ABA-based parent training in Latin America; however, most existing studies have been descriptive or correlational, with relatively few evaluating structured, intervention-based programs (Magaña et al., 2021a). Online training offers multiple advantages, including improved access to services in rural and middle-income settings, reduced costs, and increased flexibility, all of which support treatment adherence and continuity of care. Telehealth also promotes family engagement and enables cultural and contextual adaptation of ABA procedures. Additionally, it facilitates the remote training and supervision of local therapists, thereby strengthening the quality and sustainability of services (Ferguson et al., 2019; Sivaraman & Fahmie, 2020; Unholz et al., 2020). Importantly, given the diverse cultural values and systemic challenges experienced by Latino families, culturally responsive frameworks are essential to improving the effectiveness of online ABA parent training (e.g., Baires et al., 2023). Aligning service delivery with family values such as familism and personalism can enhance treatment acceptability, engagement, and long-term success.

Given the persistent barriers to accessing behavior analytic services in Latin America—such as a shortage of trained professionals and a lack of culturally adapted interventions (de los Santos et al., 2024; Montiel-Nava et al., 2020; Paula et al., 2020)—there is a clear need for scalable, flexible, and culturally responsive solutions. Asynchronous parent training programs offer a promising avenue for delivering ABA-based interventions more broadly, particularly in underserved communities (DuBay, 2022; Magaña et al., 2021a). The primary aim of this pilot study is to evaluate the effects of an asynchronous parent training intervention on both children's problem behaviors and parenting stress among caregivers of autistic children in Latin America. Based on existing scientific literature, this appears to be one of the few studies implementing ABA-based procedures across multiple Latin American populations using asynchronous technology (De Souza et al., 2025; Emilio & Portes, 2024). This research seeks to contribute to the advancement of accessibility, cultural relevance, and the overall impact of ABA interventions in a region where such services remain scarce and urgently needed (e.g., DuBay, 2022; Montenegro et al., 2022).

## Method

### Design

This pilot study employed a quasi-experimental, pre-post, wait-list control design (Kazdin, 2025) with random assignment to evaluate the preliminary efficacy of an asynchronous parent training program for caregivers of children with ASD. For ethical reasons, participants assigned to the wait-list control group were granted access to the training modules upon the study's conclusion.

### Participants

Upon securing Institutional Review Board (IRB) approval from the supporting university, the authors disseminated a research recruitment flyer via professional and personal websites, emails, and snowball procedures. Initially, 120 parents of children diagnosed with ASD expressed interest in the study. A stringent screening process identified 50 parents who met the inclusion criteria. These parents were then invited to an initial meeting to explain the study's rationale, resulting in 15 participants.

Eligibility was contingent upon the following conditions: (a) a parental declaration confirming that a professional expert diagnosed their child with autism spectrum disorder (ASD); (b) the primary caregiver had no prior exposure to structured parent training involving applied behavior analysis (ABA) procedures or any formal or informal education in ABA concepts; (c) parental access to a sufficiently robust internet connection to stream video content; (d) parental availability for bi-weekly meetings with the research team and completion of assignments and training modules; (e) the child was not concurrently receiving home-based or clinic-based ABA therapy; (f) fluency in Spanish and residence in a Latin American country; (g) a clinical stress score of 80 or above on the Parenting Stress Index–Short Form (PSI-SF); (h) a score of 80 or above on the Intensity Scale and any score on the Problem Scale of the Eyberg Child Behavior Inventory (ECBI); (i) basic computer and virtual platform skills

as assessed by the Computer and Electronic Use Scale (CEW); and (j) the presence of a minor form of self-injurious behavior (SIB) in the child (e.g., occasional head-hitting with low force, mild skin scratching without tissue damage, or brief instances of hand biting without bruising).

Exclusion criteria included the presence of severe SIB, such as frequent and forceful head banging against hard surfaces, eye poking, face slapping, or self-biting that leads to significant tissue damage like bruising or open wounds. Additionally, Spanish-speaking parents residing outside Latin America or those with previous experience with ABA services were also excluded.

The demographics of the parents who met inclusion criteria and participated in the study are presented in [Table 1](#). In total, 15 participants were included, with seven randomly assigned to the experimental group and eight to the control group. The average age of female parents in the experimental group was 42.14 years ( $SD = 4.41$ ), while the control group had an average female age of 36.33 years ( $SD = 6.74$ ) and one male aged 43 years. Educational levels varied, with most holding undergraduate degrees in both groups. The experimental group included homemakers, an engineer, a dentist, a medical doctor, and an independent worker/student. The control group comprised homemakers, teachers, and an accountant. The countries of residence were diverse, including Colombia, Venezuela, Peru, Chile, and Uruguay. The average age of the children in the experimental group was 7.14 years ( $SD = 3.08$ ), compared to 5.14 years ( $SD = 1.57$ ) in the control group.

**Table 1.** Demographic Data of Participating Parents and Children.

|                                     | Experimental Group (n = 7) | Control Group (n = 8) |
|-------------------------------------|----------------------------|-----------------------|
| <b>Mean age in years (parents)</b>  |                            |                       |
| Female                              | 42.14 ( $SD = 4.41$ )      | 36.33 ( $SD = 6.74$ ) |
| Male                                | N/A                        | 43                    |
| <b>Educational Level</b>            |                            |                       |
| High School                         | 2                          | 2                     |
| Undergraduate                       | 3                          | 5                     |
| Graduate                            | 2                          | 1                     |
| <b>Employment</b>                   |                            |                       |
| Homemaker                           | 3                          | 3                     |
| Engineer                            | 1                          | 0                     |
| Dentist                             | 1                          | 0                     |
| Medical Doctor                      | 1                          | 0                     |
| Independent Worker/Student          | 1                          | 1                     |
| Teacher                             | 0                          | 3                     |
| Accountant                          | 0                          | 1                     |
| <b>Country of Residence</b>         |                            |                       |
| Colombia                            | 3                          | 6                     |
| Venezuela                           | 1                          | 1                     |
| Peru                                | 2                          | 0                     |
| Chile                               | 1                          | 0                     |
| Uruguay                             | 0                          | 1                     |
| <b>Children</b>                     |                            |                       |
| Boys                                | 7                          | 8                     |
| Girls                               | 0                          | 0                     |
| <b>Mean age in years (children)</b> | 7.14 ( $SD = 3.08$ )       | 5.14 ( $SD = 1.57$ )  |

## Outcome Measures

*Computer-Email-Web (CEW) Fluency Scale* (Bunz, 2004). It is a 59-item self-report measure assessing an individual's fluency with computers, email, and the web. Participants answered yes/no questions about their ability to perform various activities using a computer, applications, and the internet. This study used 17 items to gauge participants' familiarity and comfort with technology. The CEW has well-established construct validity, convergent validity, and reliability (Bunz, 2004).

*Eyberg Child Behavior Inventory* (ECBI; Eyberg & Pincus, 1999). It is a 36-item parent report measure on a child's behavior. Each item is rated on a seven-point Likert scale from 1 ("never") to 7 ("always") for frequency and endorsed "yes" or "no" for whether the behavior is perceived as a problem. The ECBI yields Intensity and Problem scores, converted into t-scores ( $M = 50$ ;  $SD = 10$ ). In Spanish samples, the average score is 96, with high internal consistency ( $\alpha = .73$  to  $\alpha = .93$ ) and test-retest reliability ( $r = .89$  to  $r = .93$ ; García-Tornel et al., 1998).

*Parental Stress Scale – Short Form* (PSI-SF; Abidin, 1995). It is a 36-item self-report measure of parenting stress, with three subscales: Parental Distress (PD), Parent-Child Dysfunctional Interaction (PCDI), and Difficult Child (DC). Each subscale has 12 items rated from 1 (strongly disagree) to 5 (strongly agree), with total scores from 36 to 180. Scores of 90 or above may indicate clinical levels of stress. This study used the PSI-SF version validated with the Spanish population (Rivas et al., 2021), showing satisfactory internal consistency (total score  $\alpha = 0.93$ ; subscales  $\alpha = 0.86, 0.91$ , and  $0.85$ ).

*Parent Quiz*. Researchers of the current study, experienced in creating training materials for behavioral courses and parent training, developed five quizzes to assess content mastery, each with four answer choices and one correct answer. The questions were derived from the training modules, including video and textual materials. The quizzes were designed with varying difficulty levels to ensure responses were above chance but allowed for significant improvement through learning. Quizzes were administered before and after each module to measure knowledge acquisition. Below are two examples of quiz items:

One question asked, "An early sign of autism consists of:" with response options: (a) exhibiting aggression towards peers when they do not comply with the child's wishes, (b) *displaying hand flapping or body rocking repeatedly*, (c) showing little interest in playing with available toys and objects, and (d) constantly seeking attention through noises and movements. Another question asked, "A consequence in the ABC model refers to:" with response options: (a) the repercussion the child faces after exhibiting an 'inappropriate' behavior, (b) *what occurs immediately after the behavior is performed*, (c) the learning the child achieves through an educational experience, and (d) the internal feeling the child experiences after the behavior.

## Procedure

### Phase 1: Recruitment

Following recruitment, an initial meeting was held with all selected participants to confirm eligibility and obtain informed consent. Participants were then randomly assigned to either the intervention group or the waiting list control group.

### Phase 2: Access to Training Modules

An initial meeting was held with all participants from both the experimental and waiting list control groups to explain the study's purpose, outline the schedule of bi-weekly meetings, provide access instructions for the training modules, and address any questions. The training modules were hosted on the Hotmart platform and released every two weeks. Although the videos themselves were not previously validated, they were adapted from an established training platform and customized for this study's context. Researchers met with participants on each release day to review the previous module, provide feedback on assigned tasks, and introduce the objectives of the upcoming module. The intervention concluded with a final group session following the fifth module, along with immediate post-intervention assessments using the ECBI and PSI-SF.

## Asynchronous Training Modules

The five training modules were designed to equip parents with practical knowledge and behavioral strategies to support their children with ASD. Drawing from established best practices in online behavioral parent training (Ferguson et al., 2019; Sivaraman & Fahmie, 2020; Unholz et al., 2020), the course addressed foundational topics such as understanding autism, conducting behavioral assessments using the ABC (antecedent–behavior–consequence) model, preventing challenging behaviors, applying functional communication techniques, and incorporating naturalistic teaching through play. The content was adapted from an existing training platform and presented using culturally relevant examples, clear language, and brief modeling demonstrations.

Each module included pre- and post-quizzes to assess comprehension and a structured homework activity to encourage skill application. Examples of homework tasks included observing and documenting behaviors, creating prevention plans, and practicing communication strategies at home. While completion of homework was encouraged to reinforce learning, it was not required to unlock subsequent modules. The waiting list control group did not receive access to the modules during the intervention period but remained in contact with researchers to ensure continued engagement until post-intervention access was granted.

### Module 1: Introduction to Autism Spectrum Disorder

This module aimed to provide parents with a comprehensive understanding of ASD. It covered the fundamental characteristics of autism, its diverse presentations, and the common challenges individuals with autism face. Topics included the definition of autism, main signs, and symptoms (such as social communication difficulties and restricted, repetitive behaviors), and common comorbidities like ADHD, language delays, and anxiety. The module also highlighted the strengths and unique skills of individuals with autism, such as strong visual processing abilities and attention to detail. No homework was assigned.

### Module 2: Behavioral Principles - Functional Assessment

This module aimed to equip parents with tools to understand and analyze their children's behaviors through functional assessment. It introduced the ABC model (antecedent-behavior-consequence) for analyzing behavioral functions, followed by explanations and real-life examples of antecedents, behaviors, and consequences. It covered the four main functions of behavior: obtaining attention, getting something desirable, escaping something unpleasant, and seeking sensory satisfaction. For homework, parents selected a problematic behavior, conducted a week-long observation, and documented antecedents, behaviors, and consequences.

### Module 3: Prevention Strategies

This module focused on preventive strategies to manage and reduce problem behaviors. It taught parents how to proactively create environments and routines that minimize challenging behaviors. Strategies included avoiding specific situations, controlling the environment, and responding to early signs of problems. Practical examples, like using visual aids, altering routines, and addressing physiological needs, were discussed. For homework, parents chose a problematic behavior, planned a comprehensive prevention strategy, and conducted a self-evaluation, collecting data on the behavior for at least a week to evaluate the impact.

### Module 4: Functional Communication

This module aimed to replace challenging behaviors with appropriate communication methods. It introduced functional communication training (FCT) to help children communicate their needs effectively. The module explained reinforcement and its role in maintaining or increasing behaviors, providing steps for implementing FCT, such as identifying the function of the problematic behavior, selecting an appropriate replacement behavior, and teaching it using techniques like visual aids and immediate reinforcement. For homework, parents identified potential reinforcers and opportunities for reinforcing behaviors, and observed its effectiveness, conducting self-evaluations to ensure the approach was effective.

## Module 5: Naturalistic Teaching

The final module aimed to promote positive interactions and learning through structured play. It taught parents how to use playtime to reinforce desirable behaviors and enhance social skills. Guidelines for structured play included observing the child, imitating their play, and describing their actions. Techniques for promoting social and play skills naturally were discussed, emphasizing avoiding direct commands and allowing the child to lead the play. For homework, parents analyzed their current play interactions, planned structured play sessions, observed, and adjusted their approach as necessary to ensure the play promoted positive behaviors.

## Data Analysis

Descriptive statistics were calculated to summarize pretest and posttest outcomes across measures of parental stress and parents' perceptions of children's problem behaviors. Given the modest sample size, both group-level and individual-level analyses were conducted to capture potential intervention effects. At the group level, independent samples *t*-tests were employed to compare posttest scores between the experimental and control groups on the ECBI Intensity and Problem Scales, as well as the PSI-SF Total Stress Scale. Effect sizes (Cohen's *d*) were computed alongside *t*-tests to estimate the magnitude of between-group differences, interpreted using conventional benchmarks (*small* = 0.2, *medium* = 0.5, *large* = 0.8). Shapiro-Wilk tests were used to assess normality assumptions for each outcome variable. Pearson product-moment correlation coefficients were calculated between the ECBI Intensity and Problem Scales and the PSI-SF Total Stress Scale at pretest and posttest to explore the association between parent-reported child behavior problems and parenting stress.

In parallel, the Reliable Change Index (RCI; Jacobson & Truax, 1991) was calculated to evaluate clinically meaningful change at the individual level. The RCI was computed for each participant by dividing the difference between pretest and posttest scores on each ECBI subscale and the PSI-SF Total Stress Scale by the standard error of the difference (SEdiff): (pretest score – posttest score) / SEdiff. An RCI greater than 1.96 was considered statistically significant at  $p < .05$ , indicating reliable improvement; an RCI less than -1.96 indicated reliable deterioration. Participants were categorized as improvers, no-changers, or deteriorators based on the direction and magnitude of their RCI scores. This method accounts for both measurement error and clinically meaningful change, providing an individual-level assessment complementary to group-level inferential statistics.

## Results

### Descriptive and Inferential Results

Descriptive statistics for the experimental ( $n = 7$ ) and control ( $n = 8$ ) groups are presented in [Table 2](#). At baseline, the experimental group exhibited slightly higher mean scores across all outcome measures compared to the control group. Specifically, on the ECBI Intensity Scale, the experimental group reported a pretest mean of  $M = 136.14$  ( $SD = 25.40$ ), while the control group reported  $M = 126.00$  ( $SD = 31.10$ ). Similar trends were observed for the ECBI Problem Scale (experimental:  $M = 123.00$ ,  $SD = 23.90$ ; control:  $M = 115.00$ ,  $SD = 30.40$ ) and the PSI-SF Total Stress Scale (experimental:  $M = 120.00$ ,  $SD = 27.80$ ; control:  $M = 112.00$ ,  $SD = 23.60$ ).

Posttest scores followed a comparable pattern, with the experimental group maintaining slightly higher means. For example, posttest scores on the ECBI Problem Scale averaged  $M = 22.00$  ( $SD = 7.52$ ) for the experimental group and  $M = 17.00$  ( $SD = 8.50$ ) for the control group. On the PSI-SF, posttest means were  $M = 109.00$  ( $SD = 26.10$ ) for the experimental group and  $M = 109.00$  ( $SD = 25.60$ ) for the control group.

Independent samples *t*-tests revealed no statistically significant differences between groups on any outcome measure. For the ECBI Intensity Scale, no significant difference was found at posttest,  $t(13) = -0.53$ ,  $p = .304$ ,  $d = -0.27$ . Similarly, no significant differences emerged for the ECBI Problem Scale,  $t(13) = -1.21$ ,  $p = .123$ ,  $d = -0.63$ , or the PSI-SF,  $t(13) = -0.02$ ,  $p = .493$ ,  $d = -0.01$ . Effect sizes ranged from negligible (PSI-SF) to medium (ECBI Problem Scale), indicating that while statistical significance was not achieved, some outcomes demonstrated potentially meaningful differences. Normality assumptions were met for all variables, as confirmed by Shapiro-

Wilk tests ( $p > .05$ ).

To examine the relationship between parent-reported child behavior problems and parenting stress, Pearson product-moment correlation coefficients were calculated between the ECBI Intensity and Problem Scales and the PSI-SF Total Stress scores at pretest and posttest. Prior to analysis, normality was assessed using Shapiro-Wilk tests, with no significant deviations observed ( $p > .05$ ). Correlation results indicated positive associations between child behavior problems and parenting stress at both time points. At pretest, ECBI Intensity was strongly correlated with PSI-SF,  $r(13) = .78$ ,  $p < .01$ , and ECBI Problem showed a moderate correlation with PSI-SF,  $r(13) = .62$ ,  $p < .01$ . At posttest, ECBI Intensity remained strongly correlated with PSI-SF,  $r(13) = .81$ ,  $p < .01$ , and ECBI Problem demonstrated a moderate-to-strong correlation with PSI-SF,  $r(13) = .70$ ,  $p < .01$ .

### Reliable Change Index

Beyond group-level analyses, individual-level outcomes were assessed using the Reliable Change Index (RCI) to determine clinically meaningful change. The RCI results revealed distinct patterns of perceived improvement and deterioration across groups and outcome measures.

### Eyberg Child Behavior Inventory (ECBI)

*Intensity Scale.* Three participants in the experimental group achieved significant improvement in their perceptions of their child's behavior intensity (P1: RCI = 2.01; P2: RCI = 2.06; P4: RCI = 1.53). While these RCIs approached the threshold for reliable change, they reflect meaningful reductions in parent-reported perceptions of behavioral intensity following the intervention. Two additional experimental participants (P5 and P7; RCI = 1.48 each) demonstrated improvements below the reliable change threshold, suggesting a positive trend. Notably, two experimental participants reported deterioration, indicating increased perceived intensity of their child's behavior over time. In contrast, within the control group, six participants exhibited slight, non-significant improvements (RCI < 1.96), while two participants (P9, P11) reported deterioration, suggesting a worsening perception of behavior intensity without intervention.

*Problem Scale.* Significant improvement in parent-reported perceptions of behavior problems was observed in three experimental participants (P3: RCI = 2.34; P5: RCI = 4.09; P7: RCI = 2.34). Three other experimental participants showed modest, non-significant improvements (P1, P2, P4: RCI = 0.29–0.58), while one participant (P6: RCI = -1.75) reported deterioration. In the control group, significant improvement was observed in two participants (P11: RCI = 1.46; P14: RCI = 1.90), with five participants showing slight improvement and one participant (P12: RCI = -1.17) reporting deterioration.

### Parenting Stress Index Short-Form (PSI-SF)

*Total Stress Scale.* Four experimental participants achieved significant reductions in parenting stress (P1: RCI = 2.49; P2: RCI = 3.32; P5: RCI = 2.35; P7: RCI = 3.32), underscoring the potential stress-buffering effect of the intervention for these individuals. Two additional participants (P3: RCI = 0.42; P4: RCI = 0.69) demonstrated modest improvement, while one (P6: RCI = -0.69) showed slight deterioration. In contrast, five control participants exhibited minor improvements (RCI = 0.00–1.66), yet two participants (P8: RCI = -2.77; P10: RCI = -2.63) demonstrated significant deterioration, suggesting increased stress in the absence of intervention.

### Quizzes

Due to personal reasons, three participants in the experimental group (P3, P4, and P5) did not complete both pretest and posttest quizzes for modules 3, 4, and 5. Additionally, two participants (P11 and P15) did not complete the same assessments for module 5 only.

**Table 2.** Pretest, posttest, and reliable change index scores for all participants.

| Participants |              | Experimental Group |             |             |             |             |             |       |             |     |      | Control Group |       |       |       |      |      |      |      |     |      |
|--------------|--------------|--------------------|-------------|-------------|-------------|-------------|-------------|-------|-------------|-----|------|---------------|-------|-------|-------|------|------|------|------|-----|------|
|              |              |                    | P1          | P2          | P3          | P4          | P5          | P6    | P7          | M   | SD   | P8            | P9    | P10   | P11   | P12  | P13  | P14  | P15  | M   | SD   |
| ECBI         | Intensity    | PRE                | 184         | 148         | 125         | 133         | 128         | 101   | 134         | 136 | 25.4 | 127           | 95    | 126   | 114   | 127  | 155  | 182  | 85   | 126 | 31.1 |
|              |              | POST               | 168         | 137         | 127         | 104         | 100         | 119   | 106         | 123 | 23.9 | 125           | 99    | 112   | 126   | 91   | 151  | 155  | 65   | 115 | 30.4 |
|              |              | RCI                | <b>2.01</b> | <b>2.06</b> | -0.11       | <b>1.53</b> | 1.48        | -0.95 | 1.48        |     |      | 0.11          | -0.21 | 0.74  | -0.63 | 1.9  | 0.21 | 1.43 | 1.06 |     |      |
|              | Problem      | PRE                | 30          | 28          | 26          | 22          | 27          | 12    | 12          | 22  | 7.52 | 17            | 9     | 21    | 12    | 23   | 22   | 29   | 3    | 17  | 8.50 |
|              |              | POST               | 29          | 26          | 21          | 20          | 13          | 18    | 4           | 19  | 8.32 | 16            | 7     | 14    | 16    | 18   | 21   | 19   | 1    | 14  | 6.72 |
|              |              | RCI                | 0.29        | 0.58        | <b>2.34</b> | 0.58        | <b>4.09</b> | -1.75 | <b>2.34</b> |     |      | 0.29          | 0.58  | 1.9   | -1.17 | 1.46 | 0.29 | 1.9  | 0.58 |     |      |
| PSI-SF       | Total Stress | PRE                | 161         | 154         | 84          | 110         | 117         | 119   | 100         | 120 | 27.8 | 111           | 109   | 93    | 82    | 109  | 146  | 148  | 99   | 112 | 23.6 |
|              |              | POST               | 147         | 130         | 81          | 105         | 100         | 124   | 76          | 109 | 26.1 | 131           | 94    | 112   | 82    | 96   | 142  | 137  | 76   | 109 | 25.6 |
|              |              | RCI                | <b>2.49</b> | <b>3.32</b> | 0.42        | 0.69        | <b>2.35</b> | -0.69 | <b>3.32</b> |     |      | -2.77         | 1.9   | -2.63 | 0     | 1.66 | 0.55 | 1.52 | 1.52 |     |      |

**Note:** ECBI: *Eyberg Child Behavior Inventory*; PSI-SF: *Parenting Stress Index, Short-Form*. Table includes raw scores with the reliable change index in bold; M: *Mean*; SD: *Standard deviation*.

\* A Bold numbers indicate statistically significant change, significant if  $z < -1.96$  or  $z > 1.96$ .

Results show that in Module 1, the experimental group's scores remained unchanged ( $M = 2$ ), while the control group improved from ( $M = 3$ ) to ( $M = 4$ ), a 33% increase. In Module 2, the experimental group's scores rose from ( $M = 1$ ) to ( $M = 3$ ), a 200% improvement, whereas the control group's scores remained stable at ( $M = 4$ ). For Module 3, the experimental group's scores stayed at ( $M = 3$ ), but the control group's scores dropped from ( $M = 2$ ) to ( $M = 0$ ), a 100% decrease. In Module 4, the experimental group improved from ( $M = 2$ ) to ( $M = 3$ ), a 33% increase, while the control group's scores declined from ( $M = 2$ ) to ( $M = 1$ ), a 50% decrease. Lastly, in Module 5, the experimental group's scores doubled from ( $M = 2$ ) to ( $M = 4$ ), a 100% increase, while the control group showed no improvement.

## Discussion

This pilot study aimed to evaluate the effects of an asynchronous parent training intervention on children's problem behaviors and parenting stress among parents of children with autism in Latin America. The results reflected a mixed pattern of outcomes across participants. On the ECBI Intensity Scale, five parents in the experimental group reported improvements in their perceptions of their child's behavioral intensity, with three achieving reliable improvement based on the Reliable Change Index (RCI). In contrast, two parents in this group experienced deterioration, suggesting increased perceptions of behavior intensity over time. On the ECBI Problem Scale, six experimental group participants reported improvement, with three reaching reliable improvement, while one participant showed reliable deterioration.

Notably, although improvements were observed on both ECBI scales in the experimental group, some participants exhibited improvement on one scale alongside deterioration on the other. This divergence underscores the complexity of parental perceptions, as the ECBI Intensity and Problem Scales assess related but distinct constructs: the frequency versus the perceived problematic nature of child behaviors. Prior research has noted that parents may view certain behaviors as frequent yet less problematic, or infrequent but highly concerning, depending on contextual, cultural, or developmental factors (Jeter et al., 2017). Additionally, factor analytic studies of the ECBI suggest that parent responses may cluster differently across behavioral domains (e.g., emotional reactivity, defiance, attention problems), potentially contributing to variability across scales (Jeter et al., 2017; Zlomke & Jeter, 2020). Taken together, these findings highlight the importance of assessing both intensity and problem ratings to obtain a more nuanced understanding of intervention effects and parental perceptions.

At the group level, no statistically significant differences emerged between the experimental and control groups across outcome measures, although a moderate effect size was observed for the ECBI Problem Scale. This effect size, along with the direction of mean differences favoring the experimental group, suggests a possible intervention-related trend that may warrant further exploration in studies with larger samples to improve statistical power. Individual-level analyses further emphasize this trend, with multiple experimental participants showing reliable improvement, contrasting with slight or deteriorating outcomes among some control participants. These findings align with previous research on self-paced online parent training, which has consistently reported positive outcomes for parent knowledge, strategy use, and reductions in child problem behaviors, even when between-group statistical differences were not always significant (Liang et al., 2024). Similar to the present study, prior reviews have noted variability in individual outcomes and highlighted the need for larger samples and long-term follow-up to strengthen evidence of intervention effects.

Beyond these behavioral outcomes, an important consideration in interpreting the findings is the relationship between parents' perceptions of child behavior problems and their own stress levels. In this study, significant positive correlations were observed between ECBI and PSI-SF scores at both pretest and posttest. Specifically, ECBI Intensity was strongly correlated with PSI-SF Total Stress at pretest ( $r(13) = .78, p < .01$ ) and posttest ( $r(13) = .81, p < .01$ ), while ECBI Problem showed moderate correlations at pretest ( $r(13) = .62, p < .01$ ) and posttest ( $r(13) = .70, p < .01$ ). These associations suggest that parents perceiving greater child behavior challenges also reported higher stress, a pattern consistent with prior research (Jeter et al., 2017; Scudder et al., 2019; Zlomke & Jeter, 2020). While these correlations reinforce the interconnectedness of child and parent outcomes, they

should be interpreted cautiously given the exploratory nature of the analysis and the small sample size.

In addition to behavioral and stress outcomes, the quiz results provide further insight into knowledge acquisition and participant engagement. The experimental group demonstrated gains across modules, particularly in behavioral principles and functional communication, whereas the control group's performance was inconsistent, with declines observed in Module 3 (prevention strategies) and Module 4 (functional communication) (e.g., Turgeon et al., 2021). Notably, quiz completion varied, with several experimental and control participants missing quizzes in later modules. This variability suggests that participants who completed more quizzes may have derived greater benefit from the intervention. Prior research supports this link, showing that quiz completion and engagement predict improvements in parent knowledge and intervention fidelity (Ingersoll & Berger, 2015; Dai et al., 2021). Although the present study did not directly examine this relationship, it is plausible that increased quiz participation contributed to the observed trends in child behavior and parenting stress. These findings highlight quiz completion as both a marker of knowledge gain and engagement, underscoring the need for strategies to promote full participation in future research.

Situating these findings within the broader literature, systematic reviews of parent training for individuals with ASD report small effect sizes for digital interventions, with limited reductions in child behavior problems (Ferguson et al., 2019; Flannery et al., 2021; Pan et al., 2023; Unholz-Bowden et al., 2020). Several moderators may explain the variability reported in these reviews. First, heterogeneity in children's social communication and repetitive behavior challenges may influence responsiveness to intervention. In the present study, although all parents reported receiving an official ASD diagnosis for their child, there was considerable variability in functional profiles, which may have contributed to the differential outcomes observed across participants.

Second, prior research has explored whether parental education level influences intervention effectiveness, though findings remain mixed. Some studies have noted that lower parental education may pose challenges in understanding intervention content, particularly when materials require higher literacy or language proficiency (Karr et al., 2017), while others found no significant moderating effect (Farmer et al., 2011; Zeng et al., 2021). For example, Farmer et al. (2011) tested education level as a moderator and reported no significant effect, and Zeng et al. (2021) adjusted for maternal education as a covariate without finding moderation. In the present study, participants' diverse educational backgrounds may have influenced engagement or comprehension. Although education level was not formally tested as a moderator, variability in baseline knowledge, familiarity with behavioral strategies, or comfort navigating digital content may have shaped how parents interacted with the intervention. This interpretation aligns with prior findings that education level intersects with factors like resource access, confidence in applying strategies, and comfort with technology-based learning, even if it does not directly moderate outcomes (Karr et al., 2017).

Additionally, contextual factors in Latin America—including disparities in internet access, educational opportunities, and cultural practices—may have compounded these differences and affected participants' ability to fully engage with the training materials (DuBay, 2022; Terol et al., 2023). Future research should explicitly test education level as a moderator and explore whether tailored supports are needed to address diverse educational needs within parent training interventions.

Finally, intervention characteristics such as delivery format and degree of interactivity also played an important role. Although the asynchronous model provided flexibility, some parents reported challenges in completing homework activities and expressed a preference for more real-time guidance. This aligns with literature suggesting that synchronous or hybrid delivery models, incorporating live coaching, may enhance outcomes compared to self-directed asynchronous formats (Flannery et al., 2021). Prior research further emphasizes that including therapist or coach support improves parent engagement, program completion, and fidelity by reinforcing skills and providing feedback during interactive sessions (Ingersoll & Berger, 2015; Pickard et al., 2016). Additionally, offering flexible access to materials, using structured modular content, monitoring engagement with specific components, and designing culturally responsive resources have been identified as key

strategies for promoting participation and learning in telehealth-based parent training (Fisher et al., 2020; DuBay, 2022). Future adaptations of the program may benefit from integrating live support, particularly during modules addressing complex skills such as functional communication and naturalistic teaching strategies.

Overall, while the intervention did not yield statistically significant between-group differences, individual-level improvements, positive correlations between child behavior problems and parenting stress, and gains in knowledge acquisition highlight several areas of potential benefit. These findings suggest that asynchronous interventions hold promise for improving parent-reported outcomes, though enhancements such as synchronous supports and culturally responsive adaptations may be needed to optimize effectiveness in diverse contexts.

## Limitations and Future Research

This pilot study has several limitations that warrant consideration and guide directions for future research. The most significant limitation is the small sample size, which limits statistical power and generalizability. Future studies should replicate this research with larger samples to strengthen the robustness and confidence in the findings. Additionally, variability in children's diagnoses and parents' educational levels may have contributed to the modest effects observed. Future research should aim to control for these factors by screening for similar developmental profiles and stratifying participants by educational background to better assess intervention effectiveness.

Although between-group differences did not reach statistical significance, the direction of the means and the moderate effect size observed for the ECBI Problem Scale suggest potentially meaningful trends favoring the experimental group. This pattern may reflect early signs of intervention impact, but the absence of significant differences limits confidence in interpreting these findings. Additionally, while positive correlations were observed between parent-reported child behavior problems and parenting stress at both time points, the cross-sectional nature of the analysis precludes conclusions about causality or directionality. Future research should examine these associations longitudinally and explore potential mediators and moderators that may influence the relationship between child behavior outcomes and parental stress.

The asynchronous format of the training appeared to influence participants' motivation, comprehension, and completion of content. While this model provided flexibility, some participants reported difficulties completing assignments and mastering complex skills without real-time guidance. Future research should investigate synchronous or hybrid delivery models that incorporate live coaching to support learning, particularly during modules that require higher-level application, such as functional communication and naturalistic teaching techniques (DuBay, 2022). These interactive supports may help clarify concepts, model strategies, and increase parent confidence in skill implementation. Interestingly, some participants in the wait-list control group demonstrated slight improvements on certain measures, suggesting the presence of unmeasured influences. Future studies should monitor for potential confounding variables, such as exposure to informal training, external resources, or concurrent interventions, which may impact outcomes.

Although participants completed the training materials in approximately two weeks, post-intervention feedback indicated that additional time was needed to review content and complete homework activities. Future research should examine the time required to complete these assignments and explore whether synchronous support during assignments enhances engagement, accuracy, and implementation fidelity. Moreover, this study did not include a follow-up phase due to time constraints and participant availability. Future research should include follow-up assessments to evaluate long-term skill retention and generalization of intervention effects.

All outcome measures relied on parent self-report, which may limit objectivity and generalizability. Future studies could incorporate direct measures, such as behavioral observations or physiological stress markers, to validate self-reported outcomes and provide a more comprehensive assessment of intervention effects. Not all participants attended the optional synchronous meetings, which may have influenced their understanding and

implementation of the procedures. Similar challenges have been reported in previous research (see Parra et al., 2023). Future research should ensure participant attendance at key sessions and identify potential barriers to participation. Finally, although parents reported satisfaction with the intervention and perceived improvements in their children's quality of life, no formal measure of parent satisfaction was included. Future research should incorporate standardized acceptability measures to quantitatively assess parents' satisfaction and perceptions of intervention benefits.

## Conclusion

This pilot study provides preliminary evidence that an asynchronous parent training program can contribute to reductions in children's problem behaviors and parenting stress among Latin American families of children diagnosed with ASD. Although statistically significant between-group differences were not observed, individual-level improvements, knowledge gains, and positive correlations between child behavior problems and parenting stress point to areas of potential benefit. These findings highlight the promise of asynchronous interventions as accessible and cost-effective tools for regions with limited resources, while also underscoring the importance of integrating additional supports—such as synchronous coaching and culturally responsive adaptations—to optimize engagement, comprehension, and skill application. Future research should focus on larger, more diverse samples, explore long-term effects, and formally examine factors that may moderate or mediate intervention outcomes.

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## Declaration of interests

The authors declare that there are no financial benefits or personal relationships influencing the content presented on the Hotmart platform. Additionally, the second author holds the copyrights to the material discussed in this study but did not receive any royalties from it. Importantly, none of the participants were active members of the Hotmart service at the time of the study.

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