

EDITT-Caregiver Behaviour Rating Scale: Development and Preliminary Validation of a scale for evaluation of caregiver interaction with ASD children of developmental age 1 - 5 years.

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Received : 16 MARCH 2026; Accepted: 14 JUNE 2026

Abstract

How to cite this article:

Sandhya V, Nandini M,
Kirthika R, Savitha BS,
Udaykumar N, Prathyusha KS.
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Rating Scale: Development
and Preliminary Validation
of a scale for evaluation
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developmental age 1 - 5 years.
Indian J DevBehavPediatr.
2026;Vol 4(3):01.11. DOI:
[https://doi.org/10.5281/
zenodo.23017838](https://doi.org/10.5281/zenodo.23017838)

Keywords:

- Naturalistic developmental behavioral intervention,
- Autism spectrum disorder,
- Caregiver behavior, parent child interaction,
- Skill training, direct and interactive teaching techniques, rating scale.

Background: Naturalistic Developmental Behavioral Interventions (NDBI) for children with ASD involve training caregivers to modify their own behavior to naturally implement techniques throughout daily life, ultimately promoting positive change in the child. Addressing the critical role of caregiver behavior, the study was conducted to develop and validate the EDITT-CBRS (Educating caregivers on Direct and Interactive Teaching Techniques- Caregiver Behavior Rating Scale) to effectively measure caregiver behavior during intervention.

Methods : Development of EDITT-CBRS as a mixed-method scale. Section-I: Likert scale comprising 6 main criteria and 22 sub-criteria (rating section), section-II: open-ended sections (observations). Validation process involved: content validation by a 10-member expert focus group; Construct validation using 10-minute free-play videos of 35 caregiver-child dyads; Inter-rater reliability assessed between two coders (one being 100% blinded to sample history and therapy, other being 66%) and Concurrent validation using Mahoney Maternal Behavior Rating Scale.

Results : EDITT-CBRS demonstrated strong psychometric properties. Content validity indices were high—0.93 for criteria and 0.95 for sub-criteria. Internal consistency, construct validity and reliability was robust (Cronbach's $\alpha = 0.879$, $p < 0.001$; CITC range $r = 0.312 - 0.702$; MIC = 0.245). Inter-rater reliability was

strong (Pearson correlation coefficient $r = 0.98$; ICC 0.985 (95% CI, $p < .001$). External validity showed strong correlation (Pearson $r = 0.979$, $p < 0.001$; ICC = 0.958 , 95% CI) with Mahoney scale.

Conclusion: EDITT-CBRS is a valid, reliable tool for assessing caregiver behavior in NDBI frameworks. It offers significant potential for guiding clinical practice and monitoring caregiver progress throughout therapy.

Introduction:

Global autism prevalence has risen significantly, with CDC data showing an increase from 1 in 150 in 2000 to 1 in 31 by 2022 ^[1]. In India, approximately 1 in 65 children are affected; however, the actual prevalence is likely undervalued due to a lack of systematic epidemiological research in rural areas ^[2]. While the average age of diagnosis was 78 months (1990–2012), it dropped to 43.18 months between 2012 and 2019 ^[3,4]. This trend toward early diagnosis allows for the optimization of neuroplasticity, improving long-term outcomes ^[5].

This shift has increased the demand for interventional models in diverse community settings. Consequently, a paradigm shift has occurred toward Naturalistic Developmental Behavioral Interventions (NDBI), which emphasize caregiver-mediated delivery. Evidence suggests caregivers are competent interventionists, helping bridge treatment gaps in low-resource settings ^[6,7]. Caregiver-mediated approaches enhance comprehension, functionality, and generalization while reducing the financial burden on families in low- and middle-income countries (LMIC) like India ^[8,9].

Effective NDBI requires a fundamental change in caregiver behavior. However, existing fidelity checklists are therapy-specific and task-oriented, failing to capture the “caregiver-child chemistry”

or general naturalistic behaviors. Therefore, an objective, easy-to-use scale is necessary. This study aims to develop and validate the EDITT-CBRS (Educating Caregivers on Direct and Interactive Teaching Techniques-Caregiver Behavior Rating Scale) to evaluate caregiver behavior within NDBI frameworks.

Materials & Methods:

Caregiver behavior and interaction in Natural settings forms the foundation of NDBI implementation and the pillars of caregiver-child interaction include Caregiver engagement and bonding, Proximal developmental approach, Natural secure contingencies and Positive affirmations (figure-1); on the basis of which, the EDITT-CBRS was developed.

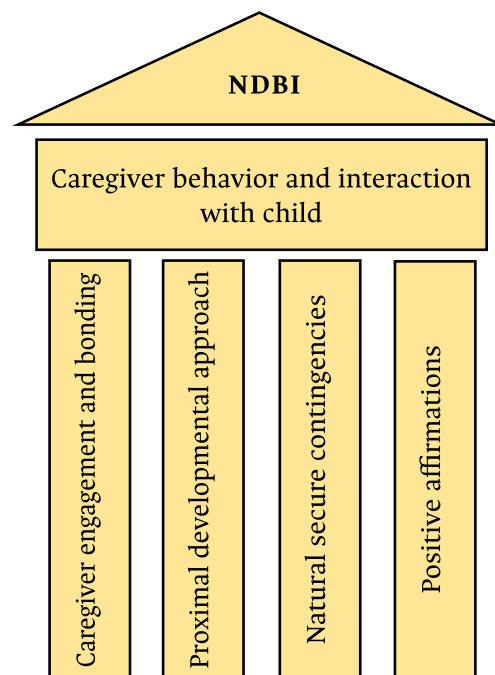


Figure 1: Theoretical framework of EDITT- CBRS.

The study employed an exploratory-confirmatory, mixed-method framework to develop and validate the EDITT-CBRS (figure-2). The tool was designed to be model-agnostic across various NDBIs.

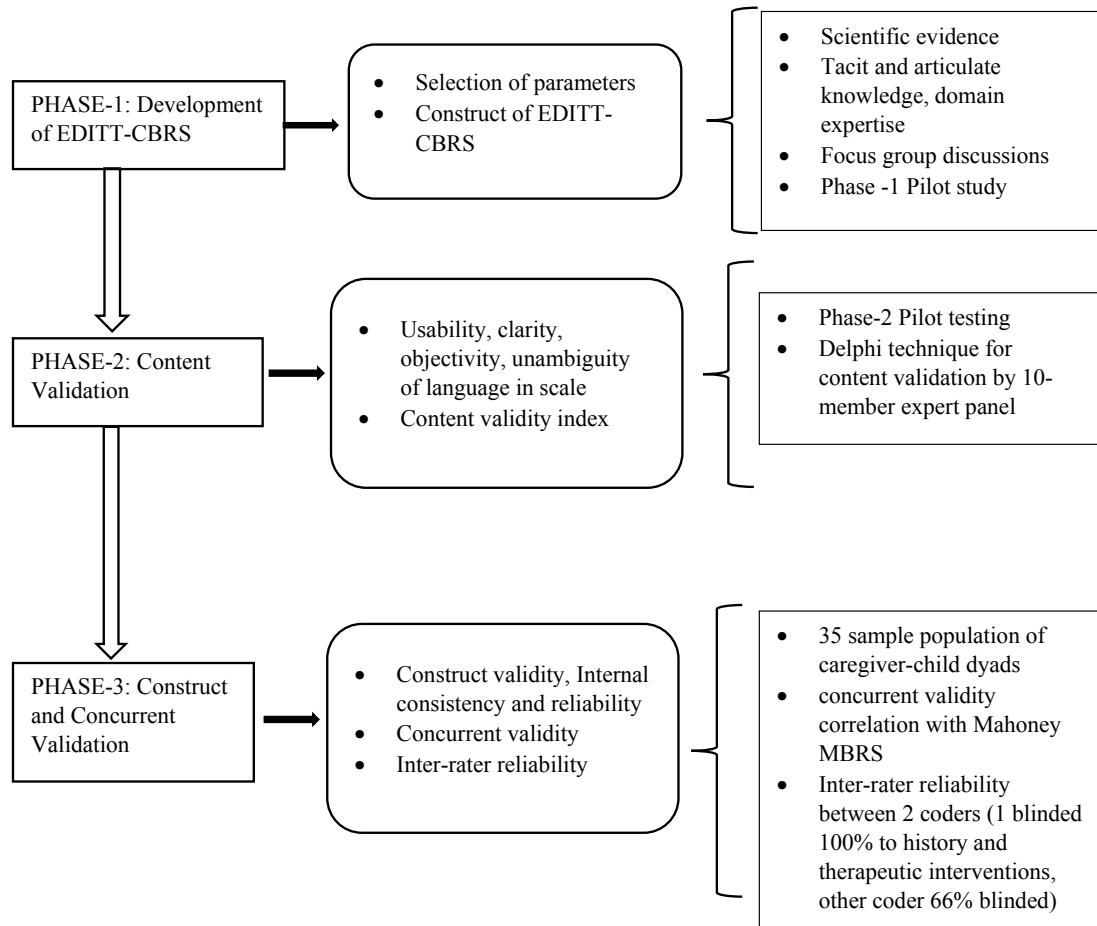


Figure 2: Process Flow Diagram of Research

PHASE-1: Development of EDITT-CBRS

An exploratory-confirmatory approach was utilized comprising four key methods:

- Scientific Evidence:** Empirical data and literature reviews ^[10,11] identified impactful behavioral characteristics across NDBI and neurotypical scales.
- Expert Knowledge:** The research was guided by the tacit and articulate knowledge of researchers with over 50 years of cumulative therapeutic experience in caregiver-mediated intervention.
- Focus Group Discussions:** Experienced developmental pediatricians, psychologists, and educators engaged in brainstorming and thematic analysis. This assimilated existing behavior scales with NDBI fidelity checklists to arrive at the final coding.

d) **Pilot Study:** Workability was tested on a convenient sample of ASD-caregiver dyads.

Selection of Parameters

Literature indicates that responsive, child-oriented behaviors foster attention and initiation ^[12,13], while extreme directive-ness restricts socialization. Consequently, six scoring dimensions were selected for scoring: Sensitivity, Responsiveness, Effectiveness, Achievement, Reinforcement, and Directive-ness.

Although affect and pace of interaction were initially considered, they were excluded from scoring due to high subjectivity and volatility; instead they were included as open-ended notes for therapeutic guidance. Similarly, caregiver self-care—critical for mitigating stress and burnout ^[14,15]—was added as a non-scoring, open-ended section due to its looming effect on the caregiver-child bond and chemistry.

Construct of the EDITT-CBRS:

The research team developed the EDITT-CBRS, ensuring suitability for ASD through test observations and resolving disagreements. Each item and scoring criterion was defined using a 5-point Likert scale (low to high presence). Sub-criteria were assigned based on NDBI working principles, empirical evidence, and qualitative data.

Section -I : DIMENSION- SENSITIVITY						
C 1	Allow the child to choose toy/ play in his own way (Not instructing/ interfering/ questioning)	nil	rarely	sometimes	often	always
C2	Be at child's eye level	nil	rarely	sometimes	often	Always
Average sensitivity score= Sum of criteria scores /5		insensitive	Low sensitivity	Moderate sensitivity	High sensitivity	Very high sensitivity
Section -I : DIMENSION: REINFORCING						
C3	Number of times the caregiver reinforces the child with verbal praise. (note whether praise is general or specific, in section-II, other)	0	1-2	3-4	5-6	More than 6
Section-II						
CAREGIVER SELF-CARE: (discussed with caregiver) ○ Identify stress factors ○ Steps to relieve stress ○ Taking respite / breaks ○ Exercise ○ Nutrition ○ Sleep ○ Hobbies ○ Communities and relationships ○ Professional front ○ Others						

Figure 3: Sample of few sections of EDITT-CBRS

As a mixed-method scale (figure 3), it features:

- Discrete Coding (Section-I): Six dimensions and 22 sub-criteria evaluating interactions via Likert ratings.
- Observations (Section-II): A qualitative section (open-ended notes) for caregiver *Affect*, *Pace*, any *Other* observations and caregiver *Self-Care*.

Criterion Description (of section-I)

The EDITT-CBRS assesses caregiver behaviors and NDBI skills, incorporating statistically significant parent fidelity points^[16]. It covers six domains:

- a) Sensitivity: Evaluation of the care giver's awareness of child interests, visual monitoring,

eye-level positioning, and attunement to subtle bids ^[11].

- b) Responsivity: evaluation of consistency and supportiveness of verbal responses and appropriate language modeling, associated with enhanced joint attention. ^[11]
- c) Effectiveness: Ability to gain child attention and participation using hyped affect, communication bids, copying, modelling, turn-taking ^[16].
- d) Achievement: Encouragement of sensorimotor and cognitive progress through scaffolding and developmental stimulation, through appropriate prompting, appropriate instructions, social routines.
- e) Reinforcing: Use of positive affirmations (verbal or gestural) to reward compliance, achievement, or initiations.
- f) Directive-ness: Frequency and intensity of commands or attempts to interfere with/obstruct the child's play.

The scale provides a structured framework to monitor the specific interactive nuances required for successful caregiver-mediated interventions in ASD.

PHASE-2: Content Validation of EDITT-CBRS by experts

In Phase 2, a 5-member focus group independently scored purposive video samples, brainstorming to ensure usability, clarity, and objectivity. Subsequently, a 10-member expert panel across India (Tamil Nadu, Karnataka, Andhra Pradesh) conducted a Delphi method assessment via Google Forms. They rated criteria on 5-point Likert scale to calculate the Content Validity Index (CVI) for importance and relevance. Expert feedback was then incorporated for final modifications.

PHASE-3: Construct Validation and Concurrent validation in the Sample Study

Materials: Free-play toys: doll, ball, pull toy, kitchen set toys, form board of simple shapes, blocks, animals. **Study period:** 6months. **Study design:** Prospective study with systematic random sampling.

Sample size: given scarcity of NDBI-specific caregiver interaction studies, exploratory pilot approach was adopted. Sample size N=35 was determined sufficient for a single-group clinical study based on prior literature regarding parenting stress index changes. This provides a statistical power exceeding 90% with a 5% Type I error rate ^[17]. This sample size aligns with methodological guidance for preliminary scale validation, specifically for assessing inter-rater reliability, content validity, and concurrent validity ^[18,19]. Literature confirms that samples 30–40 are acceptable for estimating reliability coefficients when effect sizes are large and measurement error is minimized.

Inclusion criteria: Dyads where children had confirmed diagnosis of ASD, with developmental age of 1-5 years, and the caregiver provided informed consent.

Exclusion criteria: dyads with (1) unstable, irregular or inconsistent caregiver arrangement in the family; (2) children with co-morbidities (seizures, CNS structural abnormalities, neuro-degenerative disorders, genetic syndromes); (3) caregivers on psychotherapeutic medications/suffering from major medical/mental illnesses; (4) therapies elsewhere.

Training of coders: The coding team (2developmental pediatricians, 1 psychologist) completed a one-month pilot training. Coders attained over 95% mutual agreement within one point and 80% exact agreement. The Maternal Behavioral Rating Scale (revised) was coded by the trained, expert psychologist and special educator, with 29 years of experience in neurodiversity and autism management.

Procedure and Ethical Protections:

1. Baseline Assessment Participant profiles established: Autism Diagnostic Observation Schedule-2 for ASD confirmation ^[20], Sensory Profile™-2 for sensory processing ^[21], and the Mullen Scales of Early Learning for developmental age ^[22].
2. Data Collection: Following informed written consent, 35 NDBI-trained dyads were recorded during 10-minute free-play sessions in therapy

rooms using standardized toys. To mitigate observational effects, the first minute was excluded; remaining nine minutes were utilized for rating.

3. **Coding and Blinding:** Videos were scored independently by two trained coders. Rigor was maintained through blinding: Coder 1 was 100% blinded to clinical history, and Coder 2 was blinded to 66% of the sample. Concurrent validity was assessed using the Mahoney MBRS ^[23].
4. **Ethical Standards:** Strict privacy protocols governed handling of video/patient data. Beyond research participation, caregivers received one-to-one debriefing (interaction strengths and areas for targeted improvement discussed).

Ethical considerations: ethical committee clearance was approved by CLINICOM, independent Ethics Committee for Evaluation of Protocols for Clinical Research, Bengaluru, on 10th June 2025.

Statistical analyses: were conducted using SPSS 22.0, R Environment. Psychometric evaluation of EDITT-CBRS included: **Validity:* Content validity assessed via the Content Validity Index (CVI). Construct validity established through Corrected Item-Total Correlations (CITC) and Pearson correlation coefficients for External validity. **Reliability:* Internal consistency measured using Cronbach's α and Mean Inter-Item Correlation (MIC). Stability

and agreement evaluated via Intraclass Correlation Coefficients (ICC), paired-samples t-tests, and inter-rater reliability (Pearson's r). **General Statistics:* Descriptive statistics, Chi-Square tests, and Student's t-tests were utilized for sample characteristics. Significance was set at $p < .05$.

Results:

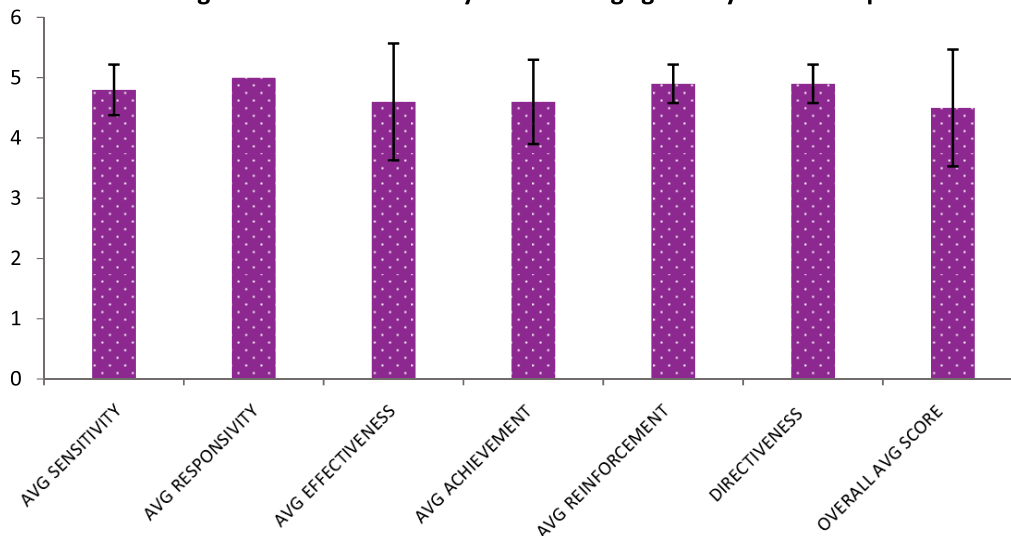
Content Validity

Content Validity The EDITT-CBRS was evaluated by 10 experts via Delphi method using 5-point Likert scale. Following Lynn ^[24], we calculated Item-level (I-CVI) and Scale-level (S-CVI) content validity indices. Our results showed high validity (S-CVI = 0.93; I-CVI = 0.95), exceeding the 0.78 threshold recommended for panels of eight or more (Table I; Figure 4).

Table I: Content Validity Index scores for criteria

DIMENSIONS- EDITT CBRS	CONTENT VALIDITY INDEX
Average Sensitivity scores	0.95
Average Responsivity scores	1.00
Average Effectiveness scores	0.90
Average Achievement scores	0.90
Average Reinforcement scores	0.97
Directive-ness score	0.87
Overall Scale level S-CVI	0.93
overall Item level I-CVI	0.95

Figure 4 : Content Validity Score Ratings given by Domain Experts



Phase-3 Demographic Characteristics

Caregivers had mean age of 31.82 years (SD = 3.68). Autistic children had mean chronological age of 42.66months (SD = 16.03) and mean developmental age of 22.17months (SD = 6.5). The gender distribution was 74.3% male and 25.7% female. Clinical concerns included sleep disturbances (22.8%), behavioral issues (54.3%), inconsistent eye contact (94.3%), joint attention deficits (88.6%).(Table II).

Table II: Caregiver and Child Characteristics

Caregiver characteristics		Frequency	%
Age distribution	25-30 years	12	34.3
	31-40 years	23	65.7
Caregiver distribution	Father	5	14.2
	Mother	30	85.7
	Non-parent	0	0
Education	Postgraduate	10	28.6
	Graduate	24	68.6
	PUC	1	2.9
Child characteristics			
Chronological age distribution	<30 months	8	22.9
	1-40 months	9	25.7
	>40 months	18	51.4
Developmental age distribution	12-20 months	15	42.9
	21-30 months	17	48.9
	30- 60 months	3	8.6
Gender distribution	Female	9	25.7
	Male	26	74.3
Severity of Autism spectrum	Mild	4	11.4
	Moderate	16	45.7
	Severe	15	42.9
Gestation	Early preterm	5	14.3
	Late preterm	1	2.9
	Term	29	82.9
Perinatal history	Uneventful	31	88.6
	HIE / medical complications	4	11.4
Sleep	Late initiation	4	11.4
	Disturbed	4	11.4
	Undisturbed	27	77.1

Behavioural concerns	No	16	45.7
	Yes	19	54.3
	Tantrums	11	
	Self-injurious	4	31.4
	Harms others	5	11.4
Eye- contact	Inconsistent	33	94.3
	Consistent	2	5.7
Joint attention	Inconsistent	31	88.6
	Consistent	4	11.4
Duration of therapy	1-3 months	14	40
	4-9 months	8	22.9
	10-18 months	6	17.1
	>18 months	7	20

Construct Validity, Internal Consistency and Reliability

The EDITT-CBRS demonstrated robust internal consistency with overall Cronbach's α of 0.879 ($p < .001$). Domain-level α ranged from excellent (Sensitivity: $\alpha = .831$) to acceptable (Effectiveness: $\alpha = .683$). For short-scale domains (Responsivity: $\alpha = .529$; Reinforcement: $\alpha = .501$), the Mean Inter-item Correlation (MIC) values of 0.288 and 0.301 fell within the optimal 0.15–0.50 range^[25], confirming conceptual congruence despite limited item counts. Construct validity was established via CITC. Correlations ranged from $r = 0.312$ to 0.702, confirming a stable structure; this approach was prioritized over EFA to maintain statistical stability relative to the participant-to-item ratio. While 20 sub-criteria exceeded $r > 0.3$, item C3 (Reinforcement) was borderline ($r = 0.221$). However, the overall dimension MIC for Reinforcement (0.301) remains within the optimal range, suggesting C3 captures a unique but conceptually aligned facet of caregiver behavior. These data provide substantial evidence of the scale's factorial validity (Table III). The overall Standard Error of Measurement is 0.239 [$\alpha = 0.879$, $SD = 0.688$] and Minimal Detectable Threshold $MDC_{95} = 0.668$ showing good precision, stability and supports measures of significant observable clinical shift in caregiver.

Table III: Summary of construct validity, Item-Analysis and Factorial Validity (N =35)

DIMENSION	Number of sub-criteria	Cronbach's a	P- value	Corrected Item- Total Correlation Range (r)	Mean Inter-Item Correlation (MIC)	Structural and Reliability Interpretation
Sensitivity	5	0.831	<0.001	0.589 – 0.702	0.496	Highly stable and robust
Responsivity	3	0.529	0.017	0.312 – 0.435	0.288	Stable (MIC & CIC)
Effectiveness	6	0.683	<0.001	0.354 – 0.521	0.264	Stable and good
Achievement	4	0.702	<0.001	0.467 – 0.512	0.371	Stable and good
Reinforcement	3	0.501	0.007	0.221 – 0.452	0.301	Acceptable (pilot)
Directive-ness	1	--	--	--	--	Single-item indicator
Overall scale	22	0.879	<0.001	0.312 – 0.702	0.245	Robust Reliability and Stability

Concurrent validity

Concurrent validity was evaluated against the Mahoney MBRS using Pearson's correlation ^[26]. Results demonstrated strong positive association ($r = .979$, $p < .001$; Figure 5) and strong ICC agreement ($ICC = 0.958$, 95% CI [0.918, 0.979]). A paired-samples t-test ($M_{diff} = 0.086$, $p = .039$) suggests that EDITT-CBRS offers greater sensitivity to NDBI-specific behaviors than the MBRS.

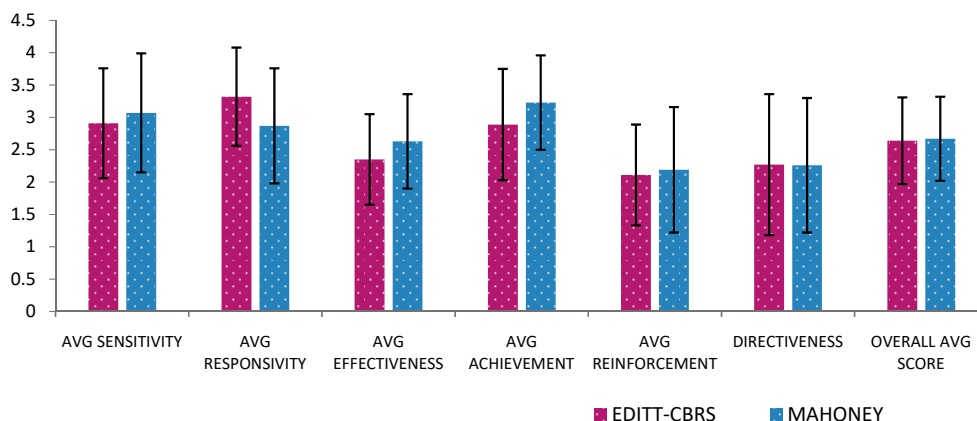
Inter-rater reliability

Inter-rater reliability between two independent coders yielded Pearson's $r = 0.981$ ($p < .001$). An ICC (two-way random effects, absolute agreement) of 0.985 (95% CI [0.970, 0.993], $p < .001$) indicates strong observer consistency (Figure 6).

Discussion:

From Structured to Naturalistic Interventions. Highly structured interventions like Applied

Figure 5: Comparison of EDITT CBRS and Mahoney MBRS Ratings in Children Studied



Behavior Analysis (ABA) often result in limited child spontaneity, poor generalizability, high prompt dependency, and avoidance behaviors ^[27]. Consequently, the field has shifted toward NDBI. Rooted in constructivist theories from Piaget and Vygotsky, NDBIs treat children as active “hypothesis-testers” ^[28].

By leveraging the zone of proximal development, NDBIs utilize a developmental sequence that fosters learning through active engagement in natural home settings. This approach systematically increases complexity within real-world contexts, significantly enhancing generalizability. Unlike rigid protocols, NDBIs acknowledge child initiative and spontaneity through natural reinforcements and positive affirmations ^[28].

Addressing the challenge in NDBI. Meta-analytic evidence supports parent-mediated interventions, yet monitoring interaction quality, outcomes, and parental stress remains critical ^[14]. Implementing NDBIs is often complicated by diverse methodological approaches and the necessity for high fidelity. At community level—where parenting norms, culture, and infrastructure vary—these complexities frequently lead to heterogeneous outcomes and significant measurement limitations ^[11,28,29].

Caregiver responsiveness and sensitivity are primary predictors of a child’s progress in social communication, engagement, and language ^[12,30]. In NDBI, caregivers must modify their behavior to integrate therapeutic skills into a “way of life.” EDITT-CBRS was developed to bridge the gap between this reliance on caregivers and the need for objective monitoring. By evaluating natural, everyday interactions, the scale ensures caregivers can effectively leverage neuroplasticity without becoming overwhelmed.

EDITT-CBRS is a model-independent tool for serial monitoring of caregiver behaviors within NDBI frameworks, focusing on dyadic bonding and communication. Operational Requirements: (a) Video-Based Assessment: Ratings performed on 10-minute free-play recordings to capture nuanced interactions often missed in real-time. (b) Training:

Therapists require brief training and trial ratings for optimal accuracy. (c) Individualization: Scores are used for longitudinal progress monitoring within a specific dyad rather than cross-dyad comparison. Section II utilizes one-to-one discussions to highlight caregiver concerns, strengths, growth areas. Therapists aim for a benchmark score of 4 or more per sub-criterion. While distinct from traditional fidelity scales, the EDITT-CBRS prioritizes the holistic “chemistry” of the dyad, empowering caregivers to foster social cognition and communication.

Gaps in current measures. Fidelity assessments alone are insufficient, as few standardized scales specifically target caregiver behavior within NDBI contexts ^[10]. Existing tools, like Mahoney MBRS, assess broad responsiveness but lack ASD-specific nuances. Most available measures are either intervention-specific parent fidelity checklists or general interaction scales not tailored to autism or NDBI requirements.

Critically, therapist-centric fidelity checklists often focus on strategy delivery rather than the “how” of the interaction—the essential “softer” aspects like warmth, attunement, and emotional support ^[28,31]. These elements are vital, as children with ASD rely on contingent, emotionally supportive interactions to facilitate learning ^[13,14]. Furthermore, significant knowledge gap persists regarding the psychometric properties of NDBI measures; current literature lacks published studies exploring their validity, short-term reliability, or responsiveness to change^[16].

Implications for Practice. EDITT-CBRS is specifically calibrated to evaluate caregiver alignment with the therapeutic protocols of NDBI. It fills a critical gap as an accessible, psychometrically sound tool specifically suited for LMICs and limited-resource settings. By incorporating universal fidelity elements ^[16], it provides a “universal language” for NDBI practitioners globally.

Its design requires only brief observation windows and minimal coder training, making it highly adaptable across diverse demographics and varying resource levels. It enables serial monitoring,

allowing clinicians to guide caregivers in naturally incorporating NDBI techniques into daily routines without the burden of overly tedious protocols.

Future Directions: multi-centric validation, longitudinal sensitivity assessments, and developing age-specific modules (12–30 months and 31–60 months). Ongoing prospective research aims to link caregiver rating trajectories directly to child behavioral improvements.

Limitations. include a small, geographically limited sample (N=35), potentially impacting generalizability and direct correlation with child outcomes. However, as a prospective study, ongoing research aims to address these trajectories in future publications.

Conclusion

EDITT-CBRS is psychometrically robust, sensitive novel tool for evaluating caregiver-child interactions within NDBI frameworks. By demonstrating high reliability and concurrent validity, it addresses the critical need for accessible assessment in limited-resource settings and LMICs. It empowers clinicians to perform longitudinal monitoring and provides a standardized language for caregiver mediation. Future multi-centric studies will further establish its generalizability and direct impact on long-term developmental outcomes for children with ASD.

Data Availability Statement: The data that support the findings of this study are available on request from the corresponding author. The data are not publicly available due to privacy or ethical restrictions.

Conflict of Interest: There is no conflict of interest.

Funding. This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

Author Contributions: Dr. Sandhya V, Dr. Nandini Mundkur, Dr. Kirthika Rajaraman, Ms. Savitha B. S have been involved in conceptualization, methodology, investigation, drafting and editing of the original paper. Dr. Udayakumar and Dr. K.S. Prathyusha have contributed to formal analysis, review and editing of the paper.

Ethical considerations: This study was performed in line with the principles of the Declaration of Helsinki. Ethical committee clearance was approved by CLINICOM, independent Ethics Committee for Evaluation of Protocols for Clinical Research, Bangalore, on 10th June 2025.

Consent for participation and publication: informed written consent have been taken from caregivers of children who participated in the sample study population.

Acknowledgments : We thank Ms. Saraswathi H.N, the Administrator and all the staff of Centre for Child Development and Disabilities (CCDD), Malleshwaram. We thank the caregivers and children who contributed to our study. We thank Ms. Manju Bhargavi, the Director for Therapy in Sangamitra early learning and sensory integration centre (sister institution of CCDD where children with severe autism spectrum disorder are empowered), and the staff, children and caregivers of Sangamitra for their support and cooperation.

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