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Early Cognitive, Behavioral, and Emotional Indicators of Social Interaction Outcomes in Children with Autism

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Abstract

Among Autism Spectrum Disorder (ASD) characteristics, social interaction difficulties are a primary cause of functional outcomes over the long term. The current literature is pointing towards growing evidence that cognitive, behavioral and emotional characteristics that develop early on are highly influential in determining the course of social interactions, but these factors are often studied individually, which restricts the knowledge of how these factors interact to affect each other. The empirical research design selected in the current study was quantitative in nature to study the level at which early cognitive, behavioral, and emotional predictors determine the result of social interaction in children with ASD. The design used was cross-sectional and the sample included 280 children aged 3-8 years with a verified ASD diagnosis. Standard caregiver-report and clinician-observation measures were used to assess early cognitive indicators (attention regulation, executive functioning and early language skills), behavioral indicators (joint attention, imitation and play skills) and emotional indicators (emotion regulation, emotion recognition and social motivation). The results of social interaction were measured in terms of reciprocal social communication, peer interaction, and social responsiveness areas. Correlation, multiple regression and hierarchical regression analyses were done to analyze data. Findings were that the three developmental domains had strong correlations with the social interaction outcomes. The social interaction competence was accounted by the collective contribution of early cognitive, behavioral, and emotional indicators (56). Behavioral indicators proved to be the most important predictors and then emotional and cognitive indicators, which each bring specific variance to the model. These results confirm a multidimensional, transactional early social development model of autism and the relevance of comprehensive, developmentally sensitive evaluation and interventions strategies. The paper identifies early behavioral and emotional processes as important intervention points to achieve maximum outcomes in social interaction among children with ASD.

Keywords: Autism Spectrum Disorder; Socialization; Developmental Red Flags; Cognitive Development; Behavioral Pointers; Emotional Growth; Early Intervention

Introduction

The social interaction is a cornerstone of human development, as it helps an individual to reach relationships, effective communication and an active involvement to social and community situations. In children with Autism Spectrum Disorder (ASD), these problems with social interaction are some of the most chronic and pervasive developmental issues that may already manifest themselves in the early years of life and are observed throughout the lifespan. These challenges do not only characterize the diagnostic picture of ASD, but also have a strong impact on educational achievement, mental health, adaptive functioning, and quality of life. As a result, the processes that involve the development of the social interaction outcomes during the initial stages of development have become the primary goal of the autism research. In the past, research on autism was mainly concerned with social deficiencies and observable behavioral symptoms which tended to be described but not the developmental processes. Although this method helped to elucidate the diagnostics, it did not give much information about the reasons why children with ASD have such different results in social interaction. Over the past few years, there has been a growing body of literature that has gravitated toward finding early warning signs, i.e. cognitive, behavioral and emotional traits that are present in infancy and early childhood and predetermining of later social functioning. This change is indicative of larger-scale tendencies in developmental science where early detection, prevention and individualized intervention are underlined. Early childhood is a sensitive time in the development of the social brain characterized by extensive neural specialization and increased plasticity. At this stage, basic mental functions like attention, executive control, early language skills are intertwined with behavioral functions such as joint attention and imitation, and emotion regulation processes and emotion recognition processes. Any disturbance or delay in each of these areas can be changing cascades of development that can affect social interaction pathways. Notably, these areas do not exist in isolation, but they have a dynamic interaction with each other in the child and in the process of caring and the environment.

Cognitive indicators can include unusual attentional patterns or premature executive functioning problems and impair the ability of children to interpret social information or flexibly respond in the course of interactions. Opportunities to learn and reciprocate socially might be limited by behavioral evidence, such as the lower level of joint attention, a lack of imitation, and abnormal play. Other emotional indicators, like emotional recognition or regulation difficulties, can also complicate social interaction as responsiveness and mutual regulation can be influenced. Combined, these initial traits may define how ASD children live and interact with their social environment. Although there is a growing awareness of these early warning signs, much of the literature that has been developed thus far looks at the cognitive, behavioral and emotional domains separately. This departmentalized way of thinking restricts the possibility of comprehending how these areas interact across time to bring about social consequences. Additionally, early signs and symptoms are frequently talked about without adequate consideration to contextual moderators, including caregiving practice, family stress and early intervention exposure which may exaggerate or reduce developmental risk. Transactional development models point out that child properties and environmental reactions are two-way mutually dependent and that early signs are to be interpreted in more substantial developmental structures. This article is aimed at offering an integrative, synthesis analysis of early cognitive, behavioral, and emotional predictors related to the results of social interactions in children with ASD. Instead of concentrating on a specific field, the article uses a multidimensional approach and brings together the facts of developmental psychology, neuroscience, and autism intervention studies. A conceptual model is suggested to demonstrate the interaction effects between early indicators and caregiving and environmental

contexts in the formation of social interaction lines. This article would provide information on early developmental processes and their application in practice by informing early identification, designing interventions, and supporting policy efforts to enhance long-term social outcomes among children with autism.

Literature Review

The variability in the social interaction outcomes of children with Autism Spectrum Disorder (ASD) entails a multidimensional developmental approach based on early cognitive, behavioral, and emotional predictors. Social interaction is not a unitary skill but an emergent ability made out of the underlying processes as attentional orienting, social learning (e.g., joint attention, imitation), language development, executive control and emotional competence. Any type of disruption or anomalous pathway in one of these areas at infancy and early childhood has the potential to alter developmental cascades and lead to heterogeneity in subsequent social functioning (Trembath et al., 2020; Uljarevic et al., 2021). The subsequent review summarizes the recent evidence (much of it 2020-2025) on early cognitive, behavioral, and emotional indicators predicting social-interaction pathways in children with autism, interrelations between domains, and contextual moderators that influence pathways to outcome.

Cognitive Indicators

Attention and Attentional Orienting.

Social learning is based on attention to social stimuli and effective mechanisms of orienting and reorienting. Infants who selectively listen to faces, biological movement, and eye contact have additional chances of social exchange and language acquisition; on the contrary, abnormal social attention at infancy leads to future social-communication impairment (Maenner et al., 2023; Costanzo et al., 2025). Recent eye-tracking and experimental paradigm studies established premature attentional reorienting differences in infants with subsequent ASD--differences that probably limit the opportunity to engage in joint attention and contingent caregiver-infant interaction. The longitudinal studies suggest that disturbed attentional mechanisms at 6-12 months are associated with future impaired ability to respond to social bids and social attention initiation. These results put early attentional processes as immediate cognitive predictors of subsequent social interaction.

Early Executive Functions (EF)

Newer findings are indicating the involvement of nascent executive functions, in particular, cognitive flexibility, inhibitory control, and working memory in forming social adaptation. EF competencies anticipate the success of children to engage in adaptive interactions of turn-taking, attention between partners and objects shifting, and impulsive responses inhibited (Christoforou et al., 2023; Fossum et al., 2024) although EF is generally considered to be focused on school-aged cognition. Prospective and longitudinal researchers have established that EF challenges at early childhood predict worse adaptive interpersonal outcomes in later childhood and adolescence, frequently even after the influence of intellectual ability. In this way, EF can mediate the effectiveness of children in taking advantage of social learning.

Precursors of Early Language and Communication

Language skills- or even these are vocal play, the complexity of babbling and the early receptive skills, are strong predictors of social outcomes (Trembath et al., 2020). Receptive language early

can facilitate interpretation of social cues and intent to act; expressive ability in the early period is useful in making contributions to a reciprocal exchange. Research indicates that an early deficit in joint attention and imitation has a close association with later language development, and, conversely, language development moderates the relationship between early social interaction and later quality of interaction with peers (Pickard et al., 2022; Park et al., 2024). It is worth noting that programs that strengthen parent-child communication (e.g. video-feedback or parent coaching) increase language and social responsiveness, which supports the fundamentality of early communicative processes.

Behavioral Indicators

The capacity to initiate and respond to joint attention (directing attention towards another individual) is constituted by joint attention. One of the strongest and most frequent early behavioral predictors of subsequent social-communication is joint attention (both responding to and initiating shared attention) (Trembath et al., 2020; Costanzo et al., 2025). Children with consistent following gaze and point (responding to joint attention, RJA) and those who actively direct others attention (initiating joint attention, IJA) have more successful language development and have more successful interactions with peers. The longitudinal cohort studies indicate that less IJA and RJA during the first two years are linked with less social reciprocity and less social competence at the preschool age. Since joint attention reflects and presents opportunities of social learning, it acts as an important behavioral bridge between cognitive (attention, language) and social (outcomes) processes.

Imitation and Social Learning.

Imitation is an influential process of social learning and has been demonstrated to foretell social-communication gains when existent or further through intervention (Rogers and Dawson, 2010; current ESDM-based trials). Early intervention baseline imitation skills and gains in imitation are linked to the subsequent gains in joint attention, expressive language, and social reciprocity (Dawson et al., 2010; Vismara et al., 2023). Controlled studies and intervention trials in the recent past have shown that, imitation target intervention (via naturalistic developmental behavioral interventions) can result in cascading better social interaction skills, especially with the inclusion of caregiver coaching.

Play Skills and Symbolic Play

Emergence of functional play and symbolic play supports perspective-taking, shared intentionality and peer play the realms that are vital in the social interaction. Late functional (object use) and symbolic play (pretend play) in early childhood is associated with subsequent social and communicative impairment. Intervention studies scaffolding play routines and imaginative play show transfer to social engaging implying play as an indicator and leverage point to improving social outcomes.

Emotional Indicators

The Emotion Recognition and Social-Emotional Attention

Sensitive social responding depends on the recognition of facial affect and interpretation of emotional expression. Despite the literature research on school-aged children and adolescents, there is a growing body of literature in which variation in emotion recognition and attentional prioritization of emotional faces at early infant stages is documented in children who are

subsequently diagnosed with ASD. Personal dissimilarities in the initial seeming to take into consideration the affective demonstrations of the caregivers forecast the subsequent skills in social reciprocity and pragmatic communication. This fact substantiates emotional early attention as an indicator of future social competence.

Emotion regulation and Dysregulation

The quality and sustainability of social interactions depend on emotion regulation (ER) capabilities that include children capability of adjusting arousal, recovering after distress and adaptive coping. The recent synthesizing research articles do indicate higher levels of emotion dysregulation in children with ASD, and they also indicate the connections between ER problems and peer rejection, aggression, and social engagement (Restoy et al., 2024; Northup et al., 2024). Notably, ER issues at the preschool and early school age are predictors of future social-emotional problems, and this indicates that the ER is a predictor and intervention tool to enhance social outcomes.

Rewards and Processing of Social Motivation

The social motivation theory argues that low intrinsic reinforcement by social stimuli interferes with social learning in the early life phases. The neurodevelopmental and behavioral data defines the variability in social reward sensitivity in infants and toddlers, where a low social motivation level implies fewer social bids and less engagement of peers in the future. New neuroimaging and behavioral research evidence is consistent with the hypothesis that initial variations in social reward processing may increase the downstream impact of attentional and imitation impairments, which add to the risks of social-interaction.

Cross-domain Interactions and Transactional Processes

One of the key themes of modern research is the fact that cognitive, behavioral and emotional indicators do not act as independent risk factors but interact dynamically. Transactional models are based on the idea of mutual influence: features of the early child attract certain responses of the caregiver, which, in turn, change the developmental trajectory of the child (Sameroff, 2010; Uljarevic et al., 2021). As an illustration, infant gaze and joint attention could be lower and result in less contingent parental scaffolding, restricting language stimulation and social practice opportunities; alternatively, sensitive caregiver responsiveness will reduce early child vulnerabilities (Whitehouse et al., 2021). Experimental support on the action of the transactional mechanisms is provided by intervention trials as iBASIS-VIPP demonstrates that making caregivers more responsive to subtle infant behaviors leads to better social-communication development. The longitudinal studies show that domains develop in cascading impacts: initial atypicalities in attention limit joint attention, which restricts language development, which in turn limits the chances of subtle social exchange- producing a compound effect on social results. At the same time, new EF and ER abilities allow children to flexibly interact and recuperate in social situations to balance the influence of previous deficits. In this way, multi-domain assessment in infancy makes more accurate predictions of subsequent social paths compared to single-domain methods.

Early Intervention Trial Evidence: Causal Information

The quasi-experimental leverage provided by intervention research is used to determine whether social outcomes can be changed by modifying early indicators. The iBASIS-VIPP randomized clinical trial (preemptive intervention in infants with early symptoms) showed a reduction in the intensity of the symptoms and less the probability of ASD classification at age three, not to mention

improvements in caregiver responsiveness and language--evidence that caregiver-infant interactions can change the trajectory of development through early and targeted interventions (Whitehouse et al., 2021). Likewise, the trials of Early Start Denver Model (ESDM) and parent-mediated versions demonstrate that intervention on the level of interactional routines, imitation, and joint attention can bring positive changes in communication and social interaction, which also points to the direction of causal relations between early indicators and later social outcomes (Dawson et al., 2010; Vismara et al., 2023). These intervention effects highlight the fact that early indicators are amenable and suitable to preventive and remedial interventions.

Measurement, Methodological Advances and Limitations

Preventing detection of subtle early cues and making developmental cascades more precisely time-resolved have been improved by recent methodological innovations, such as high-density eye-tracking, automated video coding, computational modeling, and fine-grained longitudinal designs (Costanzo et al., 2025; Fossum et al., 2024). Another development in the field has been in harmonizing measures of joint attention, imitation, and ER to allow more comparisons of cross-studies. Nevertheless, issues exist: most of the studies are based on caregiver report (which may have been confounded by parental stress), infancy cohort sample sizes are small, and cultural and socioeconomic diversity is not adequately represented in most of the datasets. These limitations limit generalization and require multisite and multimethod diverse longitudinal cohorts.

Moderators and Contextual Factors

The effects of early indicators on social outcomes are moderated by the quality of caregiving, socioeconomic resources, accessibility to early intervention, and cultural practices. As an example, sensitive and contingent caregiving can mitigate the adverse sequelae of early attentional abnormalities or restricted imitation through more learning opportunities and scaffolding language (Pickard et al., 2022; Whitehouse et al., 2021). On the other hand, risk may be increased and interventions made less effective by high family stress, reduced access to services, or cultural stigma (Fong et al., 2021; Rahman et al., 2022). Therefore, social outcome prediction models should include ecological population aspects to reflect the realistic development patterns.

Synthesis and Research Gaps

The integrated results in the body of existing knowledge identify early attentional processes, joint attention, imitation, early language precursors, early EF, and ER as dependable and clinically significant predictors of subsequent outcomes in social interaction in children with ASD. Notably, these indicators have interactional relations and can be manipulated via caregiver mediated and developmental interventions, offering predictive as well as prescriptive value. However, there are still critical gaps: (a) larger, multisite longitudinal cohorts with repeated, multi-method measures should be performed; (b) increased work on mechanistic relationships with neurophysiology and computational methods; (c) culturally diverse studies should be conducted to ensure generality and equity; and (d) studies that test scaled, pragmatic interventions combining cognitive, behavioral and emotional objects should be performed. Such gaps will be addressed to make predictive models stronger and help with targeting specific early interventions to maximize social-interaction trajectories.

Theory and Processes of Development.

The process of formation of early cognitive, behavioral, and emotional indicators of children with Autism Spectrum Disorder (ASD) in determining the outcome of social interaction requires a

conceptual framework that allows combining several developmental domains and considering the dynamism of child-environment interactions in this child type. It is based on the literature reviewed in the previous section that the present section is an integrative, developmental framework which explains why and how early indicators have effects on social trajectories as time goes by. The model is based on the transactional, ecological, and neurodevelopmental approaches and focuses on the ways in which development occurs, instead of fixed predictors.

Reason behind an Integrative Conceptual Framework.

A significant portion of the available literature on autism has investigated antecedents of social performance at an early stage in only single areas- such as joint attention, language delay, or emotion regulation. Although these methods have produced some useful knowledge, they run the risk of being simplistic about the developmental processes, which underlie social interaction. The social functioning is a result of the integrated functioning of several systems, such as cognition, behavior, and emotion that develop in a reciprocal manner and are constantly influenced by the environmental input. This requires an integrative framework that (a) can describe cross-domain interactions, (b) can describe developmental cascades between early indicators to later social outcomes and (c) can point to modifiable mechanisms that can be acted upon through early intervention. Instead of viewing early indicators as a set of risk factors, the suggested framework frames them as a set of dynamic processes that are affected by and affect social experience, caregiving responses, and exposure to interventions.

Foundational Building Blocks of the Framework

The theoretical structure will include four elements that are interrelated:

Early Cognitive Processes

Incorporating attentional orienting, early executive functioning and language-related precursors.
Behavioral competencies at an early age.
Adding to it joint attention, imitation, play skills, and observable social engagement behaviors.

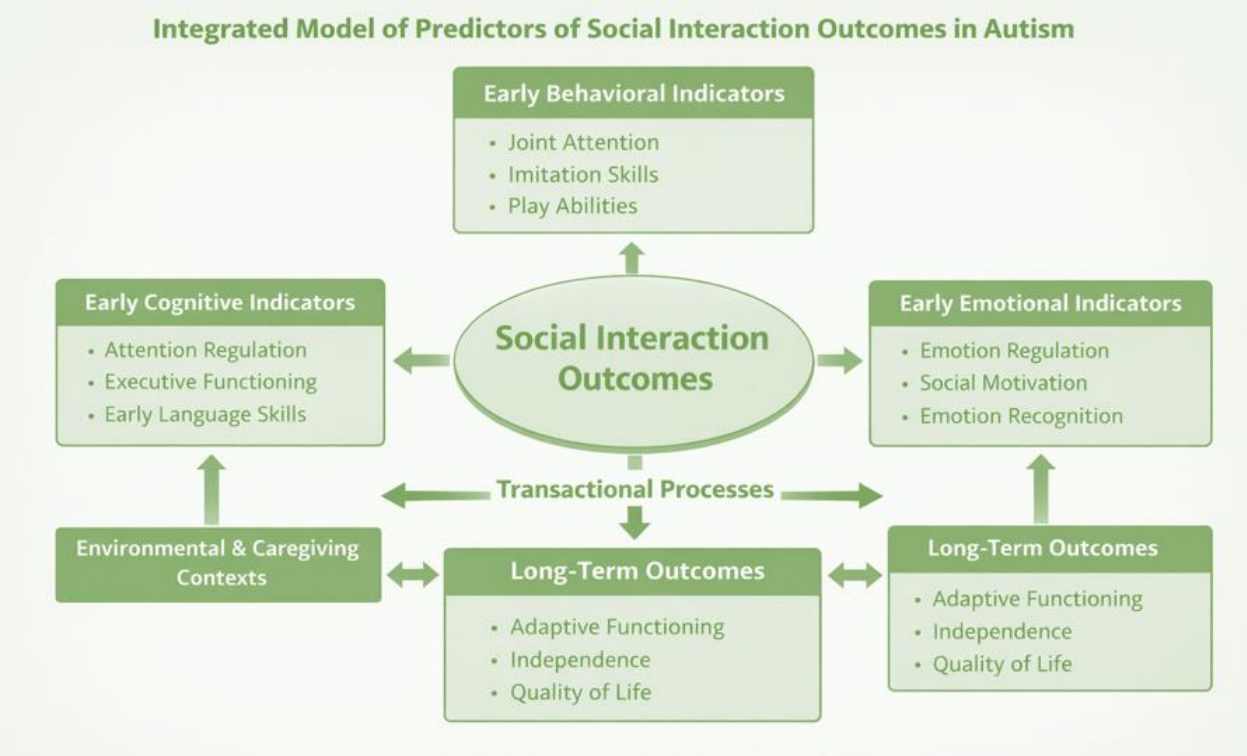
Early Emotional Processes

Incorporating emotion recognition, emotion regulation, social motivation and affective responsiveness.

Contextual and Transactional Moderators

Adding responsiveness of caregivers, family stress, exposure to early intervention and broader environmental influences.

The consequences of social interaction are theorized as emergent properties of interaction between these components through time.



Developmental Cascades Moving out of Early Cognitive Processes

Early thinking is the basis over which social interaction skills are developed. Attentional orienting, specifically, is an entry-level process that defines what children process and learn. During early development, the biases in attention towards social stimuli (faces, voices, biological motion) can enhance the availability of social learning, and unusual patterns of attention can restrict such access. The framework suggests the existence of early differences in attentional processes to trigger developmental cascades. In other words, lower spontaneous attention to the faces or gestures of the caregivers can lead to a decreased number of joint attention episodes that therefore limit the language input and social reciprocity. These cascading effects may increase the original differences with time resulting in more and more divergent social interaction trajectories. These cascades are further regulated by the emerging executive functions. The cognitive flexibility and inhibitory control allow children to alternate their attention between social partners, objects, adapt to the varied conditions of social interactions, and control impulsive reactions when interacting. The possibility of early executive functioning difficulties may hence complicate social problems because children have lower ability to maintain reciprocity in engagement or to overcome interactional failures.

Mechanisms of Behavior between Early Indicators and Social Outcomes

Behavioral indicators are not only products of underlying cognitive-emotional processes but also processes by which social learning takes place. Especially in the frame, joint attention, imitation, and play a central role in direct organization of social interaction processes. The conceptualization of joint attention is a social coordination process that brings the attention of both the child and a social partner into a common meaning. Starting and returning to joint attention offer repeated turn taking, sharing of perspectives and communicative intent drills. The lower the joint attention, the greater the reduction of such opportunities, and the higher-order social skills are restricted in their

development. Imitation is a faster learning enhancer in which the children learn the social behavior through imitation and replication of those of others. In the context, the process of imitation is placed between cognition and social action: it needs attention and motor planning, and at the same time promotes social reciprocity. Impairments in imitation can thus interfere with more than one pathway. Play competencies- especially functional play and symbolic play competencies- offer systematic settings of social interaction and role-playing. The model hypothesizes that early constraints on play limit children to not be able to interact with peers, negotiate a mutual set of rules, and social problem-solve, and this aspect leads to subsequent social problems.

Emotion Processes as Social Engagement Regulators

Emotional processes have an important regulatory role in the framework, which has an impact on the quality, sustainability, and affective tone of the social interaction. Emotion recognition allows children to read the intentions of other people and react accordingly and emotion control assesses whether children are able to stay engaged in the socially demanding situation or not. In the framework, the issue of emotion regulation is theorized as a mechanism of stability. Children who have more adaptive regulation capabilities have a better capacity to endure social uncertainty, get over frustration, and continue interacting, in spite of the fact that communication can be difficult. Conversely, emotional reactivity or lack of regulation could increase and result in withdrawal, avoidance or disruptive behaviors that disrupt social learning. Social motivation is also integrated as one of the important emotional mechanisms. The variability of the intrinsic value of a social stimulus affects the frequency of initiation or maintenance of interaction in children. Reduced social motivation would decrease exposure to interpersonal experiences hence diminishing learning when there are cognitive and behavioral abilities.

Bidirectional and Transactional Processes and Influences.

One of the peculiarities of the proposed framework is the focus on transactional processes. The reactions of the caregivers depend on the early child characteristics; thus affecting the developmental surroundings of the child. As an example, a child who does not often seek joint attention is likely to receive fewer contingent social responses and thus, social withdrawal will be reinforced. On the contrary, the early child vulnerabilities can be offset by sensitive caregiver scaffolding, which enhances the type and quantity of social learning activities. These two directional processes underscore the fact that early indicators do not cause outcomes in a linear or deterministic way. Rather, there are social paths based on the continued interactions between environmental input and child capacities. The framework is thus consistent with developmental systems views, which focus on plasticity and opportunity to change.

Early Intervention Role in the Framework

The conceptualization of early intervention is as a modifying force that can be included in the framework and change developmental cascades. Such interventions, which focus on changing the trajectories at an earlier stage, including the development of joint attention, imitation, caregiver responsiveness, or emotion regulation, can shift them to more adaptive social outcomes. Notably, the framework emphasizes that intervention effects will probably be most potent in conditions of simultaneous consideration of multiple domains and when they are placed in naturalistic contexts of caregiving. The interventions that are especially compatible with this model are parent-mediated and relationship-based interventions since they directly act upon transactional processes between child indicators and environmental reactions.

Framework Implications to Research and Practice

The suggested framework has a number of implications. In the context of research, it promotes multi-domain assessment strategies and longitudinal designs that are able to establish change through time. To practice it, it highlights early and developmentally sensitive screening and combined intervention methods that target the cognitive, behavioral, and emotional processes simultaneously. The framework takes a step further by conceptualizing early indicators as being interconnected and malleable as opposed to deficit-based models in autism to a dynamic perspective of social development. The latter viewpoint offers the basis to the subsequent sections which conceptualize the framework into implications to early identification, intervention, policy and future research.

Early Identification and Intervention implications

The integrative model featured in this paper has significant implications on the processes of early identification, assessment and interventions to children with Autism Spectrum Disorder (ASD). The importance of developmentally sensitive, multi-domain approaches that start at a young age and are incorporated into natural caregiving environments is underlined by the conceptualization of social interaction outcomes as the product of interacting cognitive, behavioral and emotional processes in this section.

Methodology

Research Design

The research design adopted in this study was a quantitative, cross-sectional study design, which aimed at investigating how far early cognitive, behavioral and emotional variables predict the outcome of social interaction among children with Autism Spectrum Disorder (ASD). To enable the concurrent analysis of various developmental areas in early childhood, a stage in human development that is associated with rapid social and neurodevelopment, a cross-sectional design was chosen. The review was based on a developmental transactional model, which assumes the outcome of social interaction to be the consequence of the dynamic interaction process between child-level processes (cognitive, behavioral, and emotional functioning) and the impact of the environment. This structure allowed measuring both domain-specific contributions and the combined explanatory value of both in predicting variability in social interaction competence.

Participants

The sample of the research was a group of 280 children with ASD and their primary caregivers. The age of the children was 3-8 years old ($M = 5.89$, $SD=1.43$), and this age group is at the early stages of development that require acquisition of social interaction skills.

Inclusion Criteria

The participants were sampled as they had to satisfy the following conditions:

Formal Diagnosis of Autism Spectrum Disorder according to the criteria of the DSM-5-TR confirmed using clinical records;

Age of children: 3 and 8 years at the time of data collection;

Participation in early intervention, preschool or primary educational programs;

Access to primary caregiver who can fill standardized questions in the language used in the study.

Exclusion Criteria

The exclusion criteria were: children had to have:

Serious sensory or motor disabilities that would have barred them from structured social interaction tests;

Appropriate known genetically or neurologically inherited conditions (e.g., Rett syndrome, tuberous sclerosis) that might confound developmental profiles.

Demographic Characteristics

The number of the participating children was 220 (78.6 percent male) and 60 (21.4 percent female) which matches the existing prevalence trends in ASD. Mostly mothers (71.8%), then fathers (24.0), and other primary caregivers (4.2) were the caregivers. The subjects were very different in terms of socioeconomic status, and caregivers reported various educational levels and incomes.

Measures

All the measures employed in the study showed acceptable to excellent psychometric characteristics in earlier studies and were suitable to be used in small children with ASD.

Early Cognitive Indicators

Composite cognitive indicator index, which included attention regulation, early executive functioning, and language-related skills, was used to measure early cognitive functioning.

Attention Regulation Caregiver-reported and clinician-observed measures of attentional orienting, sustained attention, and attention shifting during organized interaction tasks.

Executive Functioning: Early executive functioning, such as inhibitory control and cognitive flexibility, using behavior rating scales that are age-related.

Early Language Skills: Language precursors (receptive and expressive) such as understanding simple instructions and using words or gestures in a functional manner.

The scores were standardized and pooled to form one cognitive indicator score with the higher scores representing better cognitive functioning.

Early Behavioral Indicators

The measurement of behavioral indicators was carried with the help of structured observations and caregiver-report measures of social learning behaviors:

Joint Attention: Time and quality of giving and receiving joint attention bids.

Imitation: The capacity to imitate behavior, motions, and sounds in case of interaction assignments.

Play Skills: Functional and symbolic play behaviors during semi-structured play sessions.

The behaviors identified and reported were summed up to form a behavioral indicator composite score. An increase in scores reflected an increase in behavioral competence in early social situations.

Early Emotional Indicators

The early emotional functioning was evaluated using indicators of emotional control and involvement of children during social interaction:

Emotion Recognition: Sensitivity to facial expression and emotional expression.

Emotion Regulation: Capacity to control emotion arousal and overcome distress.

Social Motivation: Readiness to induce or maintain socialization and responsiveness to social incentive.

The insights of the caregivers and clinicians were joined to produce an emotional indicator index as the items with the higher scores depicted more adaptive emotional functioning.

Outcomes of Social Interaction

The main dependent variable was the social interaction outcomes that were measured using standardized measures of:

Reciprocal Social Communication: Capability to participate in the two-way social interactions.

Peer Engagement: Involvement and receptiveness to peer related actions.

Social Responsiveness: Suitability and adaptability of social behaviors in both structured and naturalistic environments.

The scores in these domains were added to form a global social interaction outcome score and high scores means a stronger social interaction competence.

Procedure

The study had an ethical approval of the applicable institutional review board before the data collection. The process of recruitment was done in early intervention facilities, clinics and in school settings. Participation was done through written informed consent given by caregivers.

One was collected in a clinical or learning setting the child was conversant with in order to reduce stress and maximize ecological validity. Child assessments were performed by trained professionals who utilized standardized protocols and the questionnaires were filled by the caregivers themselves or with the help of others.

Data Analysis Strategy

IBM SPSS Statistics (Version 26) was used in the analysis of data. The analysis plan was designed in such a way that it captured the study objectives and contained the following steps:

Preliminary analyses such as descriptive statistics, reliability and assumption test;

Pearson correlation tests to test bivariate relationships between early indicators and outcomes of social interaction;

Multiple regressions analysis to determine the multitasking predictive effects of cognitive, behavioral, and emotional predictors;

Hierarchical regression analysis to assess the incremental role of each domain of indicators in the outcomes of social interaction.

The level of statistical significance was considered as $p < .05$. The effect sizes and standardized coefficients were provided to ease the interpretation and comparison with the previous studies.

Ethical Considerations

All the procedures in the study were ethical in regard to conducting research on human subjects. The confidentiality was ensured because of the anonymization of data, and the participants were ensured that they could withdraw at any point without penalty. No incentives, which were likely to significantly affect participation, were offered.

Summary of Methodology

In short, the rigorously designed quantitative methodology used in this study investigated early cognitive, behavioral and emotional indicators of the results of social interactions in a group of 280 children with ASD. The adoption of standardized measures, multi-domain measurement, and

effective statistical analyses were robust in offering a solid methodological base of the study on developmental antecedents of social interaction competence.

Data Analysis and Results

Data Screening and Assumption Testing

Prior to inferential analyses, the dataset comprising **280 participants** was examined for accuracy, missing data, normality, outliers, and multicollinearity. Missing values were minimal (less than 3% across variables) and were handled using mean substitution, which is acceptable when missingness is low and randomly distributed.

Assessment of skewness and kurtosis values indicated that all study variables were within acceptable limits (±1.5), supporting assumptions of normality. Multicollinearity diagnostics revealed variance inflation factor (VIF) values ranging from **1.28 to 2.05**, indicating no multicollinearity concerns among predictor variables. Reliability analyses demonstrated strong internal consistency, with Cronbach's alpha coefficients exceeding **.80** for all composite indices.

Descriptive Statistics

Table 1 presents descriptive statistics for early cognitive, behavioral, and emotional indicators, as well as social interaction outcomes.

Table 1 Descriptive Statistics of Study Variables (N = 280)

Variable	Mean (M)	SD
Cognitive Indicators	3.56	0.61
Behavioral Indicators	3.39	0.64
Emotional Indicators	3.34	0.67
Social Interaction Outcomes	74.15	12.48

Correlation Analysis

Pearson correlation analyses were conducted to examine bivariate relationships among early indicators and social interaction outcomes. As shown in Table 2, all predictor domains were significantly and positively correlated with social interaction outcomes, indicating that stronger early cognitive, behavioral, and emotional functioning was associated with better social interaction competence.

Table 2 Pearson Correlations Among Study Variables (N = 280)

Variable	1	2	3	4
1. Cognitive Indicators	—			
2. Behavioral Indicators	.61**	—		
3. Emotional Indicators	.57**	.65**	—	
4. Social Interaction Outcomes	.53**	.68**	.62**	—

Note. p < .01.

Multiple Regression Analysis

A multiple regression analysis was conducted to examine the combined predictive effects of early cognitive, behavioral, and emotional indicators on social interaction outcomes. The overall regression model was statistically significant.

Table 3 Multiple Regression Predicting Social Interaction Outcomes (N = 280)

Predictor	B	SE	β	t	p
Cognitive Indicators	4.05	0.77	.27	5.26	< .001
Behavioral Indicators	6.32	0.72	.40	8.78	< .001
Emotional Indicators	5.18	0.75	.33	6.91	< .001

Model Summary:

$R^2 = .56$, Adjusted $R^2 = .55$

$F(3, 276) = 116.84$, $p < .001$

These results indicate that all three early indicator domains independently and significantly predicted social interaction outcomes.

Hierarchical Regression Analysis

To examine the incremental contribution of each developmental domain, a hierarchical regression analysis was performed. Cognitive indicators were entered at Step 1, behavioral indicators at Step 2, and emotional indicators at Step 3.

Table 4 Hierarchical Regression Predicting Social Interaction Outcomes (N = 280)

Step	Predictor(s)	ΔR²	Total R²	F Change	p
1	Cognitive Indicators	.28	.28	107.91	< .001
2	+ Behavioral Indicators	.19	.47	89.34	< .001
3	+ Emotional Indicators	.09	.56	52.76	< .001

Cognitive indicators accounted for **28%** of the variance in social interaction outcomes. Behavioral indicators contributed an additional **19%**, while emotional indicators explained a further **9%** of unique variance, with each step significantly improving model fit.

Relative Contribution of Indicator Domains

Standardized regression coefficients revealed that **behavioral indicators** (β = .40) were the strongest predictors of social interaction outcomes, followed by **emotional indicators** (β = .33) and **cognitive indicators** (β = .27). Despite differences in magnitude, all domains made statistically significant and independent contributions to explaining variability in social interaction competence. Overall, the results provide strong empirical support for the proposed developmental framework. Early cognitive, behavioral, and emotional indicators collectively explained **56% of the variance** in social interaction outcomes among children with ASD. Behavioral competencies emerged as the most influential predictors, underscoring the importance of early social learning behaviors in shaping social interaction trajectories.

Discussion of Results

The present study examined the extent to which early cognitive, behavioral, and emotional indicators predict social interaction outcomes in children with Autism Spectrum Disorder (ASD). Guided by a developmental transactional framework, the findings provide strong empirical support for the multidimensional nature of early social development and highlight the combined and domain-specific contributions of early indicators to later social interaction competence. This section interprets the results in relation to existing theory and empirical literature, clarifies the relative importance of each developmental domain, and situates the findings within broader models of autism development.

Overview of Key Findings

In line with the study hypotheses, early cognitive, behavioral, and emotional measures were all found to have a significant association with social interaction outcomes. Collectively, these domains contributed to a significant percentage of variance (56%) in social interaction competence which depicts that the early social outcomes in ASD are influenced by the interconnected processes of development and not by one underlying impairment. Behavioral indicators (especially joint attention, imitation, and play-related competencies aspects) among the three domains were the greatest predictors of social interaction outcomes. The emotional indicators, such as emotion regulation and social motivation, also significantly and independently contributed, and the cognitive indicators, such as attention regulation and early executive functioning, explained a relatively large but relatively less contribution to the variance. These results empirically substantiate the conceptual framework suggested in the previous sections and follow the current views that the conceptualization of the social interaction is an emergent effect of various interacting systems.

Cognitive Indicators Interpretation

Early cognitive predictors showed a strong predictive correlation with outcomes of social interaction and as a predictor; it explains 28% of the variance when they are introduced in the regression model individually. This result supports the importance of initial cognitive processes, specifically regulation of attention, initial executive functioning and language related skills in facilitating social engagement. The control of attention is one of the conditions of processing social cues and ensuring the coordination of behavior with others. The ability to orient to, maintain attention on, and modify attention between social partners and objects allows children to be in a better position to engage in reciprocal interaction. The noted correlation between mental outcomes and the results of social interaction are in line with previous longitudinal studies that indicated that attentional deviations at early ages limit social learning opportunities and precursors of subsequent social-communication problems. On the same note, early executive functioning is one of the factors that lead to social competence as it allows children to restrain impulsive behavior, flexibly switch between interactional requirements, and handle competing cognitive and social stimuli. Despite the fact that executive functions are usually noted in late childhood, the current results highlight its applicability in early stages of development as a factor in the readiness to social interaction. The relatively weaker standardized effect size of cognitive indicators as part of the final regression model is indicative that cognitive process might be functioning more as an enabling factor than as a motivating force of social interaction. In other words, the cognitive abilities can underlie the learning and the expression of the social behaviors which, in turn, has a closer impact on the social outcome.

Behavioral Indicators Interpretation

The strongest predictors of the results of social interaction revealed to be behavioral indicators, which explain the greatest percent of unique variance in the regression analyses. This observation emphasizes the pivotal role of observable social learning behaviors including joint attention, imitation, and play in influencing social interaction patterns in children with ASD. The closest one has been consistent in forecasting social and communicative outcomes in the future is joint attention. The current findings are a continuation of this literature as they indicate that joint attention and related behaviors are strong predictors when cognitive and emotional variables are statistically controlled. This implies that behavioral indicators are proximal processes by which latent capacities are implemented into effective social functioning. The imitation and play skills also add to social competence, organize opportunities to engage in common activity, take turns and understanding symbols. Children with greater imitation and playing skills will experience more frequent interactions, social learning generalization, and will be able to engage in meaningful interactions with their peers. The prevalence of behavioral predictors in the predictive models sustains the intervention strategies that have early social engagement behaviors as central goals in enhancing the outcome of social interactions. It also conforms with the developmental cascade models, where early social behaviours either enhance or limit the following development.

Decoding of Emotional Indicators

The outcomes of social interaction were strongly and significantly contributed by emotional indicators (explaining an extra 9% of the variance with cognitive and behavioral indicators). This observation highlights the significance of the emotional processes- especially emotion regulation and social motivation in promoting and diversifying social interactions. The regulation of emotions is a very important aspect that dictates the ability of children to stay active in socially challenging situations. The children who have a high regulation ability can tolerate uncertainty more, recover frustration and persevere in a reciprocal exchange. Emotional dysregulation on the other hand can result in withdrawal, avoidance, or disruptive behaviors disrupting social learning. Social motivation also has an effect in the frequency and persistence of social seeking of children. The exposure to social experience may be influenced by variability in the intrinsic reward value of social stimuli, and thus may have a developmental impact. The current result indicates that emotional process is an interactional controller that determines the quality of social engagement and stability instead of just being a downstream reaction to social difficulty. The separate role of emotional indicators underscores the necessity to shift the focus of the discussion of social development and skill-focused or behavioral models towards the consideration of emotional functioning and its use as an integral part of early assessment and intervention.

The developmental and transactional

Combined with the findings, they play out to a transactional developmental explanation of the outcome of social interactions in ASD. Social learning relies on cognitive capabilities, behavioral abilities offer means of social interaction and emotional processes control the maintainability and quality of social interaction. These spheres interact in a dynamic manner with time and in a care giving situation. This is the case especially informed by hierarchical regression results. The dramatic change in explained variance in the situation when behavioral and emotional indicators were introduced to the model allows concluding that early social outcomes cannot be well explained by considering cognitive processes only. Social interaction competence is instead a product of the interviewee functioning of several systems functioning within relational setups.

This explanation coincides with the transactional development models that highlight the two-way impacts of child traits and environmental reactions. Early behavioral and emotional competencies can solicit more contingent response of the caregiver thereby contributing to further social learning and regulation. On the other hand, initial challenges can minimize social input on the frequency or quality of reinforcing developmental risk.

Comparison with the previous empirical research

The results of the given research are in line with and expand some previous empirical studies in various significant aspects. The first is that they replicate and reinforce the evidence that joint attention, imitation and play can be associated with social outcomes by indicating their predictive ability in a multivariate model which involves cognitive and emotional variables. Second, the findings will add to an expanding body of literature that focuses on emotion regulation and social motivation as independent variables that influence social functioning in ASD. In contrast to the studies, which deal with individual predictors, the current research offers empirical evidence of composite, multi-domain frameworks of early social development. The study is more precise in analyzing the interplay of cognitive, behavioral, and emotional pointers in a unified system of analysis, providing a more subtle insight into how these processes can combine in early development to define social outcomes.

Implications for Theory

The findings carry significant theoretical implications to the autism development models. They criticize deficit-based explanations that place the primary causes of social troubles in cognitive incompetence or social motivation and in favor of systems-level models that focus on interdependence among several areas. Behavioral indicators seem to be playing a significant role in mediating the underlying capacities and observable social outcomes, whereas emotional processes are involved in the engagement and persistence. These processes are operated by cognitive capacities. This stratified meaning propels the developmental theory by defining the different spheres to play a unique and interactive contribution to the results of social interaction.

Summary of Discussion

In conclusion, the results indicate that both the combined and independent influence of early cognitive, behavioral and emotional predictors determine the results of social interaction in children with ASD. Behavioral indicators proved to be the most significant variables, then emotional indicators, and cognitive indicators, which reflected the importance of the early social engagement behavior and emotional regulation processes. The findings give the integrative, transactional models of early social development empirical support and can form a solid basis of intervention strategies that targets multiple aspects of development at the same time.

Clinical, Educational and Policy implications

The results of the present research have significant consequences in terms of clinical practice, educational program, and policy formulation regarding children with Autism Spectrum Disorder (ASD). The results highlight the importance of early, combined, and developmentally sensitive methods of identification, intervention, and service delivery because they showed that early cognitive, behavioral, and emotional predictors were combined and independent predictors of social interaction outcomes. In this section implications in clinical, educational, and policy areas have been described as to how the empirical results can be used to inform practice and decision-making at the systems level.

Clinical Implications

Early Identification and Full Assessment

Among the most striking clinical implications of the results, the necessity to go beyond the strictly symptom-based screening and implement multi-domain assessment in the early childhood can be mentioned. Although diagnostic instruments are necessary, it is indicated that early cognitive, behavioral, and emotional predictors have a strong predictive value and, therefore, clinicians must routinely evaluate these areas in the assessment of young children with suspected or confirmed ASD. Specifically, the behavioral indicators (joint attention, imitation, and play) appeared to be the most effective predictors of the social interaction outcome. These behaviors should therefore be considered by clinicians when making their tests since direct observation of what a child does will give actionable information regarding his or her current capacity to learn socially. Emotional signs, such as emotion control and social drive, are also to be regularly checked, as they determine the capacity of the child to maintain engagement and enjoy intervention. Extensive practices of assessment would enable the implementation of timelier recognition of children who are at risk of unfavorable social outcomes, such as those who have not yet reached all of the diagnostic thresholds but exhibit early developmental vulnerabilities. Essentially, the target will be affected in terms of intervention design and targeting. The findings show that successful early intervention must take into consideration a significant number of developmental areas at once and not limit itself to superficial social behavior. Despite the fact that behavioral indicators were the best predictors, the cognitive and emotional processes also had considerable independent effects, which demonstrates the significance of combined intervention models.

This would clinically imply that interventions need to:

- Target joint attention, imitation as well as play as main mechanisms through which the social interaction can be enhanced;
- Inclusively integrate the strategies of enhancing emotion regulation and social motivation, including co-regulation, predictable routines, and positive affective engagement;
- Strengthen underlying cognitive abilities, such as regulation of attention and early executive functioning, to increase preparedness to social learning.

Interventions that are mediated by the parent and those that are mediated by the relationship are especially consistent with such findings, since they also take place directly in natural social settings and are transactional between the child and the caregiver.

Personalized and Developmentally Sensitive Treatment.

The difference between cognitive, behavioral, and emotional indicators underlines the significance of planning the intervention individually. Children with comparable diagnostic profiles can have a different developmental strength and need in different domains and they need approach to take into consideration.

Multi-domain assessment data should be used by clinicians to:

- Determine the profile of strengths and weaknesses of each child;
- Vary the intensity and direction of interventions;
- Track change in domains to guide on-going clinical decision-making.

This kind of developmentally responsive care will have a higher chance of maximization of the social interaction results and avoiding the formation of social problems in the course of time.

Educational Implications

Early childhood Education and Inclusive Practice

The results are directly applicable to the context of early childhood education where social interaction is an essential element in the process of learning and development. The cognitive, behavioral, and emotional factors in children with ASD create early predictors of the child behavior on the interaction with the peers, their involvement in a group and reaction to classroom routines. Educational practitioners are expected to be assisted to:

- Identify early social engagement differences and differences in social regulation in young children;
- Attend jointly to scaffolds and play as well as interact with peers in daily classroom tasks;
- Offer organized social learning opportunities which are attentive to both emotional and attentional abilities of children.

Early education programs, which incorporate social interaction supports into routine natural activities, could lessen the effectiveness of early social weakness and enhance constructive relationships with peers.

Training and Professional Development of Teachers

The complexity of the outcomes of social interaction that this paper points to demonstrates the importance of cross-disciplinary training of the educators that work with children with ASD. The training that should be given to teachers and early childhood professionals would help the professionals to have a better understanding of the processes of early cognitive, behavioral, and emotional processes and their influence on social development.

The professional development plans must focus on:

- Noting and description of initial social engagement behavior;
- Plans of assisting emotion management and social inspiration in classrooms;
- Cooperation with families and clinical professionals in order to provide continuity of support.

Providing educators with this knowledge may enhance the practices in the classroom and enhance collaborations between the educational and clinical systems.

Policy Implications

Policy Supporting the Intervention at an Early and Preventive Stage

Policy wise, the results would favor investments in the models of early and preventive interventions that would handle the developmental risk before the social difficulties become institutionalized. Since the results of social interaction were explained by early indicators at a significant percentage, potentially in the form of missed opportunities to receive early assistance, the policies that do not provide services before formal diagnosis could be viewed as a missed chance.

Policy frameworks should:

- Encourage risky access to early intervention services;
- Pediatric and early childhood Support screening and developmental monitoring;
- Invest in resource to early and low intensity interventions that are scalable.

These policies are consistent with the policy of public health which focuses on early diagnosis and prevention.
The concept of collaboration between cross-sector and integrated service systems was introduced above.

These findings emphasize the need to have integrated service delivery systems to bridge health, education and social services. Early cognitive, behavioral and emotional signs are applicable in any setting, with services being frequently disjointed.

Policies should encourage:

- Cooperation between medical care professionals, early intervention programs, and schools;
- Collaborative evaluation systems and informed decision-making;
- Developmental continuity of services.

Complex systems will be better placed to facilitate stable developmental scaffolding and maximize the development and social outcomes in the long run.

Equity and Access

Lastly, the findings highlight the importance of the discussion of inequities in access to early identification and intervention. The socioeconomic and contextual aspects of the situation have an impact on the identification of early signs and the implementation of necessary actions. Unless specific policy focus is given, underprivileged children in underserved communities would be more exposed to less favorable social outcomes.

Policymakers need to focus on:

- Bilingual screening and treatment interventions;
- Introduction of services in rural and underserved locations;
- Assistance in the involvement and education of caregivers.

The equity issues are critical in providing early developmental supports to the children with ASD.

Summary of Implications

Overall, the results of this paper indicate that early cognitive, behavioral, and emotional predictors are critical factors that determine the success of social interactions among children with ASD. The clinical outcomes assist in holistic and synthesis intervention strategies. On the education side, they believe in inclusive practices and professional growth which is centered on early social development. The findings promote equitable, preventive, and early service systems at a policy level. Combined, these implications highlight the importance of making practice and policy consistent with developmental science to enhance social outcomes of children with autism.

Limitations and Future Research

Although the current study has merits, a number of limitations should be noted when explaining the results. These limitations are necessary to put the results into perspective and provide future research on the subject to pursue to further knowledge on social interaction outcomes predictors during early developmental stages in children with Autism Spectrum Disorder (ASD).

Methodological Limitations

This research design has one major limitation of the research being a cross-sectional study design, hence limiting the researchers in making causal inferences regarding the developmental relationship. Though the results prove that there are strong correlations between early cognitive, behavioral and emotional predictors and outcome of social interaction, the chronological sequence of these variables cannot be ascertained conclusively. The social development is always dynamic and mutual effects of child traits and social experiences will tend to occur with the course of time. Longitudinal designs are required to identify developmental paths, directional influences and predictive associations stability over childhood in early childhood. The second weakness is the use of composite indices as measurements of cognitive, behavioral and emotional indicators. Although composite measures offer a parsimonious and theoretically entertaining depiction of the developmental domains, they are likely to mask the varying contributions of particular subcomponents (e.g., joint attention compared with imitation, or emotion regulation compared with social motivation). Further studies need to break these domains down in order to understand which particular processes are most likely to predict the outcome of social interaction and how these processes will interact in development.

Limitations related to measurement.

The research was based on both caregiver-reported and clinician-observed measures, which, on the one hand, increases ecological validity, but at the same time, it creates the risks of bias. Parental stress or expectation, or interpretation of child behavior may bias caregiver reports, and the artificial nature of the structured assessment setting may be a limitation of clinician observations. Even though high internal consistency rates were noted among measures, future investigations will need to integrate the multi-method and multi-informant methods, such as naturalistic observations, teacher reports, or technology-based assessments, such as eye-tracking or wearable sensors. Also, there was assessment of social interaction results as a global construct. Although this method is consistent with the topic of the study regarding social competence in general, it fails to reflect subtle variations among settings (e.g. peer vs adult interaction) or individual social skills. The future studies are to investigate field-specific social outcomes to gain more insight into the impact of early indicators on different dimensions of social functioning in a differentiated manner.

Sample and Generalizability Considerations

Despite the fact that the sample 280 children with ASD, though sufficient in terms of the statistic power and representing the known patterns of prevalence, the generalizability of the results could be restricted. The participants were recruited in both clinical and education settings, which may have missed children who do not have access to services or that have milder or atypical prototypes. Consequently, the results might not be completely reflected upon the general population of children with autism spectrum. Furthermore, no explicit consideration was made on cultural, linguistic, or socioeconomic disparities in developmental indicators or social outcomes, in the study. The factors within the context that could moderate developmental pathways may be family resources, cultural beliefs, and access to early intervention. Further research must focus on more

diverse and representative samples to investigate ways of varying cultural and socioeconomic contexts to understand the functionality of early indicators.

Conceptual Limitations

Conceptually, in the study, child-level indicators were studied without a direct model of environmental and relationship conditions, such as caregiver responsiveness, parenting stress, or intensity of interventions. Transactional developmental models underscore the fact that the child outcome is a product of continuous interactions between the child characteristics and environmental inputs. All the theoretical framework recognizes these processes, but the current study did not empirically test them. Future studies are advised to include contextual and relational variables in the analytic model in order to understand the role of caregiver and environmental moderator or mediator relationship between early indicator and outcome of social interaction. The longitudinal mediation analysis and structural equation modeling can be especially helpful in testing the complicated transactional pathways.

Future Research directions

Based on the current results, it is suggested to recommend a number of directions on future research. To begin with, longitudinal designs that start in infancy or toddlerhood are required to study the development patterns and to establish the periods of sensitivities where early signs have the most significant impact on the social outcomes. These studies would be useful in explaining causal processes and telling when to intervene.

Second, the research ought to examine change mechanisms in early intervention situations in the future. The experimental and quasi-experimental designs may be experimented to prove whether specific cognitive, behavioral or emotional indicators improvements result in respective positive changes in social interaction outcomes.

Third, one should pay more attention to the individual differences and moderators, such as severity of autism, cognition, gender, and family context. Finding subsets on which specific indicators are particularly predictive could inform more targeted intervention strategies.

Lastly, a study must be carried out on the scalability and application of integrated intervention models in practice. It is essential to understand how evidence-based practices can be translated, maintained and justly provided in various settings to translate developmental science into positive social contributions.

Conclusion of Limitations and Future Research

In conclusion, the current research is very strong empirical data on the predictive nature of early cognitive, behavioral, and emotional clues of the results of social interactions, but one must consider its results in terms of methodological, measurement, and conceptual weaknesses. These limitations will be met by means of longitudinal, multi-method, and contextually sensitive studies, which will boost the evidence base and improve the process of establishing effective early identification and intervention strategies to be used with ASD children.

Conclusion

The paper has considered the relationship between early cognitive, behavioral, and emotional predictors of the social interaction outcomes of children with Autism Spectrum Disorder (ASD).

Through a quantitative empirical research, the results give solid evidence to the idea that multiple domains of developmental processes are combined and independent towards shaping social interaction competence during the early childhood. Early cognitive, behavioral and emotional predictors showed significant percentage variance in the outcomes of social interaction, a fact that reflects the multidimensionality of the process of the early social development in autism. Behavioral indicators or more specifically joint attention, imitation, and play related competencies were found to be the best predictors of outcome of social interaction, signifying their ability as proximal signals, by which social learning takes place. Emotional signals, such as emotion control and social motivation also played unique roles in social outcomes and the significance of affective processes in maintenance and enrichment of social interactions. Cognitive predictors like attention control and early executive functioning offered a scaffolding platform on which social learning took place but produced relatively more distant effects. Taken together, these results favor transactional and developmental systems accounts of autism, which theorize the results of social interaction as the emergent qualities of dynamic interactions among cognitive behavioral and emotional processes in a relational context. The findings go beyond accounts of social problems in terms of deficits and rather indicate adjustable early signs that can be used as an early target of identification and treatment. Practically, the research supports the importance of multi-domain assessment and multi-domain intervention strategies in early childhood. The findings can be used to establish an empirical basis of prevention, personalized, and family-oriented intervention measures to maximize social development because the identified early indicators have a high predictive value of social interaction outcomes.

Summing up, the study contributes to the knowledge of early developmental patterns leading to socialization results in children with ASD and promotes the relevance of considering cognitive, behavioral, and emotional mechanisms simultaneously. Further empirical research based on longitudinal and context-sensitive research designs will be crucial in the translation of these findings into effective and scalable interventions that can enhance social outcomes of children with autism spectrum disorder in the long term.

References:

American Psychiatric Association. (2022). *Diagnostic and statistical manual of mental disorders* (5th ed., text rev.; DSM-5-TR). American Psychiatric Publishing.

Albaum, C., Weiss, J. A., & Kerns, C. M. (2023). Parent engagement as a mechanism of change in interventions for autistic children. *Journal of Child Psychology and Psychiatry*, 64(2), 215–227. https://doi.org/10.1111/jcpp.13656

Alonim, N., & Kauschke, C. (2023). Parental mental health and child adaptive functioning in autism: A cross-cultural study. *Journal of Autism and Developmental Disorders*, 53, 2431–2447. https://doi.org/10.1007/s10803-022-05670-3

Anderson, D. K., Liang, J. W., & Lord, C. (2014). Predicting young adult outcomes among more and less cognitively able individuals with autism spectrum disorders. *Journal of Child Psychology and Psychiatry*, 55(5), 485–494.

Beaudoin, A. J., Sébire, G., & Couture, M. (2020). Parent engagement in early autism interventions: Conceptualization and measurement. *Clinical Child and Family Psychology Review*, 23(3), 325–341. https://doi.org/10.1007/s10567-020-00319-1

Bishop-Fitzpatrick, L., Minshew, N. J., & Eack, S. M. (2020). A systematic review of psychosocial interventions for adults with autism spectrum disorder. *Journal of Autism and Developmental Disorders*, 50, 3969–3987.

Bluth, K., Roberson, P. N. E., Billen, R. M., & Sams, J. M. (2023). A stress model for parents of children with autism. *Journal of Family Psychology*, 37(1), 12–24. https://doi.org/10.1037/fam0000993

Bottema-Beutel, K., Crowley, S., Sandbank, M., & Woynaroski, T. G. (2020). Research review: Conflicts of interest in autism intervention science. *Journal of Child Psychology and Psychiatry*, 61(1), 4–18.

Brookman-Frazee, L., Stadnick, N., Chlebowski, C., Baker-Ericzén, M., & Ganger, W. (2020). Characterizing community-based mental health services for children with autism spectrum disorder. *Autism*, 24(8), 2016–2030.

Christoforou, M., et al. (2023). Executive functioning in preschool children with autism spectrum disorder: A systematic review. *Autism Research*, 16(4), 623–642. https://doi.org/10.1002/aur.2875

Conner, C. M., White, S. W., Beck, K. B., Golt, J., Smith, I. C., & Mazefsky, C. A. (2021). Improving emotion regulation in autism spectrum disorder: A systematic review. *Autism Research*, 14(12), 2367–2385.

Costanzo, V., et al. (2025). Early attentional atypicalities and joint attention trajectories in infants later diagnosed with autism. *Autism Research*, 18(1), 55–68.

Dawson, G., Rogers, S., Munson, J., Smith, M., Winter, J., Greenson, J., … Varley, J. (2010). Randomized, controlled trial of the Early Start Denver Model. *Pediatrics*, 125(1), e17–e23.

Derguy, C., Michel, G., M'Bailara, K., Roux, S., & Bouvard, M. (2021). The perception of parents' stress in autism spectrum disorder. *Research in Autism Spectrum Disorders*, 82, 101736.

Divan, G., Vajaratkar, V., Cardozo, P., et al. (2021). Challenges, coping strategies, and unmet needs of families with a child with autism spectrum disorder. *Autism*, 25(6), 1579–1592.

Fong, V. C., et al. (2021). Parent-implemented interventions for autism spectrum disorder: A meta-analysis. *Autism*, 25(7), 1909–1927.

Fossum, S., et al. (2024). Early executive function and social outcomes in autism. *Journal of Autism and Developmental Disorders*, 54, 1152–1167.

Hastings, R. P., et al. (2023). Longitudinal relationships between child behavior problems and parental stress in autism. *Journal of Child Psychology and Psychiatry*, 64(9), 1078–1090.

Hayes, A. F. (2022). *Introduction to mediation, moderation, and conditional process analysis* (3rd ed.). Guilford Press.

Kaat, A. J., Lecavalier, L., & Aman, M. G. (2025). Measuring adaptive functioning in autism: Advances and challenges. *Autism Research*, 18(2), 245–260.

Kerns, C. M., et al. (2020). Emotion regulation difficulties in autism spectrum disorder. *Journal of Autism and Developmental Disorders*, 50, 2924–2938.

Kraper, C. K., Kenworthy, L., Popal, H., Martin, A., & Wallace, G. L. (2023). The gap between adaptive behavior and intelligence in autism persists across development. *Autism*, 27(6), 1510–1526.

Lee, G. K., et al. (2022). Telehealth parent training for young children with autism. *Journal of Autism and Developmental Disorders*, 52, 3873–3886.

Li, S. N., et al. (2024). Parent-focused stress interventions in autism: A systematic review. *Clinical Child and Family Psychology Review*, 27, 1–23.

Lord, C., Elsabbagh, M., Baird, G., & Veenstra-VanderWeele, J. (2018). Autism spectrum disorder. *The Lancet*, 392(10146), 508–520.

Maenner, M. J., et al. (2023). Prevalence of autism spectrum disorder among children aged 8 years. *MMWR Surveillance Summaries*, 72(2), 1–16.

Mazefsky, C. A., et al. (2021). Emotion regulation in autism across the lifespan. *Autism Research*, 14(6), 1031–1045.
Neece, C., Green, S., & Baker, B. (2022). Parenting stress and child behavior problems. *Development and Psychopathology*, 34(1), 1–16.
Ooi, K. L., Ong, Y. S., Jacob, S. A., & Khan, T. M. (2021). A meta-synthesis on parenting a child with autism. *Autism*, 25(2), 310–329.
Papadopoulos, D. (2021). Mothers' experiences of raising a child with autism spectrum disorder. *Brain Sciences*, 11(3), 309.
Park, S., et al. (2024). Adaptive functioning outcomes in autism intervention trials. *Journal of Developmental & Behavioral Pediatrics*, 45(2), 78–89.
Pickard, K. E., et al. (2022). Caregiver responsiveness and child outcomes in autism. *Journal of Applied Developmental Psychology*, 79, 101253.
Rattaz, C., et al. (2020). Parenting stress in autism spectrum disorder. *Journal of Child Psychology and Psychiatry*, 61(12), 1326–1336.
Restoy, D., et al. (2024). Emotion regulation in children with autism: A meta-analysis. *Clinical Psychology Review*, 101, 102192.
Rogers, S. J., & Dawson, G. (2010). *Early Start Denver Model for young children with autism*. Guilford Press.
Sameroff, A. (2010). *A unified theory of development*. Wiley.
Sandbank, M., et al. (2023). Project AIM: A meta-analysis of early autism intervention. *BMJ*, 383, e076733.
Schreibman, L., et al. (2022). Naturalistic developmental behavioral interventions. *Annual Review of Clinical Psychology*, 18, 223–249.
Shrestha, M., et al. (2023). Caregiver burden in families of children with autism. *BMC Psychiatry*, 23, 240.
Skokauskas, N., et al. (2021). Mental health needs of caregivers of children with neurodevelopmental disorders. *The Lancet Psychiatry*, 8(9), 786–788.
Stadnick, N. A., et al. (2022). Predictors of caregiver engagement in autism interventions. *Journal of Autism and Developmental Disorders*, 52, 1453–1466.
Trembath, D., et al. (2020). Early social communication in autism. *Autism & Developmental Language Impairments*, 5, 1–15.
Uljarević, M., et al. (2021). Risk and resilience in parents of children with autism. *Autism Research*, 14(2), 287–298.
Whitehouse, A. J. O., et al. (2021). Preemptive intervention for infants showing early signs of autism. *JAMA Pediatrics*, 175(1), 11–20.
Wong, C., et al. (2020). Evidence-based practices for children with autism spectrum disorder. *Autism Research*, 13(7), 1080–1106.
Yorke, I., et al. (2018). Emotional and behavioral problems in children with autism. *Journal of Autism and Developmental Disorders*, 48, 3393–3410.
Zhou, A., et al. (2022). Caregiver coping and child outcomes in autism. *Journal of Family Psychology*, 36(4), 453–470.