**Emotional Understanding and**

**Social Functioning in Autistic Children: Could They be Improved Using a Teacher-Mediated Computerized Program?**

Ifat Bar - Ben Shabat

Faculty of education

Ph.D. Thesis

Submitted to the Senate of Bar-Ilan University

Ramat – Gan, Israel June 2025

This work was carried out under the supervision of

Prof. Sigal Eden, Faculty of Education

Prof. Ofer Golan, Department of Psychology

Bar-Ilan University, Ramat Gan, Israel.

**List of content**

[Abstract x](#_Toc202089909)

[Scientific Background 1](#_Toc202089910)

[1.1 Autism Spectrum Disorder 2](#_Toc202089911)

[1.2 Theoretical Perspectives on EU Deficits in Autistic Children 3](#_Toc202089912)

[1.2.1 Emotion Recognition from Nonverbal Sensory Cues 3](#_Toc202089913)

[1.2.2 Cognitive Empathy 4](#_Toc202089914)

[1.2.3 The Relationship Between Emotion Recognition and Cognitive empathy 6](#_Toc202089915)

[1.2.4 Emotional Language 6](#_Toc202089916)

[1.2.5 Social Functioning 8](#_Toc202089917)

[1.3 The Relationship Between EU Components and Social Functioning 9](#_Toc202089918)

[1.4 EU Intervention Programs: Approaches and Strategies 11](#_Toc202089919)

[1.4.1 Group-Based Social-Emotional Intervention 11](#_Toc202089920)

[1.4.2 Computer Based Social-Emotional Intervention 11](#_Toc202089921)

[1.4.3 School-Based Social-Emotional Intervention 12](#_Toc202089922)

[1.5 Generalizability of Social-Emotional Interventions for Autistic Individuals 13](#_Toc202089923)

[1.6 The Current Thesis 14](#_Toc202089924)

[1.6.1 Research Questions 15](#_Toc202089925)

[1.6.2 Research Hypotheses 15](#_Toc202089926)

[2. Pilot Study: Adapting a Computer-Based Emotion Understanding Program to Special Education for Autistic Children 17](#_Toc202089927)

[2.1 Method 18](#_Toc202089928)

[2.1.1 The Adapted Intervention Program 18](#_Toc202089929)

[2.1.2 Participants 19](#_Toc202089930)

[2.1.3 Measures 21](#_Toc202089931)

[2.1.4 Procedure and Design 24](#_Toc202089932)

[2.1.4 Analysis Plan 25](#_Toc202089933)

[2.2 Results 26](#_Toc202089934)

[2.2.1 Adaptation of EmotiPlay 26](#_Toc202089935)

[2.2.2 Evaluation of EU and Social Functioning Measures 28](#_Toc202089936)

[2.3 Discussion 31](#_Toc202089937)

[2.3.1 Study Limitations 33](#_Toc202089938)

[2.3.2 Conclusion 33](#_Toc202089939)

[3. Baseline Study: Is the Association between Emotion Recognition and Social Functioning Mediated by Cognitive Empathy and Emotional Language in School-Aged Autistic Children? 35](#_Toc202089940)

[3.1 Method 35](#_Toc202089941)

[3.1.1 Participants 35](#_Toc202089942)

[3.1.2 Instruments 36](#_Toc202089943)

[3.1.3 Procedure 38](#_Toc202089944)

[3.1.4 Statistical Analysis 38](#_Toc202089945)

[3.2 Results 39](#_Toc202089946)

[3.2.1 Correlation analysis 39](#_Toc202089947)

[3.2.2 Mediation Analyses 41](#_Toc202089948)

[3.3 Discussion 44](#_Toc202089949)

[3.3.1 Limitations and Future Directions 47](#_Toc202089950)

[3.3.2 Conclusion 47](#_Toc202089951)

[4. Intervention Study: The Effects of a Computerized Teacher-Mediated Intervention on the Emotional Understanding of Autistic Children: A Block Randomized Controlled Trial 48](#_Toc202089952)

[4.1 Method 48](#_Toc202089953)

[4.1.1 Design 48](#_Toc202089954)

[4.1.2 The EmotiPlay School-based Program 49](#_Toc202089955)

[4.1.3 Measures 50](#_Toc202089956)

[4.1.4 Participants 53](#_Toc202089957)

[4.1.5 Procedure 56](#_Toc202089958)

[4.1.6 Statistical Analysis 57](#_Toc202089960)

[4.2 Results 58](#_Toc202089964)

[4.2.1 Descriptive Statistics 58](#_Toc202089965)

[4.2.1 Children's Performance on EU Tasks 59](#_Toc202089966)

[4.2.2 Children's Social Functioning 63](#_Toc202089967)

[4.2.3 The Contribution of Background Characteristics in Explaining the Benefit from the Intervention 65](#_Toc202089968)

[4.2.4 Implementation Results 66](#_Toc202089969)

[4.3 Discussion 69](#_Toc202089970)

[4.3.1 Conclusions 72](#_Toc202089971)

[5. General Discussion 73](#_Toc202089972)

[5.1 A Summary of the Study’s Main Findings 73](#_Toc202089973)

[5.2 Implementation of EU Program in the Educational System 73](#_Toc202089974)

[5.3 Generalization in ASD 75](#_Toc202089975)

[5.4 Clinical Implications 77](#_Toc202089976)

[5.5 Future Research Directions 79](#_Toc202089977)

[5.6 Conclusion 80](#_Toc202089978)

[6. References 81](#_Toc202089979)

[Hebrew Abstract ‏א](#_Toc202089980)

**List of Tables**

[Table 1 Background Characteristics and Performance on the Screening Tests 1](#_Toc201429424)

[Table 2 *Mean, SD and F-values of the Performance on Emotional Evaluative Measures* 10](#_Toc201429425)

[Table 3 *Mean, SD and F-values of the Performance on Social Functioning* 12](#_Toc201429426)

[Table 4 *Descriptive Statistics and Pearson Correlation Coefficients of the Study Measures* 22](#_Toc201429427)

[Table 5 *Background Characteristics by Group* 37](#_Toc201429428)

[Table 6 *Mean and SD of Children’s Performance on Emotion Recognition, TEC, and ED and Social Functioning at Each Time Point* 41](#_Toc201429429)

[Table 7 *MLM Results for Children's Performance on Emotion Recognition, TEC, and Emotion Definition Tasks* 43](#_Toc201429430)

[Table 8 *MLM Results for Children's Social Functioning (POPE Task)* 46](#_Toc201429431)

[Table 9 *MLM Results for Children's Performance on emotion recognition, TEC, and ED (%) Among Autistic Children in the Research Group* 48](#_Toc201429432)

**List of Figures**

[Figure 1 *Path Analysis Predicting Social Functioning Based on Emotion Recognition, Cognitive Empathy, and Emotional Language* 24](#_Toc201429032)

[Figure 2 *CONSORT Diagram of the Study Design and Randomization of Participants Into the Intervention and Control Groups* 36](#_Toc201429033)

[Figure 3 *MLM Results for Children's Performance on Emotion Recognition, TEC, and Emotion Definition Tasks* 44](#_Toc201429034)

[Figure 4 Quality of Implementation Over Time (%) 49](#_Toc201429035)

**List of abbreviations**

Adaptive Behavior Assessment System - ABAS

Autism Diagnostic Observation Schedule - ADOS

ASD - Autism Spectrum Disorder

ANCOVA – Analysis of Covariance

CBI - Computer Based Intervention

CFI - Comparative Fit Index

CMIN - Chi-square MINimum

ED – Emotion Definition

EU – Emotional Understanding

FEFA - Frankfurt Test and Training of Facial Affect Recognition

GFI - Goodness of Fit Index

ICC - Intraclass Correlation Coefficients

ID – Intellectual Disability

IFI - Incremental Fit Index

Institutional Review Board - IRB

MANCOVA – Multivariate analysis of Covariance

MLM – Multi Level Modeling

Non-Autistic-NA

QoI - Quality of Implementation

RMSEA – Root Mean Square Error of Approximation

SST - Social Skills Training

Social Responsiveness Scale – SRS

TCE – Theory of Constructed Emotions

TEC – Test of Emotional Competence

URP-IR - Usage Rating Profile Intervention Rating

Wechsler intelligence scale for children - WISC

Whole school approach - WSA

Abstract

Autism spectrum disorder (ASD) is a lifelong neuro-developmental condition characterized by social communication differences, and restricted repetitive behaviores and altered sensory sensitivity. Research presents significant evidence to challenges in emotional understanding (EU) among autistic individuals. These challenges include impaired recognition of emotions from nonverbal cues, difficulties with cognitive empathy - interpreting others’ affective and mental states, and reduced utilization of emotional language. Previous studies suggest a potential link between emotion recognition and social functioning mediated by emotional language and cognitive empathy. However, this relationship remains underexplored in autistic children. Hence, the first objective of this study was to examine the pathway through which emotion recognition facilitates effective social functioning via emotional language and cognitive empathy among autistic children.

Over the years various interventions have been developed to enhance social-emotional skills in autistic individuals, with growing interest in computer-based interventions (CBI) due to their structured and simplified presentation of the social-emotional world. This systematic approach is particularly well-suited to the learning preferences of autistic individuals. Research shows that CBIs can improve EU abilities. However, most existing programs primarily focus on recognizing emotions through facial expressions, often overlooking other essential nonverbal cues conveyed through body language and tone of voice. Additionally, most programs emphasize "basic" emotions (happiness, sadness, fear, anger, disgust, and surprise) while neglecting more "complex" emotions (such as disappointment, shame, pride), which involve cognitive processes related to mental states and social situations.

To address these gaps, we employed EmotiPlay, a computer-based program designed to address multiple modalities of emotional recognition—facial expressions, body language, and tone of voice—covering both basic and complex emotions. The program has been cross-culturally validated and has shown efficacy in enhancing emotion recognition from non-verbal cues for autistic children. However, like most technological interventions, 'EmotiPlay' was originally designed for individual use, which can limit the generalizability of its outcomes to real-life social functioning. Integrating such programs into the children’s natural social settings, such as the educational system, may enhance their effectiveness by providing opportunities for real-world application and interaction. Thus, the second objective of the current study was to evaluate the effectiveness of a teacher-mediated version of the EmotiPlay program in improving EU abilities and social functioning among school-age autistic children who attend special education classes.

The study consisted of three parts: (1) **Pilot study** - adaption of the EmotiPlay intervention for implementation in special education classrooms for autistic students (2) **Baseline study** - examination of the pathway linking emotion recognition to social functioning through emotional language and cognitive empathy in autistic children; and **(3) Intervention study** – evaluation of a computer-based, teacher-mediated intervention aimed at enhancing EU in autistic children in special education, and examining its potential indirect effects on social functioning.

The pilot study evaluated the integration and accessibility of the modified teacher-mediated EmotiPlay intervention in a school environment and assessed the feasibility and reliability of the study’s measures. The pilot study included five special education classes integrated within mainstream schools. Twenty-four autistic children (4 girls), aged 7-10 (*M =* 9.12, *SD* = 1.21), were compared with 19 non-autistic (NA) children (3 girls), aged 7-9 (*M* = 7.92, *SD* = 0.83). Gender and cognitive abilities were comparable between the two groups. Children participated in a comprehensive assessment that included a multi-model emotion recognition task, a cognitive empathy task, and two emotional language tasks. Additionally, children’s prosocial behavior was observed during unstructured playtime. Following this, autistic students participated in a short version of teacher-mediated EmotiPlay program, consisting of 16 lessons delivered over a span of three months. Biweekly observations of the lessons, as well as teacher reports and teacher interviews were collected.

Overall, the program received very positive feedback from both the teachers and the students. However, several modifications were suggested to better adapt the program to the diverse age range and functional levels of the students. These included reducing verbal and cognitive demands and adjusting the balance of emotional content between basic and complex emotions. Most measures of EUand social functioning distinguish effectively between autistic participants and NA participants, revealing significant deficits in autistic children. These results led to further adaptations of EmotiPlay’s intervention for school implementation.

Next, the baseline study investigated the relationship between emotion recognition from nonverbal cues and everyday social functioning in autistic children, focusing on the potential mediating roles of emotional language and cognitive empathy. For this purpose, we relied on pre-intervention data from 116 autistic children (17 girls), aged 7-10 (*M* = 8.26, *SD* = .76) who were recruited through their schools for the intervention evaluation. Participants completed a comprehensive assessment that included a multi-modal emotion recognition task, a cognitive empathy task, and an emotional language task. Social functioning was evaluated through naturalistic observations during free play and supplemented by parent-reported measures. Path analysis results revealed that the relationship between emotion recognition and social functioning was mediated by cognitive empathy, after controlling for age, cognitive abilities and autism severity. Furthermore, emotional language emerged as a contributing factor, enhancing cognitive empathy and further supporting its role in social functioning. Findings from this baseline study present an indirect path between emotion recognition and social functioning through emotional language and cognitive empathy in autistic children. This underscores the importance of targeting these components in interventions aimed at improving social communication and adaptive social skills in this population.

Finally, the Intervention study examined whether the adapted, teacher-mediated EmotiPlay program could enhance EU and social functioning in autistic children attending special education classes. The above-mentioned 116 autistic children were randomly assigned, at the class level, into the intervention group (n = 59), which received two lessons of EmotiPlay per week for 22 weeks, or the control group (n = 57) which maintained their standard special education curriculum. Participants’ emotion recognition from nonverbal cues, cognitive empathy, and emotional language were assessed, while their social functioning skills were observed during free playtime. Additionally, implementation and social validity of the intervention were assessed through lesson observations and teachers’ questionnaires and interviews.

The intervention group showed significant improvements in interpreting emotions from nonverbal cues, cognitive empathy, and in emotional language compared to the control group. However, these improvements did not significantly generalize to emotions not specifically taught in the program or to broader social behaviors, highlighting the program's targeted impact. The study confirms the feasibility and accessibility of implementing the intervention in school settings. It contributes to our understanding of how computer-based programs can enhance social-emotional learning in autistic children and highlights their potential as practical tools within special education frameworks.

Together, these studies emphasize the central and complex role of EU skills in social functioning, a core challenge for autistic children. The findings demonstrate the efficacy and feasibility of implementing a teacher-mediated, computer-based intervention in special education classrooms, successfully enhancing emotion recognition, cognitive empathy, and emotional language. However, while the intervention yielded clear benefits, it also revealed limitations in the transfer of these skills to broader social interactions. These findings highlight the importance of continued research into strategies for implementing such interventions within natural social environments, and for integrating them across diverse real-life contexts to maximize their practical impact.

Scientific Background

The current study focuses on enhancing emotional understanding (EU) among children with autism spectrum disorder (ASD). Previous social-emotional programs have struggled to address the diverse challenges within this population, which vary across different levels of functioning, and face challenges generalizing skills to new contexts. Alongside these limitations, technological interventions offer notable advantages in promoting social-emotional skills, particularly for autistic1 individuals. Hence, this study expanded a computerized evidence-based intervention designed to promote EU in individual home-based practice and adapted it for group-based implementation in special education classrooms for autistic children.

The first chapter outlines the scientific background, exploring the key concepts and evidence base underpinning the use of social-emotional interventions for autistic children. The second chapter presents the pilot study which examines feasibility and adaptability of the EmotiPlay computerized program to a special education classroom setting. Findings from the pilot were used to formulate an adapted intervention program and an evaluation protocol, to be used in the full trial. The third chapter employed the baseline study of the full trial to examine the role emotion language and cognitive empathy play in the relationship between emotion recognition from nonverbal cues and social functioning among autistic children. This chapter aims to deepen our understanding of the mechanisms underlying the social-emotional challenges autistic children face. The fourth chapter presents the intervention study, findings of the full evaluation of the intervention program in special education classes, comparing the intervention group to a treatment as usual control group. The study examined the program’s impact on enhancing children’s EU and social functioning, as well as the outcomes of integrating the intervention in the educational setting. The final chapter presents a general discussion of the complete study.

The scientific review will explore theoretical perspectives on EU deficits in autistic children, examining the multifaceted nature of emotional processing, including emotion recognition from nonverbal sensory cues, cognitive empathy, and emotional language. It then investigates the complex interplay between these components of EU and their collective impact on social functioning in autistic children. Next, the review presents intervention approaches aimed at enhancing EU and social functioning in autistic children. Three primary social-emotional intervention models are examined: group-based, computer-based, and school-based. Each approach is analyzed in terms of effectiveness, implementation strategies, and limitations in addressing the unique social-emotional needs of autistic children. Finally, the review addresses the critical issue of generalizability in social-emotional interventions, exploring the challenges of transferring skills learned in structured environments to real-world social interactions.

1.1 Autism Spectrum Disorder

ADS is a neurodevelopmental condition characterized by social-communication challenges, circumscribed interests, a preference for sameness and repetition, and altered sensory experience (American Psychological Association, 2022). The term ASD addresses a broad phenotype, including subclinical differences in social and communication abilities, as well as cognitive, linguistic, and behavioral traits (Chiarotti & Venerosi, 2020). The prevalence of ASD continues to rise globally. According to the Centers for Disease Control, ASD affects 1 in 36 school-aged children in the United States (Maenner, 2023). Similarly, reports from Israel in 2022 indicate a growing prevalence of ASD diagnoses among children and adolescents, with a reported rate of 1 in 64 (Dinstein et al., 2024). ASD is more common in males than females, with diagnoses occurring at reported ratios ranging from 4:1 to 3:1 (Ferman & Segal, 2024; Loomes et al., 2017). The rising prevalence of ASD has required adaptations in educational frameworks to better support the diverse needs of autistic children. In Israel, autistic children aged 6–18 are entitled to one of three specialized educational settings: (1) dedicated ASD - specific special education schools with small classes (5–8 students) and enhanced staff support, (2) special education classes for autistic children within mainstream schools (5–8 students), or (3) mainstream classrooms with individualized integration support (Ferman & Segal, 2024).

1.2 **Theoretical Perspectives on EU Deficits in** Autistic **Children**

The ability to understand another person’s emotions is a nuanced and intricate skill. It involves both sensory and cognitive components. During social interaction, speakers simultaneously transfer verbal and nonverbal emotional information through facial expression, body language, and tone of voice (Raamkumar & Yang., 2022). These emotion recognition abilities are supplemented by cognitive empathy, which involves interpreting others’ affective and mental states, based on past experiences. Additionally, it has been argued that language plays a pivotal role in bridging sensory information and social knowledge (Gendron & Feldman-Barrett., 2018). In non-autistic (NA) children, these processes jointly contribute to optimal social functioning (Denham et al., 2001). However, their development may be significantly affected by neurodevelopmental differences, such as autism.

Previous research indicates that the developmental trajectories of emotion recognition from non-verbal cues, cognitive empathy, and emotional language differ between autistic children and NA children (Bamicha & Drigas, 2022; Fridenson-Hayo et al., 2016; Lartseva et al., 2015). These challenges are thought to significantly impact a central feature of autism - social functioning. In the following sections, we will review each element of EU in autistic children, and how they influence social development.

1.2.1 Emotion Recognition from Nonverbal Sensory Cues

In a social interaction, emotional information is transferred through nonverbal sensory cues, including facial expressions, gestures and prosodic cues. The ability to interpret these cues develops progressively in typically developing children, beginning with basic emotions and gradually extending to more complex ones. This trajectory reflects both biological predisposition and cognitive-social maturation (Dash & Davis, 2022). From early infancy, children can discriminate between simple emotional expressions such as happiness and sadness. By the end of the first year, their sensitivity expands to a broader range of nonverbal signals, marking the emergence of emotional awareness. Throughout the preschool years, children demonstrate increasing accuracy in recognizing basic emotions, typically starting with happiness, followed by sadness and anger, then fear, and finally surprise and disgust. Although the developmental patterns may vary depending on the modality assessed (e.g., facial expressions, body language, or prosody) (Riddell et al., 2024). These emotions are widely regarded as biologically rooted and universally expressed, a perspective supported by Ekman’s Neuro-cultural Theory of Emotion (1999), which identifies distinct, cross-cultural facial expressions for basic emotions. However, the recognition of complex emotions, such as pride, shame, and frustration, develop more gradualy and is contingent on higher-order cognitive abilities. As noted by Camras and Allison (1985), understanding complex emotions necessitates skills such as self-reflection, perspective-taking, and comprehension of social norms. These emotions are typically more context-dependent and lack consistent nonverbal markers, making them challenging to identify both for the child experiencing them and for others interpreting the signals. As a result, accurate recognition of complex emotions tends to emerge only in later developmental stages (Koltcheva & Popivanov., 2025).

Accumulating evidence indicates that autistic children often experience challenges in recognizing emotions from these nonverbal cues (Fridenson-Hayo et al., 2016; Leung et al., 2022; Todorova et al., 2019). These difficulties extend across a wide span a wide range of emotions, from basic to complex, and are evident across individual modalities as well as in tasks that require integration of multiple cues (Griffiths, 1997; Suhaimi et al., 2020; Fridenson-Hayo et al., 2016). Additionally, research indicates that children’s age, as well as their verbal and nonverbal abilities, are linked to their performance in emotion recognition tasks (Schlegel et al., 2019; Trevisan & Birmingham, 2016).

These difficulties in emotion recognition among autistic children constitute one aspect of emotional understanding, given that emotional information is deciphered within a social context.

1.2.2 Cognitive Empathy

The multifaced aspect of human mental development, cognitive empathy, encompasses the ability to interpret social cues, share perspective or point view with others, and mentally represented their intentions, beliefs or emotions to draw casual inferences about their behavior (Duradoni, et al., 2023). This capacity is often referred to in the literature as either ‘affective Theory of Mind’ or ‘cognitive empathy’. Although these terms are closely related and sometimes used interchangeably, the current study adopts the term cognitive empathy, as it captures not only the mentalizing process involved in inferring others’ emotional states, but also the interpersonal connectedness central to the empathy framework (Schurz et al., 2021), as well as its association with pro-social behavior (Dovidio & Banfield, 2015). In typically developing children, cognitive empathy follows a gradual yet dynamic developmental trajectory throughout early and middle childhood. Around age two, children begin to distinguish between the mind and the physical world, a shift that often emerges through pretend play. At this stage, toddlers start to recognize both their own desires and those of others and can verbally express them. This growing understanding of desires allows them to infer basic emotional states (e.g., "the doll wanted milk and got it, so she is happy"). By age three, children begin to grasp what others know and think, and they use this awareness to interpret emotional cues. A more substantial leap occurs around age four, when children begin to reason about others’ beliefs and expectations, recognizing that unmet expectations can lead to emotional reactions (e.g., "the doll expected juice but got milk, so she is sad"). Between the ages of five and six, children further refine their understanding of false beliefs and their emotional consequences. They come to realize that emotions are not driven solely by external events but can also be shaped by internal representations and prior expectations (Lane & Bowman, 2021; Wellman, 2014; Dorris et al., 2022). The highest level of this early development appears in late childhood (around ages 10–12), when children begin to integrate multiple mental states, such as thoughts, memories, and anticipations, and understand how these complex internal experiences shape nuanced emotional responses. This period has been identified as a peak phase for cognitive empathy (Schurz et al., 2021).

Autism research consistently highlights the challenges autistic individuals face in understanding the social and emotional perspectives of NA individuals (Bamicha & Drigas, 2022; Fitzpatrick et al., 2018; Pedreño et al., 2017). These difficulties impede their ability to interpret social-emotional contextual cues during interactions. Furthermore, evidence suggests that these gaps in social understanding are persistent and tend to expand as autistic individuals grow older, particularly as social demands and expectations become more complex with age (O’Hearn & Lynn, 2023).

1.2.3 The Relationship Between Emotion Recognition and Cognitive empathy

The links between emotion recognition and cognitive empathy have been well established. The two constructs are closely interconnected. Theoretically, and supported by neurological evidence, emotion recognition is considered to precede the cognitive empathy (Dorris et al., 2022; Mitchell & Phillips, 2015). This connection has been demonstrated in autism research, where difficulties in emotion recognition across different modalities have been found to associate with impaired cognitive empathy, highlighting the role of emotion recognition as a foundational component of empathic understanding (Altschuler et al., 2021; Metcalfe et al., 2019; Rueda et al., 2015). Moreover, atypical brain activation and connectivity within social brain networks, including the limbic system and amygdala, have been linked to both emotional processing and cognitive empathy in autistic individuals (May et al., 2022). However, there is evidence suggesting that this link is mediated by language development (Gendron & Feldman-Barrett., 2018).

1.2.4 Emotional Language

Emotional language is a broad term that addresses verbal concepts of emotion-laden words, sentences and text (Lartseva et al., 2015). Its development is vital for two main causes: first, it enables humans to share personal experiences with others and to discuss internal mental states and thoughts. In addition, language development facilitates the awareness of one’s own and others’ internal worlds, thereby nourishing cognitive empathy development (Gavazzi & Ornaghi, 2011). Among typically developing children, the acquisition of emotional language begins early in life. During the toddler years, typically between ages 2 and 3, children start labeling basic emotions, such as happiness, anger, and sadness (Ogren & Sandhofer., 2022). Between the ages of 3 and 4, their emotional vocabulary expands to include fear and surprise. The emotion of disgust tends to be labeled slightly later, often between ages 4 and 6, as it requires a more abstract understanding of both social and physical aversions (Grosse et al., 2021; Widen & Russell, 2008). As children transition into the early school years (approximately ages 5 to 7), they begin to identify and verbalize more complex emotions, which rely on understanding of others’ mental states. Around the age of seven, children become increasingly capable of naming emotions such as pride, guilt, embarrassment etc. (Bartsch & Wellman, 1995; Golan et al., 2015). This period marks a significant expansion in their emotional lexicon, which continues to grow throughout middle childhood. Remarkably, the number of emotion-related words children comprehend and use doubles approximately every two years, reaching a peak around the age of eleven (Baron-Cohen et al., 2010). More recent research highlights that this growth is not just about learning more words, but also about children’s increasing ability to understand the meanings, contexts, and social uses of those words (Sturrock et al., 2023). This capacity continues to develop throughout childhood and matures fully only in late adolescence (Nook et al., 2020(

The *theory of constructed emotion* *(TCE)* proposed by Gendron and Feldman-Barrett (2018) highlights the crucial role of language in shaping emotional perception. According to this model, the synchronization between perceiving emotional nonverbal cues and social-emotional knowledge can be achieved through acquiring verbal concepts to construct predictions of others' emotional state. The authors describe a “top-down” model of neural organization, where higher cortical regions send predictions to lower regions, which are then corrected by incoming sensory input. This means that the brain continuously predicts and adjusts to incoming information based on prior expectations. Words and concepts provide scaffold and play a significant role in formulating predictions (Feldman-[Barrett, 2017](https://journals.sagepub.com/reader/content/16cbb61f8e6/10.1177/1754073917705717/format/epub/EPUB/xhtml/index.xhtml#bibr6-1754073917705717); Lindquist, 2017).

Among autistic individuals, however, the development and use of emotional language often follow atypical patterns. Many autistic children experience difficulties in various aspects of language development, including semantic, syntactic, and pragmatic difficulties (Vogindroukas et al. 2022). Previous research examining the development of emotional language in autistic individuals has revealed atypical patterns in their ability to encode and retain emotionally related words. For instance, while NA children demonstrated a clear advantage in recalling emotional concepts over neutral stimuli over time, autistic participants did not exhibit the same benefit (Lartseva et al., 2015). This discrepancy suggests a fundamental difference in how emotional information is processed and stored. Further studies assessing expressive emotional language through picture description and narrative tasks have similarly highlighted differences. Autistic children and adolescents aged 5–19 were found to use fewer emotional terms compared to NA peers (Kauschke et al., 2016; Teh et al., 2018). These findings are supported by research on emotion definition (ED) tasks, which revealed that autistic children aged 4–11 faced significant challenges in defining a wide range of emotions compared to NA children (Ben-Itzchak et al., 2016, 2018; Gev et al., 2017; Golan et al., 2010). Collectively, these studies underline the persistent difficulties autistic individuals experience in both understanding and expressing emotional concepts. These challenges contribute to broader deficits in EU, which, in turn, significantly impact their social behavior and interactions.

1.2.5 Social Functioning

Social functioning refers to the ability of an individual to interact effectively with others and to navigate social environments. This includes forming and maintaining relationships, understanding social norms and cues, and successfully engaging in social activities (Pallathra et al., 2018). In typically developing children, the attainment of social-emotional milestones is shaped by neurological and environmental development, especially interactions with caregivers and peers. From the first months, infants respond to faces, voices, and emotional expressions, demonstrating sensitivity to social cues that form the basis for later engagement. By six months, early signs of joint attention and social referencing appear, supporting the development of shared focus and emotional attunement. Between 12 and 18 months, children begin to show emerging social behaviors such as mutual gaze, imitation, and simple peer exchanges, along with early indications of empathy and prosocial responses. As they enter the toddler years (18 to 30 months), they increasingly initiate social contact and engage in parallel and associative play, practicing cooperation, turn-taking, and imitation. From approximately 30 to 54 months, children begin to engage in a collaborative pretend play with shared goals and negotiated roles. They begin to internalize basic social norms. By the ages of five to six, their social play becomes more rule-based and cooperative, incorporating empathy, negotiation, and the foundations of group dynamics. Between the ages of seven and ten, peer relationships take on greater emotional depth and stability, with shared goals and mutual understanding playing a central role. Children at this stage increasingly integrate social norms into their behavior. (Kostelnik et al., 2016; Soto-Icaza et al., 2015).

One of the core diagnostic criteria for ASD is persistent deficits in social communication and social interaction across multiple contexts (American Psychiatric Association, 2022). Autistic children often experience difficulties initiating and maintaining reciprocal interactions with others. These challenges can range widely and may include reduced eye contact, limited initiation of social exchanges, difficulties engaging in joint play, challenges with turn-taking, and trouble sustaining conversations. As a result, they are at increased risk for social isolation compared to their NA peers, often reporting fewer friendships and a sense of disconnection from their social environment (Bauminger-Zviely & Shefer, 2021 Freeman et al., 2017; Locke et al., 2016).

In young children, social functioning can be assessed in several ways. These include, among others, rating of the child’s social behavior by caregivers, and direct behavioral observation in natural settings. Whereas the former builds on the extensive familiarity of stakeholders with the child’s functioning in different settings, the latter offers ecologically valid samples of the child’s behavior (Dowdy et al., 2013).

1.3 The Relationship Between EU Components and Social Functioning

Despite extensive research on the association between emotion recognition from nonverbal and social cues, and social functioning (Denham et al., 2001), the examination of this connection in autism is still preliminary. A meta-analysis by Trevisan and Birmingham (2016) found that autistic children’s ability to recognize nonverbal emotional cues was positively associated with age, verbal and nonverbal intelligence, cognitive empathy, and adaptive functioning. In contrast, it was negatively associated with the severity of autism symptoms. These findings suggest that nonverbal emotion recognition is not only a developmental milestone but may also serve as an important indicator of broader social and functional outcomes in autistic individuals. However, the findings of this meta-analysis are limited in two keyways. First, emotion recognition was assessed solely through facial expressions, omitting other nonverbal modalities such as body language and prosody, as well as contextual understanding. Second, social functioning was inferred using broad adaptive behavior scales (e.g., Vineland Adaptive Behavior Scales, ABAS-II), which rely on informant reports and may not adequately capture naturalistic social behavior.

The positive association between cognitive empathy and social functioning is well-documented in NA children (Chiu et al., 2023; Ronchi et al., 2020; Rosello et al., 2020). Evidence supports this association in autistic individuals, although cognitive abilities have been shown to influence the strength of this relationship (Mao et al., 2023; Wang et al., 2022). Interestingly, Peterson et al. (2016) demonstrated that whereas in hearing impaired and typically developing children, cognitive empathy independently predicted social functioning, in autistic children, this relationship was indirect and mediated by language ability. This finding flags the key role of language in the social-emotional processing of autistic children.

The role of language in cognitive empathy has received considerable attention in autism research, given that ASD is often characterized by impairments in pragmatic language use (Tager‐Flusberg et al., 2005). Various aspects of language have been shown to predict cognitive empathy in autistic children (Andrés-Roqueta & Katsos, 2017; Durrleman & Franck, 2015). Specifically for emotional language, Siller et al. (2014) found that the use of emotion-related terms in autistic children was associated with their cognitive empathy. This suggests that language supports social functioning not only by enabling speech production but also by fostering the development of cognitive empathy.

Considering the evidence, exploring the intricate interplay between emotion recognition and social functioning through emotional language and cognitive empathy is imperative, particularly for autistic children who face unique challenges in these domains. The first aim of this study is to explore the bridge between these constructions, providing a deeper understanding of the pathways that connect emotion recognition and social functioning, through emotional language and cognitive empathy. By doing so, the study seeks to offer valuable insights for targeted social-emotional interventions tailored to the needs of autistic children. Next, we examine intervention approaches that promote EU in autistic children, highlighting strategies tailored to their unique social-emotional needs.

1.4 EU Intervention Programs: Approaches and Strategies

Over the years, a variety of methods have been developed to improve the social-emotional skills of autistic individuals (Atkinson‐Jones & Hewitt, 2019; Goldberg et al., 2019; Tang et al., 2019). These interventions have been implemented across clinical, family, and educational settings, in both individual and group formats, with and without technological support. The following sections will revise the interventions most relevant to this work.

1.4.1 Group-Based Social-Emotional Intervention

Group-based interventions form a widely practiced approach for the facilitation of social-emotional goals. These interventions employ techniques that are tailored for the unique needs of autistic individuals such as clear instruction, demonstration, role-playing, and ongoing feedback (Wolstencroft et al., 2018). Literature reviews on group-based social skills interventions provide strong evidence that various group formats can effectively enhance social competence, cognition, and empathy in autistic children (Atkinson‐Jones & Hewitt, 2019; Wolstencroft et al., 2018). However, while improvements are often seen in task-based assessments, learned skills are not consistently transferred to school settings or reflected in self-reported social behavior (Atkinson‐Jones & Hewitt, 2019; Gates et al., 2017). In addition to these limitations, group-based approaches present practical challenges, such as being resource-intensive and requiring participants to be physically present in the same location (Radley et al., 2020). They may miss those whose skills are way above or way below the taught material and may deter the more socially anxious participants (Golan & Baron-Cohen, 2006). Finally, these groups seldom focus on EU as a key feature in their curricula.

1.4.2 Computer Based Social-Emotional Intervention

In the past two decades there has been increasing focus on Computer-Based Interventions (CBIs) to enhance social-emotional skills among autistic individuals as they provide opportunities to explore and understand the complex social-emotional world at one’s own pace and level (Lee et al., 2018; ‏Tang et al., 2019; Wang et al., 2025). Technological environments offer consistent and predictable settings with well-defined rules. They highlight details, foster visual thinking and learning, encourage active participation, and provide user-tailored rewards (Eden & Oren., 2021; Khan, et al., 2019).

CBIs targeting social-emotional skills have been shown to improve emotion recognition from nonverbal cues and from social context (e.g. Didehbani et al., 2016; Eden & Oren, 2021; Fridenson-Hayo et al., 2017; Lopata et al. 2016), as well as in promoting emotional language (Gev et al, 2017; Marino et al., 2019; Russo-Ponsaran et al, 2016). However, the positive outcomes have some notable limitations. First, social-emotional technological programs often emphasize teaching and evaluating emotion recognition from facial expressions (Berggren et al., 2018), neglecting other crucial nonverbal cues such as body language and tone of voice. Moreover, most programs focus on “basic” emotions (happiness, sadness, fear, anger, disgust, and surprise) while neglecting more "complex emotions" (e.g., disappointment, shame, pride, etc.), which involve cognitive components tied to mental states and to social situations (Chaidi & Drigas., 2020; Ekman., 1999). Additionally, CBIs have also been criticized for the limited generalizability of their outcomes into real life social functioning (Berggren et al., 2018; Ramdoss et al., 2012; Zhang et al., 2021). Most studies rely on parent-reported measures of social functioning (Fridenson-Hayo et al., 2017; Russo-Ponsaran et al., 2016; Zhang et al., 2021), with few assessing generalizations to natural social interaction (LaCava, 2007; Rice et al., 2015; Wang et al., 2025).

The latter limitation stands out as particularly important and a fundamental objective, as autistic individuals often struggle to apply their skills across different settings (de Marchena et al., 2015). The primary goal of these interventions is to enhance social-emotional skills; to achieve this, alternative ecological methods may be needed to integrate social-emotional interventions into the primary social environments of children. One such key platform is the educational system.

1.4.3 School-Based Social-Emotional Intervention

Children and adolescents spend a greater part of their time within the educational system, making schools a central setting for both academic learning and social-emotional development (Eccles & Roeser, 2015). Research highlights that interventions are most effective when seamlessly integrated into daily practices and school culture, engaging all staff members and reinforcing skills in various settings, including hallways and playgrounds (Barry et al., 2017; Goldberg et al., 2019; Jones et al., 2017). For autistic children, elementary schools often serve as primary service providers, delivering specialized education interventions (Kasari & Smith, 2013). Additionally, the inclusion of children with disabilities in mainstream classrooms has been shown to promote social understanding among peers (Smogorzewska et al., 2020).

Although there is potential in introducing social-emotional interventions within the educational system to impact children's behavior in their primary social environment, most of these interventions occur in clinics rather than in schools (Kasari & Smith, 2013). CBI programs, particularly, are commonly administered individually at children’s homes or by specialists out of the classroom setting (Berggren et al., 2018).

Literary reviews assessing the efficacy of school-based interventions targeting social communication behaviors revealed that these interventions often lead to an increase in both the frequency and the duration of autistic students initiating and reciprocating communication with their peers (Hugh et al., 2021; Sutton et al., 2019). However, most of these interventions were conducted by researchers or their assistants outside the classroom, with only a limited number overseen by teachers (Sutton et al., 2019). To our awareness, no CBIs have been integrated into classroom settings. Instead, they have typically been delivered individually or in small groups outside the classroom environment, without the involvement of educational staff (Eden & Oren, 2021; LaCava, 2007; Marino et al., 2019; Rice et al., 2015). Excluding teachers from the implementation of CBIs in school settings may limit the ecological validity and generalizability of the intervention (Sutton et al., 2019).

1.5 Generalizability of Social-Emotional Interventions for Autistic Individuals

A major challenge in the design of social-emotional interventions for autistic individuals is ensuring external validity—the degree to which skills learned in structured intervention settings are effectively transferred to real-world social interactions across diverse people and contexts beyond therapy (Atkinson‐Jones & Hewitt, 2019; Berggren et al., 2018; Jonsson et al., 2016). The difficulties surrounding skill maintenance and generalization have been acknowledged since the identification of ASD and continue to pose significant clinical challenges (Arnold-Saritepe et al., 2023). As noted previously, although various intervention approaches often demonstrate positive outcomes in controlled environments, many encounters considerable barriers in facilitating the crucial transfer of skills to everyday life.

Stokes and Osnes (1989) were among the first researchers to highlight the importance of generalization and maintenance in therapeutic interventions. They proposed three key principles to enhance these processes: using functional contingencies to reinforce target behaviors, incorporating diverse training to promote flexibility and reduce rigidity, and integrating functional mediators—stimuli from the natural environment - to support skill transfer.

Building on this foundation, subsequent research has demonstrated that fostering the generalization of social-emotional competence requires training across multiple environments. Effective interventions should actively involve key individuals, such as school peers and family members, and be implemented in various settings, including classrooms, play areas, and homes. Moreover, it is essential for skills to be practiced beyond the intervention phase and applied flexibly, enabling autistic individuals to navigate a range of social situations successfully (Gunning et al., 2019). Embracing these principles the second aim of this study is to evaluate the effectiveness of a teacher-mediated version of the EmotiPlay program in improving EU and social functioning among school-age autistic children in special education classes. By integrating evidence-based strategies for promoting generalization, this study seeks to assess whether the program facilitates lasting improvements in social-emotional competence, providing insights into its potential for broader application.

1.6 The Current Thesis

This work consisted of three parts: (1) A pilot study aims to examine the adaptability and accessibility of the adapted teacher-mediated EmotiPlay program in a class setting; (2) The baseline study aims to examine the relationship between emotion recognition and social functioning in autistic children; and (3) The intervention study aims to examine the effectiveness of the teacher-mediated computerized EmotiPlay program in enhancing EU and social functioning among autistic children.

1.6.1 Research Questions

This thesis explores the following research questions, organized according to the three phases of the research design:

Pilot study:

1. How well is the adapted version of EmotiPlay program integrated and accessible within the school system?
2. Are the evaluative measures suitable for assessing the program's effectiveness?

Baseline study:

1. What is the pathway through which emotion recognition supports effective social functioning in autistic children?
2. What roles do emotional language and cognitive empathy play in linking emotion recognition to social functioning among autistic children?

Intervention study:

1. To what extent does a computer-based, teacher-mediated EU intervention enhance EU and social functioning among school-age autistic students in special education classes?
2. To what extent do individual differences, such as age, cognitive abilities, and verbal skills, moderate the effectiveness of the teacher-mediated EmotiPlay intervention in improving EU and social functioning in autistic children?
3. How feasible and effective is the implementation of this intervention within a school setting?

1.6.2 Research Hypotheses

For the baseline study, it was hypothesized that:

* Emotional measures will be positively correlated with social measures, suggesting that higher performance in emotional measures (emotion recognition, cognitive empathy, emotional language) will be linked to stronger social functioning, as assessed through both observational measures and parent reports.
* The association between emotion recognition and social functioning will be mediated through emotional language and cognitive empathy (accounting for cognitive abilities, age, and level of autistic traits).

For the intervention study, it was hypothesized that:

* Following the intervention, autistic children who participated in the EmotiPlay program will demonstrate enhanced performance in (a) Emotion recognition from nonverbal cues, (b) Cognitive empathy, and (c) Emotional language, compared to the control group of autistic children who maintained their routine special education program.
* Following the intervention, autistic children who participated in the EmotiPlay program will show improvements in their social functioning during free play, compared to the control group of autistic children who maintained their routine special education curriculum.
* The effectiveness of the teacher-mediated EU program would be moderated by children’s age, cognitive, and verbal abilities.

2. Pilot Study: Adapting a Computer-Based Emotion Understanding Program to Special Education for Autistic Children

Over the past two decades, CBIs have been increasingly explored for their potential to enhance social-emotional skills in autistic individuals. Meta-analyses (Lee et al., 2018; Tang et al., 2019; Wang et al., 2025) have consistently demonstrated their effectiveness in improving various social-emotional domains, including emotion recognition, social communication, and interpersonal engagement. These reviews highlighted that the structured, consistent, and visually engaging nature of digital platforms can simplify complex social concepts, making them more accessible to autistic individuals. Moreover, the interactive features of CBIs help sustain motivation and foster active learning.

One of these interventions is EmotiPlay, an innovative computer-based program designed to teach autistic children to recognize emotions from non-verbal and contextual cues. The program was evaluated cross-culturally by Fridenson-Hayo et al. (2017) and implemented at home with high-functioning autistic children aged 6 to 9. Results showed that participants demonstrated significant gains in recognizing emotions across multiple modalities—facial expressions, body language, and vocal tone—and in interpreting these cues within social contexts, compared to peers who did not participate. However, the extent to which these improvements translated into everyday social functioning remained unclear. The study relied exclusively on parental reporting, and reductions in autism-related symptoms were only modest (Fridenson-Hayo et al., 2017).

Embedding such programs into children’s natural social environments, such as the educational system, may enhance their real-world applicability by offering consistent opportunities for authentic social engagement (Barry et al., 2017; Goldberg et al., 2019; Jones et al., 2017). However, implementing the program effectively in a school setting requires balancing fidelity to the original intervention with contextual adaptation. Maintaining core components preserves the intervention’s integrity, while strategic modifications enable responsiveness to the specific cultural and situational needs of the setting (Escoffery et al., 2019; Moore et al., 2021).

For the current study, EmotiPlay program was adapted from its original format as an individual, home-based practice to a group-based, teacher-led model designed for use in special education classrooms. This pilot study aimed to evaluate the accessibility and feasibility of the adapted version prior to broader rollout. To this end, a shortened version of the program was implemented in five special education classes. Qualitative data were collected through classroom observations and teacher interviews, while quantitative data were gathered using EU and social functioning measures administered to participating autistic children and a control group of NA children from the same schools.

2.1 Method

2.1.1 The Adapted Intervention Program

EmotiPlay is a computer-based program designed to teach autistic children how to recognize and understand emotions in social interactions. The program’s storyline follows Professor Zinkman and his assistant, Max, who invite users to become explorers in a research camp, investigating various emotional scenarios. EmotiPlay incorporates key elements that facilitate learning and enhance motivation in autistic children. It provides a structured environment featuring engaging animated characters who present validated video- and audio-recorded emotional expressions by human actors. The program systematically breaks down specific nonverbal cues in each modality—facial expressions, body language, and tone of voice—while offering exercises to integrate these cues into diverse social contexts.

The program is structured into distinct units, starting with an introduction to fundamental emotional concepts. It then progresses through twelve units, each dedicated to a specific emotion. Each unit consists of four lessons covering the target emotion’s introduction, facial expression cues, tone of voice cues, and body language cues. These lessons incorporate short, animated videos in which Professor Zinkman and Max introduce the lesson’s topic, alongside videos and recordings of human actors expressing the target emotion. These activities enable students to observe and explore emotional cues.

To transition EmotiPlay into a teacher-mediated, group-based intervention, additional activities were developed to promote peer interaction and collaborative learning. Interactive exercises were introduced for both pair and group practice, such as partner interviews where students ask each other about things that make them feel a certain emotion, and role-playing activities that involve acting out social scenarios to express specific emotions. Group discussions were also incorporated, students watch short videos from EmotiPlay, depicting a social situation with multiple characters, then analyze how each character may have felt and discuss the reasons behind their emotions. These modifications enable students to actively practice EU and social communication skills in a dynamic, interactive setting in order to facilitate generalization. Examples of the school version of EmotiPlay’s program are presented in Appendix 1. For more information, visit: <https://www.emotiplay.com/>

2.1.2 Participants

A total of 28 autistic children (4 girls), aged 6-10 (*M* = 2.79, *SD* = 1.39), were recruited from five special education classes across three schools. All participants had received a clinical diagnosis of autism from a child psychiatrist/neurologist and a psychologist, in accordance with DSM-5 criteria (American Psychiatric Association, 2022). Four 1st -grade students had difficulty fully participating in the program and were therefore excluded from the assessment of the evaluation measures. The remaining 24 autistic children (4 girls), aged 7-10, were compared with 19 NA children (3 girls), aged 7-9, that were recruited from the same schools. Groups were comparable on gender, cognitive and language abilities (Table 1).

Table 1

Background Characteristics and Performance on the Screening Tests

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | ***ASD***  **(*n* = 24)** | | |  | ***NA***  **(*n* = 19)** | | |  |  |  |
|  | ***M*** | ***SD*** | ***Range*** |  | ***M*** | ***SD*** | ***Range*** | ***t*** | ***p*** | **Cohen's d** |
| Gender  (Females/ Males) |  | 4/20 | |  |  | 3/16 | | χ² (1) =.94 | | |
| Age | 9.12 | 1.21 | 7.17-10.67 |  | 7.92 | .83 | 7.08-9.16 | 3.68\*\*\* | <.001 | 1.13 |
| WISC vocabulary | 24.92 | 10.79 | 10-51 |  | 26.00 | 9.39 | 13-49 | .35 | .37 | .11 |
| WISC matrix | 18.96 | 5.20 | 7-30 |  | 17.00 | 6.27 | 6-28 | 1.12 | .14 | .34 |

\*\*\* *p*< 0.01

***Note.*** ASD – autism spectrum disorder;NA – non-autistic; WISC, Wechsler Intelligence Scales for Children test (4th Ed.).

Raw WISC scores were used for group comparison, due to age differences.

2.1.3 Measures

All participants completed the following tests:

2.1.3.1 Screening Measures.

2.1.3.1.1 Vocabulary and Matrix Reasoning Subsets. (WISC-IV; Wechsler, 2003) These measures assess the intellectual ability of children from 6 to 16, representing verbal and performance IQ, respectively. The test demonstrated high test-retest reliability (*r* =.90).

2.1.3.2 Implementation Measures.

2.1.3.2.1 Teacher Reports.Following each lesson, teachers submitted a brief yet comprehensive report via Qualtrics. Teachers documented the number of children participating and staff members present, providing insight into attendance and supervision. They detailed the activities completed during the lesson and noted any that were omitted, along with the rationale for skipping them. The reports also addressed any technical challenges encountered, offering feedback on the program's technological aspects. Furthermore, teachers shared observations on student behavior and overall participation levels. The reporting process concluded with an opportunity for teachers to offer additional comments, allowing for the capturing of qualitative insights not covered by the structured elements (see Appendix 2).

2.1.3.2.2 Observation Report.To assess intervention fidelity, the research team, which included five trained psychology undergraduates, conducted observations of the lessons once every fortnight. For each activity within the lesson, the team documented its duration, the level of student participation, any technical difficulties encountered, and general comments or insights.

2.1.3.2.3 Semi-structured Interviews.At the conclusion of the program, semi-structured interviews were conducted to gain deeper insight into the implementation process within each classroom. Teachers were asked open-ended questions, co-developed by the authors, to reflect on their experiences with EmotiPlay, share their perceptions of the work environment, and discuss the program's accessibility and feasibility in special education settings. These interviews were conducted by the research coordinator.

Interviews questions included:

1. Can you share your experience with delivering the program in your classroom?
2. How did the students engage with the computerized program, and what was their overall response?
3. Were there any challenges in incorporating the program into your regular classroom activities, and how did you modify it to suit your students' needs?
4. Would you recommend incorporating EmotiPlay program into other special education classes for autistic students, why or why not?

2.1.3.3 Evaluation Protocol.

2.1.3.3.1 Emotion Recognition from Nonverbal Sensory Cues Test. (Fridenson-Hayo et al., 2016) examines emotion recognition from: 1. facial expression videos 2. decontextualized vocal utterances 3. body language videos 4. Integrative video clips presenting all modalities in context, with muffled speech to exclude semantic information, while keeping prosodic cues. For the current study, the task included 12 emotions – 5 basics (happiness, sadness, anger, fear and surprise) and 7 complex emotions (pride, kindness, unfriendliness, shame, boredom, interest and disappointment). For each stimulus, 4 potential answers are presented. The test was previously validated vis-à-vis the Frankfurt Test and Training of Facial Affect Recognition (FEFA-2), showing a positive correlation with FEFA-2 for both the autism group (*r* =.52) and the NA group *(r* =.40) (Fridenson-Hayo, 2016).

2.1.3.3.2 Test of Emotion Competence (TEC). (Pons & Harris, 2000) The TEC was used in the current study to assess cognitive empathy. Designed for children aged 3 to 12, the TEC evaluates foundational components of cognitive empathy, including the ability to understand the causes of emotions (e.g., desires, beliefs, and memory), to recognize the influence of contextual factors (e.g., external causes, moral considerations), and to grasp the complexity of emotional experiences (e.g., mixed emotions, emotional regulation). The TEC consists of short stories with gender-matched illustrations lacking nonverbal emotional cues. The child is asked to choose how a protagonist feels from four options. Scores range between 0-21. TEC is reported to have high test-retest reliability (.84; Pons et al, .2002) and good compatibility with cognitive and verbal skills (Tenenbaum et al., 2016).

2.1.3.3.3 Emotion Definition Task (ED). (Golan et al., 2010) examines participants’ ability to define 12 emotions, six basic emotions (happiness, sadness, anger, fear, disgust, surprise) and six complex emotions (pride, kindness, unfriendliness, shame, disappointment, frustration). Participants are asked to define the emotion (for example: “please explain what is happy?”) and to give an example of a personal experience (e.g.: “can you describe a situation in which you felt happy?”). The definition and examples were audiotaped, and transcribed verbatim. Following Gev et al., (2017) scores of 0, 1, or 2 were given for each emotion according to the rationale used in the vocabulary subtest of the WISC manual. Task scores ranged from 0 to 24, with an average inter-rater agreement of .91, range .85 - 1, between the two judges.

2.1.3.3.4 A Story Telling Task. examine the use of emotional and mental terms in a narrative, two picture-books, “Frog on His Own (Mayer, 1973) and “Frog, where are you?” (Mayer, 1969) were used. These picture books were chosen because they contain several instances of deception and trickery on the part of the protagonist, and thus, offer the narrator several opportunities to describe cognitive and affective states and behaviors and have previously been used with autistic children (Pham et al., 2022; Torng & Sah., 2019; Solari et al., 2020). Stories were shortened to a 15-page format presented digitally on an iPad using the “Book Creator” app. Participants were first instructed to look through the pictures in the book. On their second pass, they were asked to narrate the story in their own words while revisiting the images. The stories were audiotaped, transcribed verbatim and coded for the use of mental verbs and emotional words according to Ravid & Egoz-Leibstein (2012).

2.1.3.3.5 Playground Observation of Peer Engagement. (POPE; Kasari et al., 2005) a timed interval behavior coding system that measures peer engagement in natural environments. Twelve independent blind observers rated children on the playground for 10 minutes. Each minute was subdivided into 40 consecutive seconds of observation, followed by coding for the subsequent 20 seconds during the school recess. Observers documented the child’s engagement state with peers (solitary, proximity, onlooking, parallel, parallel aware, joint engagement, and games and rules) in each interval. Following Kasari et al. (2005), playground engagement states were summed for a total proportion of interval in each engagement state and then categorized into unengaged (incorporating isolation, proximity) and engaged (incorporating joint engagement, games and rules). Coders also noted positive and negative initiations of the child towards other children, as well as positive and negative responses to a peer’s social overtures. Observers underwent eight training sessions administered by the research coordinator and attained a reliability level of at least 80% in taped video observations prior to the beginning of the study.

2.1.4 Procedure and Design

The study received approval from the Bar-Ilan University Institutional Review Board (IRB) and the Chief Scientist of the Israeli Ministry of Education. Informed consent was obtained from parents for their child's participation. The research coordinator administered two subtests from the WISC-IV to all participants. Subsequently, a team of five psychology undergraduates visited the schools to administer the emotion recognition task, the TEC, and the POPE. Additionally, five education graduate students conducted a separate visit to administer two emotional language tasks. Each research assistant was blindly assigned approximately 10 participants, ensuring a balanced distribution between the groups. Tasks were administered individually in counterbalanced order, with each half-hour session conducted in a quiet room at the school premises. The POPE was administered during recess to assess social functioning; each participant was observed for 10 minutes. Observations were scheduled randomly across the two visits to ensure even distribution within the available time.

After all participants completed the assessment measures, teachers received individual training sessions on the program led by the research coordinator (Appendix 3). Subsequently, the five special education teachers implemented the intervention. Each class consisted of 4 to 9 students, and participation in the study required majority parental approval. The intervention was implemented with all students in the class, including both study participants and non-participants; however, only participating students were assessed. Teachers were instructed to schedule two lessons per week for the program and to complete the Teacher Report following each lesson. Additionally, every two weeks, a research assistant observed a lesson and completed an Observation Report.

The intervention started in February 2022 and concluded in May 2022, spanning a total of 16 weeks. At the program's conclusion, the research coordinator conducted interviews with each teacher to gather their insights on the implementation of the program in their classrooms.

2.1.4 Analysis Plan

To evaluate the feasibility and accessibility of implementing the intervention program in a school setting, a qualitative analysis was conducted based on teacher reports, lesson observations, and interview transcripts. Data analysis followed the thematic analysis framework outlined by Braun & Clarke (2006), involving six phases: familiarization with the data, initial coding, theme development, theme review, theme definition, and report production. Teacher reports and lesson observations were coded to identify patterns related to the implementation process, focusing on perceived challenges, and contextual factors affecting program feasibility and accessibility. Interviews were transcribed verbatim and coded independently by the researcher coordinator. To ensure trustworthiness, transcripts were verified by an independent peer. The themes were identified and refined across all data sources and organized into the main categories. The raw data and theme coding were conducted collaboratively with research supervisors and a staff member from the EmotiPlay team, which developed and maintained the program’s technological interface and led the adaptation for classroom use. Discrepancies in coding were resolved through discussion and consensus.

To assess the evaluative measures for EU, several analyses were performed: A one-way Multivariate analysis of Covariance (MANCOVA) was used to examine emotion recognition across two levels of emotional complexity (basic, complex), with group as the independent variable and age as a covariate. A one-way analysis of covariance (ANCOVA) was then conducted to assess group differences in scores on cognitive empathy (TEC task), also with age as a covariate. Additionally, a one-way MANCOVA was conducted to examine group differences in the ED task across two levels of emotional complexity (basic, complex), with age and verbal abilities included as covariates given the task's verbal nature. Finally, a one-way ANCOVA was employed to assess group differences in the use of emotional-mental verbs on the story task, also with age and verbal abilities as covariates. To assess the social functioning in natural setting, one-way MANCOVAs were conducted. The dependable variables were the duration of time the children spent in each of the two engagements states (engaged, unengaged), and the children’s number of positive initiatives and responses, with group as the independent variable and age as a covariate.

2.2 Results

2.2.1 Adaptation of EmotiPlay

Three key themes regarding program accessibility and feasibility in special education classes emerged from the teachers’ experiences during program implementation, observations by the research team, and the teachers’ reflections in post-intervention interviews:

1. **Tailoring Program Accessibility to Diverse Learning Levels**

Implementing the program among elementary school students presented certain challenges, particularly for younger students. Teachers noted that the program’s language, both in instructions and tasks, was often too complex for 1st and 2nd grade students. The advanced nature of the instructions, as well as the reading and writing requirements, often exceeded the abilities of many young learners, resulting in difficulties in comprehension and the partial omission of activities. As one of the teachers noted: *"I couldn’t administer all activities because they were too difficult. The students enjoyed the short videos and quizzes, but I had to constantly break down and repeat the instructions so they could follow."* These insights highlighted the need to adapt the language and task requirements to make them more age appropriate.

2. **Balancing Emotional** C**ontent Complexity Across Age Groups**

The emotional content of the program, which progressed from basic to complex emotions, received varied responses across different age groups. For younger students in lower grades, the focus on basic emotions proved beneficial, and their teachers noted that these students needed to develop fundamental emotional skills. In contrast, older students, particularly those in fifth grade, found the basic emotional content too simplistic and insufficiently challenging for their level. As their teacher shared, *"For the fifth-grade students, the first units (basic emotions) felt too easy… It would be better to focus on complex emotions like shame or pride to keep them interested."* These insights point to the necessity of adapting the program's emotional content to align with students' developmental levels. A more balanced emotional complexity content could ensure that the program remains relevant and stimulating across different elementary school grades.

**3. Activity Design and Its Role in Student Engagement**

The EmotiPlay program incorporated a diverse range of activities to maximize student engagement and learning outcomes. Feedback from teachers and classroom observations highlighted that interactive elements, such as videos and quizzes, were especially effective in capturing students’ attention and encouraging participation. These dynamic activities made complex content more accessible and enjoyable, even in group settings. However, group-based activities, such as games and role playing, while socially beneficial, were often more time-consuming than expected. Although each lesson included 10 planned activities, teachers typically managed to complete only six, indicating the need to balance engaging group tasks with efficient time management to meet lesson goals. Finally, more cognitively demanding or didactic tasks (e.g., reading, writing, or structured discussions) were less well received. Students tended to view them as traditional classwork. As one of the teachers summarized: “*The children really enjoyed the videos, and I believe they conveyed the message effectively. During the interactive tasks, such as games or role-playing activities, they were very engaged and participated nicely. However, when given worksheet-based tasks, they immediately associated them with homework and were reluctant to complete them”*. To maintain a high level of engagement, such activities may need to be simplified, reframed, or used more selectively in keeping the program’s interactive and playful approach.

Based on these insights several key adaptations were made across two main domains to improve the suitability of the intervention for elementary school students. The first domain focused on reducing the cognitive and linguistic demands of the program’s content, ensuring greater accessibility for younger or more challenged learners. The second involved structural adjustments aimed at enhancing the program’s compatibility with the practical realities of classroom implementation, including time constraints, instructional flow, and, importantly, the incorporation of children’s preferences regarding the nature of the activities. A full description of these adaptations is provided in Appendix 4.

2.2.2 Evaluation of EU and Social Functioning Measures

2.2.2.1 EU Measures. The results of the evaluations for each of the EU measures — basic and complex emotion recognition from nonverbal cues, cognitive empathy (TEC), and two emotional language tasks - basic and complex ED and story tasks are summarized in Table 2.

Table 2

*Mean, SD and F-values of the Performance on Emotional Evaluative Measures*

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | |  | | ***ASD***  **(*n* = 24)** | |  | ***NA***  **(*n* = 19)** | |  | |  | | | | |
|  | |  | | ***M (SD)*** | ***E.M (SE)*** |  | ***M (SD)*** | ***E.M (SE)*** | | ***F*** | | **df** | ***p*** |  | |
|  | **Range** | | **Emotion recognition1** | | | | | | | | | | | |
| Basic | | 0-20 | | 15.82 (3.08) | 15.21 (.57) |  | 16.94 (2.27) | 17.65 (.62) | | 7.52\*\* | | (1,38) | .009 | .16 | |
| Complex | | 0-28 | | 18.36 (4.49) | 17.16 (.76) |  | 20.58 (3.52) | 21.97 (.82) | | 16.28\*\*\* | | (1,38) | <.001 | .30 | |
|  |  | | **Cognitive empathy** | | | | | | | | | | | |
| TEC | | 0-21 | | 15.58 (3.46) | 15.29 (.63) |  | 17.89 (2.05) | 18.27 (.73) | | 8.41\*\* | | (1,40) | .006 | .17 | |
|  |  | | **Emotional language2** | | | | | | | | | | | |
| Basic ED | | 0-12 | | 6.65 (3.73) | 6.01 (.69) |  | 8.68 (2.08) | 9.29 (.71) | | 7.69\*\* | | (1,35) | .009 | .18 | |
| Complex ED | | 0-12 | | 3.90 (2.98) | 3.12 (.72) |  | 5.95 (3.55) | 6.65 (.75) | | 7.27\* | | (1,35) | .011 | .17 | |
| Story - verbs | |  | | 2.30 (1.81) | 2.15 (.45) |  | 2.11 (2.03) | 2.26 (.47) | | .13 | | (1,35) | .718 | .00 | |

\* *p* < .05, \*\* *p* < .01, \*\*\* *p* < .001

***Note.*** ASD – autism spectrum disorder; NA – non-autistic; ED – emotion definition.1 -n = 22 for ASD group,2- n = 20 for ASD group

As presented in Table 2, the NA group outperformed the ASD groups in all evaluative measures, except for the use of emotional-mental verbs in the story task. For emotion recognition from nonverbal cues, group differences had a significant effect, [*F*(1,38) = 15.75, *p* < .001, = .29]. Univariate ANCOVAs for each complexity (basic, complex) revealed a significant main effect, with age being a significant covariate, [*F*(1,38) = 9.24, *p* = .004, = .20 for basic; *F*(1,38) = 20.15, *p* < .001, = .35 for complex emotion recognition]. For cognitive empathy, on the TEC task, a significant main effect was found for group (see Table 2), age was not a significant covariate, [*F*(1,40) = 1.72, *p* = .197, = .04].

Regarding the emotional language tasks: on the ED task, group differences had a significant effect, [*F*(1,35) = 8.29, *p* = .007,=.19]. Univariate ANCOVAs conducted for each complexity level revealed a significant main effect for both basic and complex ED (Table 2). While age was not significant as a covariate for each of the complexities (basic, complex) [*F*(1,35) = 2.68, *p* =.111, = .07; *F*(1,35) = 1.29, *p* =.264, = .04 respectively], verbal ability was significant for complex ED, [*F*(1,35) = 9.46, *p* = .004, =.22], but not for basic ED, [*F*(1,35) = 1.13, *p* = .295, =.03]. In the story task, no significant main effect for group was observed (Table 2), and neither age nor verbal abilities were significant as covariates [*F*(1,35) = .001, *p* = .982, = .00; *F*(1,35) = 3.24, *p =* .08*,*  = .09 respectively]

2.2.2.2 Social functioning.The results of the Pope task, number of children's positive initiations and positive responses, as well as the duration of time spent in each of the two engagement states (engaged and unengaged), are summarized in Table 3.

Table 3

*Mean, SD and F-values of the Performance on Social Functioning*

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | **ASD**  **(*n* = 24)** | | |  | | **NA**  **(*n* = 19)** | | |  | | |
|  | ***M (SD)*** | ***E.M (SE)*** |  | | ***M (SD)*** | | ***E.M (SE)*** | ***F*** | | ***p*** |  | | |
| **Engagement states (in percentages)** | | | | | | | | | | | | |
| Unengaged | 33.33 (3.23) | 32.32 (5.59) |  | | 6.28 (1.16) | | 7.56 (6.39) | 7.44\*\* | | .009 | .16 | | |
| Engaged | 47.92 (32.97) | 46.25 (6.31) |  | | 81.57 (22.18) | | 83.68 (7.21) | 13.39\*\*\* | | <.001 | .25 | | |
| **Initiatives and responses** | | | | | | | | | | | | |
| PI | 6.38 (5.01) | 5.86 (1.05) |  | | 10.47 (4.65) | | 11.13 (1.20) | 9.59\*\* | | .004 | .19 | | |
| PR | 6.75 (5.09) | 6.07 (1.11) |  | | 10.26 (5.35) | | 11.12 (1.28) | 7.87\*\* | | .008 | .16 | | |

\*\* *p* < .01, \*\*\**p* < .001.

***Note*.** ASD – autism spectrum disorder; NA- non-autistic; PI – positive initiative, PR – positive response

As presented in Table 3, group differences in children’s social engagement states showed a significant main effect across both engagement states and the number of positive initiatives and responses. Age had no significant effect as a covariate in either engagement state (engaged, unengaged) [F(1, 40) =.55, *p* = .464, = .01; F(1, 40) =.26, *p* = .614, = .01, respectively], nor in the number of initiatives and responses [F(1, 40) = 1.90, *p* = .176, = .05; F(1, 40) = 2.95*, p* = .094, = .07, respectively].

Univariate ANCOVAs for each engagement state revealed a significant main effect for both engagement states, as well as the number of initiatives and responses to peers.

2.3 Discussion

This study aimed to adapt evidence-based, computerized social-emotional intervention for autistic children. The original home-based, individual format was modified into a group-based, teacher-mediated program within special education classrooms, to enhance accessibility and ensure relevance across diverse social contexts

Effective intervention implementation requires balancing adaptation and adherence. While maintaining fidelity to the original protocol preserves internal validity, adaptation improves external validity by ensuring alignment with cultural and contextual needs (Escoffery et al., 2019). A meta-analysis by Sundell et al. (2016) found that interventions adapted to their specific context tend to be more effective than those adopted without modification. These findings underscore the importance of tailoring programs to their environment, a key principle in adapting EmotiPlay for use in special education settings. A second principle in this adaptation is the sustainability of school-based interventions. Herlitz et al. (2020) emphasize that an intervention’s long-term viability depends on its workability - the degree to which it can be integrated into existing school routines and practices. This includes alignment with class schedules, relevance to students’ needs, and access to necessary resources. Sustainability is reinforced when the intervention is embedded within school policies and formal plans, as institutional support helps legitimize the program, and increase staff commitment. By having the teachers deliver the intervention, this adaptation aims to enhance feasibility, promote long-term implementation, and ensure the program becomes an integral part of the school environment (Sutton et al., 2019).

In this pilot study, the program was implemented in five special education classes, spanning 1st to 5th grade. A mixed-methods approach was utilized, combining qualitative data to gain a deeper understanding of the implementation process in each classroom, and quantitative data to assess the EU and social functioning measures. The results underscored the need for specific adaptations to enhance the program’s effectiveness. The program was designed to teach a broad range of emotions from basic, situational emotions to more complex emotions that require cognitive empathy (Chaidi & Drigas., 2020; Ekman, 1999). Overall comparisons between autistic students and their NA peers revealed significant difficulties in recognizing and verbalizing both basic and complex emotions. However, teachers of older students reported a strong understanding of basic emotions and recommended placing greater emphasis on complex emotions. Therefore, a more targeted approach was suggested, refining the participants' age range and limiting the review of basic emotions to better align with their developmental needs. Additionally, assessment of children’s participation across various activities revealed highly positive outcomes. Students showed an enthusiastic response to the interactive elements and group-based activities, an important achievement in itself. However, while group activities effectively fostered social interaction and engagement, time constraints posed a significant challenge, and didactic activities were generally less engaging for students. Given that active participation and engagement in practice are crucial for maximizing the learning outcomes, particularly for autistic children (Kou et al., 2023), these findings underscore the need to balance pedagogical content with time-efficient and engaging interactive frameworks.

Considering these results, the EmotiPlay intervention was adapted for school settings to better accommodate students' diverse needs. The verbal and cognitive demands were simplified, making the language and cognitive tasks more accessible across a wider range of ages and functioning levels. Additionally, the emotional context of the program was modified by shortening the introduction to emotions and the basic emotion units, while expanding the sections dedicated to complex emotions to provide greater depth. To enhance engagement, the program's pacing was adjusted, incorporating an average of six activities per lesson to maintain a balanced mix of activity types that sustain students' motivation. Furthermore, with the exception of the story task, the evaluation tasks for EU and social functioning were retained, as they proved to be effective. However, the story task, which aimed to assess emotional language, did not elicit a rich emotional-mental vocabulary from the children. Due to its low scores and limited effectiveness in distinguishing between autistic children and NA children, this task was excluded from the upcoming broader study.

2.3.1 Study Limitations

The study includes only one class from each grade, which limits the generalizability of the findings. The small sample size may not capture the full range of experiences and perspectives of autistic children across different educational settings. Additionally, as a qualitative study, the results are based on subjective interpretations of participants' experiences, which may introduce bias. Therefore, the conclusions drawn should be interpreted with caution, and further research is necessary to validate these findings across a broader population

2.3.2 Conclusion

To conclude, refining EmotiPlay program design based on the current insights, may enhance student engagement and ultimately improve learning outcomes. Findings from this pilot study laid the ground for the full-scale evaluation of the intervention.

The following chapters will first present a baseline analysis of the participating special education students, exploring the link between core components of the program – emotion recognition, cognitive empathy, and emotional language - and social functioning (chapter 3). This will follow by an assessment of the program’s effectiveness after its full-scale implementation (chapter 4)

3. Baseline Study: Is the Association between Emotion Recognition and Social Functioning Mediated by Cognitive Empathy and Emotional Language in School-Aged Autistic Children?

Previous research indicates a connection between emotion recognition from nonverbal cues and the ability to understand another’s mental perspective - cognitive empathy, as well as a further link between cognitive empathy and social functioning. Gendron and Feldman-Barrett’s TCE posits that language acts as a key mediator in this chain. According to their model, the brain relies on verbal concepts to predict others’ emotional states, underscoring the foundational role of emotional language in linking emotion recognition to cognitive empathy. This theoretical framework was empirically collaborated among typically developmental children, however, is not explored in autistic children. This study draws on data collected during the pre-intervention phase of the full trial to explore a central research question (Questions 3,4): What is the pathway through which emotion recognition supports effective social interactions, and what roles do emotional language and cognitive empathy play in this process among autistic children?

To that end 116 elementary school autistic students underwent a comprehensive assessment battery that included multi-modal tasks evaluating emotion recognition, cognitive empathy, and emotional language. In order to gain a comprehensive view of participants’ social functioning, it was assessed using two research tools: naturalistic observations during free play and parent-reported measures.

3.1 Method

3.1.1 Participants

The study included 140 autistic children recruited from special education classes within mainstream schools in central Israel. Of these, 126 met the inclusion criterion, demonstrating scores of at least two standard deviations below the mean on each of the two subtests of the Wechsler intelligence Scale. All autistic children received clinical diagnoses of autism by a child psychiatrist/neurologist and a psychologist, according to DSM-5 criteria (American Psychiatric Association, 2022). The diagnosis was confirmed using the second edition of the Autism Diagnostic Observation Schedule (ADOS-2) (Lord et al., 2012). Ten additional participants were excluded from the analysis due to the presence of extreme values, identified as outliers. Ultimately, the study included a total of 116 autistic children (17 girls) aged *M* = 8.26, *SD* = .76. (see Table 4).

3.1.2 Instruments

3.1.2.1 Emotion recognition from nonverbal cues. (Fridenson-Hayo et al., 2016) This task examined the recognition of 12 emotions (happiness, sadness, anger, fear, surprise, pride, kindness, unfriendliness, shame, boredom, interest, and disappointment). The recognition of each emotion was tested through four items, comprising a facial expression video, a decontextualized vocal utterance, a body language video, and an integrative video clip presenting all modalities in context. For each item, 4 potential answers were presented. Participants received a score of 1 for each correct answer, with a total score ranging between 0 - 48 for the entire test. Positive correlations were previously reported with an established facial emotion recognition task for autistic children (*r* = .52) and NA children (*r* = .40) (Fridenson-Hayo et al., 2016).

3.1.2.2 Test of Emotion Comprehension. (TEC; Pons & Harris, 2000). The TEC was used in the current study to assess cognitive empathy. Designed for children aged 3 to 12, the TEC evaluates foundational components of cognitive empathy, including the ability to understand the causes of emotions (e.g., desires, beliefs, and memory), to recognize the influence of contextual factors (e.g., external causes, moral considerations), and to grasp the complexity of emotional experiences (e.g., mixed emotions, emotional regulation). The TEC consists of short stories with gender-matched illustrations lacking nonverbal emotional cues. The child is asked to choose how a protagonist feels from four options. Scores range between 0-21. TEC is reported to have high test-retest reliability (.84; Pons et al, .2002) and good compatibility to cognitive and verbal skills (Tenenbaum et al., 2016).

3.1.2.3 Emotion Definition Task. (Golan et al., 2010). This task examined participants’ expressive emotional language. It included 12 emotions (happiness, sadness, anger, fear, surprise, pride, kindness, unfriendly, boredom, shame, disappointment, frustration), for each the participants were asked to define the emotion (for example: “please explain what is happy?”) and to give examples to a personal experience related to each of the emotions (e.g.: “can you describe a situation that you felt happy?”). The definition and examples were audiotaped, and transcribed verbatim. Scores of 0, 1, or 2 were given to the definition of each emotion, following Gev et al., (2017). Hence, task scores ranged from 0 to 24. Scoring was conducted by two naïve trained judges. The average inter-rater agreement in the current study was .98.

3.1.2.4 Playground Observation of Peer Engagement. (POPE; Kasari et al, 2005). The POPE is a time-interval behavior coding system that evaluate social-emotional functioning in natural setting. Twelve independent, naïve observers from the research team rated children on the playground during the school recess for a total of 10 minutes. Each minute was subdivided into 40 consecutive seconds of observation, followed by coding for the subsequent 20 seconds. The observers documented the child’s level of engagement with peers on the playground (solitary, proximity, onlooking, parallel, parallel aware, joint engaged with peers and involved in games and rules) in each interval. Following Kasari et al. (2005), playground engagement states were summed for a total proportion of interval in each engagement state and then divided into two styles: unengaged (incorporating solitary and proximity) and engaged (incorporating joint engagement and games and rules). Coders also noted positive initiations of the child towards other children, and positive and negative responses to a peer’s social overtures. Observers underwent eight sessions of training administered by the research coordinator and attained a reliability level of at least 80% reliability in taped video observations prior to the beginning of the study. In line with earlier research employing the POPE (Gilmore et sl., 2019; Locke et al., 2016; Santillan et al., 2019) reliability was collected on 20% of sessions during the study. The Intraclass Correlation Coefficients (ICCs) were notably high for all four measures (unengaged, engaged, positive initiations and positive response), demonstrating an average percent agreement score of .96. The ICCs ranged from .90 to 1.00, indicating strong agreement across the board.

3.1.2.5 Adaptive Behavior Assessment System, Second Edition (ABAS-II). (Gray & Carter, 2013). The ABAS-II is a comprehensive, norm-referenced assessment of adaptive skills of individuals from birth to 89 years. In the current study parents completed the social scale of the ABAS-II, comprising the social and leisure subscales. Standardized scores for the social scale have an average of *M* = 100, and a *SD* =.15. The internal consistency of the ABAS-II is high, with average reliability coefficients for the skill areas across age groups ranging between .85 to .97.

3.1.3 Procedure

The study received approval by the authors’ university IRB and by the Chief Scientist of the Ministry of Education. Upon receiving parental signed informed consent, trained professionals administered the two WISC-IV subtests and the ADOS-2 to all participants. Parents filled out the ABAS-II social scale online.

Next, 12 trained psychology undergraduates conducted assessments during two scheduled school visits. Each assistant was randomly assigned 10–12 participants. For each child, the assistant conducted two individual sessions, each lasting approximately 30 minutes, in a quiet room. During these sessions, participants completed the emotion recognition, TEC, and ED tasks, in a counterbalanced order. Additionally, each assistant individually observed each of their assigned participants for 10 minutes during free play at recess, as part of the POPE task. Observations were scheduled randomly across the two visits to ensure even distribution within the available time.

3.1.4 Statistical Analysis

To address the study's aims, a series of statistical analyses were conducted. Initially, associations among the primary study variables were examined. These included children’s scores on EU tasks—emotion recognition, TEC, and ED, as well as indicators of social functioning from the POPE task (positive initiatives, positive response, engaged and unengaged interactions), and the ABAS Social scale. In addition, correlations were calculated between these outcome measures and background variables including participants’ age, cognitive scores derived from the Matrix Reasoning and Vocabulary subtests of the WISC-IV, and ADOS-2 scores. This preliminary stage served both to characterize the interrelations among the core constructs and to identify potential covariates for subsequent analyses.

Building on these findings, mediation analyses were employed to explore the underlying mechanisms through which EU measures may influence social functioning. Specifically, attention was given to the potential mediating role of emotional language in the association between emotion recognition and TEC, as well as to the possibility that TEC mediates the relationship between emotional language and social functioning. The mediating effects were tested using Model 4 of the PROCESS macro for SPSS (Hayes, 2018), with age, cognitive scores (Matrix Reasoning and Vocabulary), and ADOS-2 scores entered as covariates, given their observed associations with relevant variables. Finally, to examine the complex relationships among emotion recognition, ED, TEC, and positive initiatives, a comprehensive path analysis was conducted. This analysis assessed both direct and indirect effects within an integrated model, incorporating participant’s age, Matrix Reasoning and Vocabulary scores, and ADOS-2 scores as covariates.

3.2 Results

3.2.1 Correlation analysis

The study measures included children's performance scores on emotional tasks - emotion recognition, TEC, and ED, along with social functioning measures assessed through the POPE and ABAS-social scale scores. Table 4 presents the intercorrelations among these variables alongside background variables including children's age, WISC-IV subtests’ scores (Matrix reasoning and Vocabulary), and ADOS scores.

Table 4

*Descriptive Statistics and Pearson Correlation Coefficients of the Study Measures*

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | **Descriptive statistics** | |  |  | **Pearson correlation coefficients** | | | | | | | | |
|  |  |  |  |  | **Emotional measures** | | |  | **Social functioning** | | | |  |
|  | *M* | *SD* |  |  | ER | TEC | ED1 |  | PI | PR | Unengaged | Engaged | ABAS-S2 |
| Age | 8.27 | .76 |  |  | .23\* | .20\* | .23\* |  | .093 | .042 | -.063 | .096 | -.28\*\* |
| ADOS CSS | 8.68 | 1.01 |  |  | -.101 | -.23\* | -.19\* |  | -.017 | -.035 | .019 | -.007 | -.142 |
| Matrix | 6.92 | 3.38 |  |  | .35\*\* | .18\* | .28\*\* |  | .061 | .076 | -.066 | .097 | .058 |
| Vocabulary | 7.10 | 2.95 |  |  | .26\*\* | .34\*\* | .41\*\* |  | .090 | .009 | .087 | .035 | -.082 |
| ER | 30.82 | 5.74 |  |  |  | .42\*\*\* | .43\*\*\* |  | .25\*\* | .09 | -.14 | .17 | -.03 |
| TEC | 16.22 | 2.18 |  |  |  | - | .50\*\*\* |  | .37\*\*\* | .29\*\* | -.20\* | .24\*\* | .13 |
| ED1 | 8.05 | 5.74 |  |  |  |  | - |  | .25\*\* | .10 | -.05 | .12 | -.08 |
| PI | 6.67 | 5.23 |  |  |  |  |  |  | - | .65\*\*\* | -.53\*\*\* | .68\*\*\* | .15 |
| PR | 6.79 | 5.04 |  |  |  |  |  |  |  | - | -.52\*\*\* | .61\*\*\* | .15 |
| Unengaged | 1.97 | 2.58 |  |  |  |  |  |  |  |  | - | -.78\*\*\* | -.13 |
| Engaged | 5.97 | 3.58 |  |  |  |  |  |  |  |  |  | - | .07 |
| ABAS-S2 | 79.44 | 13.12 |  |  |  |  |  |  |  |  |  |  | - |

\**p*<.05, \*\**p*<.01, \*\*\**p*<.001

***Note.*** 1 n= 114; 2 n= 104.

As shown in Table 4, participant’s age was positively associated with emotion recognition, TEC, and ED scores, indicating that older children tended to perform better on these. Age was negatively associated with the ABAS Social Scale, indicating that gaps in children’s social adaptive functioning, relative to age norms tend to widen as they grow older. Non-verbal ability, assessed by the Matrix reasoning subtest, also showed significant positive correlations with emotion recognition, TEC, and ED scores, suggesting that participants with higher non-verbal ability performed better in these domains. Similarly, verbal ability, measured by the Vocabulary subtest, was positively correlated with emotion recognition, TEC, and ED scores. ADOS scores were negatively correlated with TEC and ED scores, but not with emotion recognition scores.

In line with our first hypotheses, significant positive correlations were observed among the study measures. Emotion recognition was strongly associated with TEC, ED, and positive initiatives scores, indicating that better emotion recognition was linked to improved performance in these areas. However, no significant correlations were observed between emotion recognition and other social functioning measures, such as positive responses, engagement levels or ABAS-Social scores. Similarly, ED showed a positive correlation with both TEC and positive initiatives scores. Finally, the TEC demonstrated a significant positive correlation with all measures of social functioning observations, including positive initiatives, positive responses, and levels of engagement, emphasizing that higher TEC scores were associated with better social functioning outcomes. Contrary to our hypothesis, none of the emotional measures or observational social measures shown were correlated with the ABAS- Social scale, which reflects parents' reports of their children's social abilities. Notably, the frequency of positive initiatives directed by children toward their peers emerged as the social functioning measure most strongly correlated with all emotional measures. Consequently, we selected positive initiatives as the primary indicator of social functioning for subsequent analyses.

3.2.2 Mediation Analyses

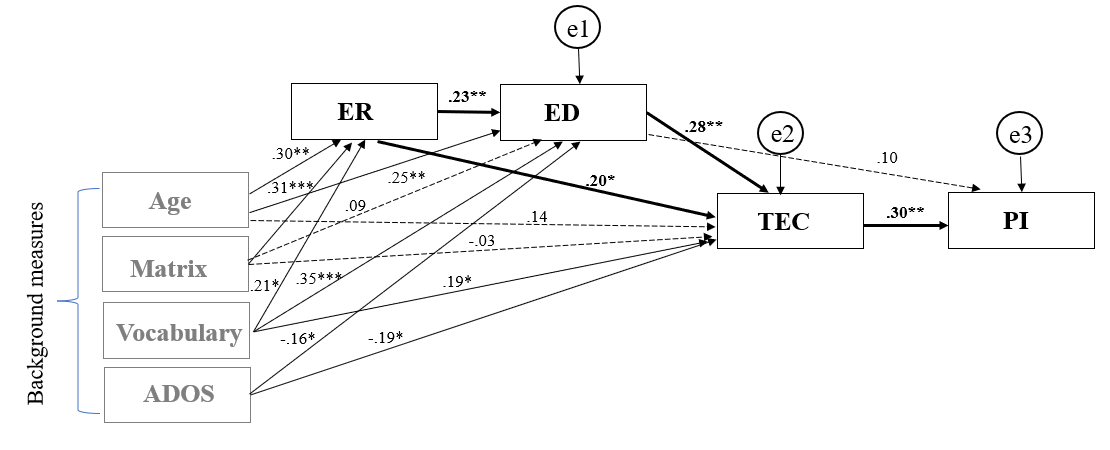
The second aim was to explore the relationship between emotion recognition and social functioning through emotional language and cognitive empathy. To achieve this, we first examined the mediation between emotion recognition and TEC via emotional language, as well as the mediation between emotional language and social functioning through TEC. Finally, we evaluated the integrated model connecting emotional recognition to social functioning

Results of the first mediation analysis revealed a significant direct effect of emotion recognition on TEC [*b* = .08, *SE* = .03, *t* = 2.24, *p* = .027], as well as a significant effect of emotion recognition on ED [*b* = .23, *SE* = .09, *t* = 2.61, *p* = .010], and a significant effect of ED on TEC [*b* = .11, *SE* = .04, *t* = 2.87, *p* = .005]. The indirect effect, representing the mediation pathway from emotion recognition to TEC via ED, was significant [*b* = .06, *SE* = .04, 95% CI: .008, .145].

Results of the second mediation of TEC as a mediator between ED and positive initiatives, revealed a non-significant direct effect of ED on positive initiatives [*b* = .11, *SE* = .11, *t* = 1.02, *p* = .312]. However, a significant effect of ED on TEC [*b* =.11, *SE* = .04, *t* = 2.87, *p* = .005], and of TEC on positive initiatives [*b* = .74, *SE* = .27, *t* = 2.77, *p* = .007] were found. The indirect effect, representing the mediation pathway from ED to positive initiatives via TEC, was significant (*b* = .09, *SE* = .04, 95% CI: .015, .179].

The final path analyses examined the direct and indirect effects within the holistic model connecting the intricate relationships between emotion recognition, ED, TEC and positive initiatives. Figure 1 presents the full model.

Figure 1

*Path Analysis Predicting Social Functioning Based on Emotion Recognition, Cognitive Empathy, and Emotional Language*

***Note****.* ER- emotion recognition; ED – emotion definition; TEC – cognitive empathy measure; PI – positive initiative

The evaluation of the model fit revealed satisfactory results across several goodness-of-fit indices. The χ²/df ratio (CMIN) was 1.79, which is well below the threshold of 3, indicating an acceptable fit according to Kline (2005). The GFI was .95, surpassing the .90 benchmark, suggesting a good overall fit (Hoyle, 1995). Additionally, both the IFI and CFI were .94 and .93, respectively, both exceeding the threshold of .90, which is indicative of a good fit (Hair et al., 2010). However, the RMSEA was .08, slightly above the ideal cutoff of .07 defined by Steiger (2007), suggesting a moderate fit. Taken together, these results suggest that the model fits the data reasonably well, although the RMSEA indicates room for improvement in model fit.

To refine the model and enhance its parsimony, we have omitted paths that were not significant or had a p-value greater than .10. Specifically, we excluded the paths from age to TEC, from the Matrix to TEC and ED, and from ED to positive initiatives. This revision yielded a RMSEA of .07, which is exactly at the ideal cutoff defined by Steiger (2007), suggesting an acceptable model fit.

The evaluation of the model fit revealed satisfactory results across several goodness-of-fit indices. The χ²/df ratio (CMIN) was 1.79, which is well below the threshold of 3, indicating an acceptable fit according to Kline (2005). The GFI was .95, surpassing the .90 benchmark, suggesting a good overall fit (Hoyle, 1995). Additionally, both the IFI and CFI were .94 and .93, respectively, both exceeding the threshold of .90, which is indicative of a good fit (Hair et al., 2010). However, the RMSEA was .08, slightly above the ideal cutoff of .07 defined by Steiger (2007), suggesting a moderate fit. Taken together, these results suggest that the model fits the data reasonably well, although the RMSEA indicates room for improvement in model fit.

To refine the model and enhance its parsimony, we have omitted paths that were not significant or had a p-value greater than .10. Specifically, we excluded the paths from age to TEC, from the Matrix to TEC and ED, and from ED to positive initiatives.  This revision yielded a RMSEA of .07, which is exactly at the ideal cutoff defined by Steiger (2007), suggesting an acceptable model fit.

The final model is depicted in Figure 1 and reveals two significant mediation pathways linking emotion recognition from non-verbal cues to social functioning (positive initiatives during free play) in autistic children. First, a mediation pathway was found through cognitive empathy, such that better emotion recognition predicted enhanced cognitive empathy, which in turn positively influenced social functioning. Second, an additional significant pathway emerged through emotional language: stronger emotion recognition predicted greater use of emotional language, which subsequently enhanced cognitive empathy and, ultimately, positively impacted social functioning.

3.3 Discussion

This part of the study examined the interplay between emotional understanding components and social functioning in autistic children. The findings confirmed the hypothesis that cognitive empathy mediates the relationship between emotion recognition and social functioning. Additionally, emotional language emerged as a key factor in enhancing cognitive empathy. These findings further emphasize the importance of language in shaping social functioning and extend findings on typically developing children to the context of autism.

Previous research highlights significant challenges in EU among autistic individuals (Bamicha & Drigas., 2022; Fridenson-Hayo et al., 2016; Gev et al., 2017; Zhang et al., 2022), which are thought to be closely linked to deficits in social functioning, a defining feature of ASD (Denham et al., 2019). Studies consistently demonstrate strong correlations between the affective perception involved in emotion recognition and the cognitive process of inferring others' mental states—cognitive empathy (Altschuler et al., 2021; Metcalfe et al., 2019; Mitchell & Phillips, 2015) as well as between cognitive empathy and social functioning (Bishop-Fitzpatrick et al., 2017; Chiu et al., 2023; Sasson et al., 2020). However, the route from the perception of emotional cues, through its conceptualization in context, to its manifestation in social behavior has scarcely been studied. Moreover, Gendron and Feldman-Barrett's (2018) TCE posits that emotional language serves as a critical mediator in the relationship between emotion recognition and cognitive empathy. However, this theory has not been tested among autistic individuals, many of whom show emotional language difficulties alongside challenges both in verbal and in nonverbal communication (Delehanty et al., 2018; Vogindroukas et al. 2022).

Building on this evidence, we examined how emotion recognition in autistic children contributes to social functioning through the mediation of emotional language and cognitive empathy.  The results of the first mediation analysis confirmed a direct association between emotion recognition from non-verbal cues and cognitive empathy, as well as an indirect association mediated by emotional language. These findings align with TCE (Gendron & Feldman-Barrett, 2018), highlighting the role of language as a bridge between the sensory perception of emotional cues and social-emotional knowledge. The second mediation analysis revealed that the relationship between emotional language and social functioning was mediated through cognitive empathy. The entire theoretical model was examined through a path analysis testing the relationship between emotion recognition and social functioning in autistic children, while accounting for background characteristics such as age, cognitive abilities, and severity of autistic traits. The findings validated the proposed theoretical framework, confirming the central role of cognitive empathy in mediating the relationship between emotion recognition and social functioning. Moreover, they highlighted the significant contribution of emotional language in enhancing cognitive empathy and its indirect influence on social functioning among autistic children. These results align with prior research demonstrating the connection between various aspects of language and cognitive empathy in ASD (Andrés-Roqueta & Katsos, 2017; Durrleman & Franck, 2015; Siller et al., 2014). The findings reinforced the view that, particularly for autistic individuals, language serves as a distinct compensatory tool to support social-emotional understanding. Language contributes to social functioning not only through speech production but also by fostering the development of cognitive empathy (Eigsti et al., 2016; Eigsti & Irvine, 2021).

To gain a comprehensive understanding of the children's social functioning, the current study utilized two assessment measures: parent-report questionnaires and behavioral observations during the children’s free-play time. Interestingly, we found no correlation between parental reports of children’s social abilities and observational measures. This discrepancy may stem from the different perspectives captured by these tools: while parental reports offer a broader, longitudinal view of the child’s social abilities across various contexts and may be influenced by the parent-child relationship dynamics, observational measures are assessed impartially by a researcher but provide a snapshot of the child’s performance at a specific moment (Lemler, 2024; Moens et al., 2018). This distinction between the two types of assessment tools highlights the complexity of measuring social functioning and the importance of considering multiple sources of data to gain a more comprehensive understanding of a child’s social abilities. Furthermore, all emotional measures (emotion recognition, cognitive empathy, emotional language) and social functioning observations were conducted in a standardized manner, involving direct assessment of the children at a specific point in time by an objective researcher. These similarities may explain why the correlations between emotional measures and social functioning were found significant only with natural play-time observations, and not with parental reports.

Among the measures collected through observations of the children's social behavior, positive initiatives demonstrated the strongest correlation with emotional measures. This measure reflects the child's motivation to actively engage with peers and proactively initiate positive social interactions. Research suggests that when children initiate requests, they gain greater control over their environment by accessing their needs and desires, which subsequently increase social interaction (Aal et al., 2022; Mohammadzaheri et al., 2021). In contrast, the second measure, positive responses, represents a more passive dimension of social engagement. Positive responses capture the child’s ability to react to others’ social overtures, even if those reactions are not always appropriate. While this measure provides valuable insight into the child’s receptiveness to social interactions, it reflects a reactive rather than proactive form of social behavior. Notably, no significant association was found between emotion recognition and positive responses. This finding is particularly interesting given that emotion recognition, as a receptive skill, might be expected to also align with reactive forms of social functioning. These findings suggest that the effects of emotion recognition on social behavior may be mediated by additional factors not assessed in the current study, such as social motivation, self-confidence, attentional control, or the capacity to process social information in real time. These factors may play a differential role in children’s social initiative vs. social response (Itskovich et al., 2020; Øzerk et al., 2021). Moreover, the measurement of engagement types (Engaged and Unengaged) was constrained by a limited range, as it was based on only 10 minutes of coded observations. This restriction may have diminished its ability to capture meaningful variability in behavior. In contrast, the positive initiatives variable was not subject to a maximum limit, enabling it to more accurately reflect individual differences among the children and their connections to emotional measures.

Finally, an examination of the correlations between background variables and measures of emotional and social functioning revealed associations with emotional measures but no direct correlation with social functioning outcomes, whether assessed through observations or parent reports. This finding suggests that the influence of background variables is mediated through emotional functioning. In other words, the child’s age, cognitive abilities, and level of autistic traits may affect children's emotional understanding, which in turn shapes their level of social functioning.

Our results carry significant clinical implications, particularly for the development of intervention programs tailored for autistic individuals. Many existing interventions focus predominantly on improving the ability to recognize emotions through nonverbal cues (Berggren et al., 2018, Zhang et al., 2022). While such skills are undoubtedly important, this study highlights that in addition emotion recognition addressing cognitive and linguistic aspects of social-emotional development may also be needed to bring about meaningful improvements in social functioning.

3.3.1 Limitations and Future Directions

Alongside the contribution presented above, it should be acknowledged that certain factors that could influence the path from emotion recognition to social functioning were not accounted for in this study. Emotion regulation may play a significant role in autistic children social functioning, as previous studies have shown (Cibralic et al., 2019; Goldsmith & Kelley, 2018). Executive functioning, essential for goal-directed behavior and effective communication, is another potential factor worth examining (Bottema‐Beutel et al., 2019). Additionally, Gender differences pose a limitation due to the overrepresentation of boys compared to girls, consistent with patterns in autism research (Barsotti et al., 2023). Further research is needed to enhance our comprehension of the intricate relationship between emotion recognition and social functioning in autistic children, as well as within the specific context of gender.

3.3.2 Conclusion

The findings of this study uncover the complex pathway linking emotion recognition and social functioning among autistic children. These insights have important implications for the development of intervention programs. By adopting a holistic approach that integrates emotion recognition, emotional language, and cognitive empathy, such programs may address the diverse needs of autistic children more effectively, equipping them with the skills to navigate social situations and achieve meaningful improvements in their emotional and social outcomes.

Building on these insights, the next chapter evaluates the effectiveness of a school-based computerized intervention designed to enhance emotion recognition, emotional language, and cognitive empathy in autistic children, and to examine whether such improvements can translate into broader gains in social functioning.

4. Intervention Study: The Effects of a Computerized Teacher-Mediated Intervention on the Emotional Understanding of Autistic Children: A Block Randomized Controlled Trial

Computerized interventions have demonstrated considerable potential in promoting social-emotional skills among autistic individuals (Eden & Oren, 2021; Fridenson-Hayo et al., 2017; Gev et al., 2017). However, despite these promising findings, their effectiveness in supporting the generalization of acquired skills across settings remains limited (Berggren et al., 2018; Zhang et al., 2021). This limitation is particularly significant for autistic children, who often struggle to transfer learned behaviors from structured environments to more dynamic, everyday situations (Berggren et al., 2018; Neely et al., 2016). One way to address this challenge is by embedding interventions within naturalistic contexts, such as school settings, which offer rich opportunities for social learning during daily routines (Eccles & Roeser, 2015).

The present study seeks to assess the effectiveness of a teacher-mediated, adapted version of the EmotiPlay program in enhancing EU and social functioning in autistic children within special education classrooms. In addition to evaluating the program’s efficacy, we also examined its feasibility and adaptability for implementation in educational settings. By integrating the intervention into routine classroom activities and having teachers facilitate its delivery, the study aimed to increase accessibility and promote skill generalization. This approach was also intended to support the transfer of newly acquired skills to students’ everyday social interactions and learning experiences.

4.1 Method

4.1.1 Design

Twenty-six special education classes were recruited to evaluate the adapted EmotiPlay intervention in a block randomized controlled trial. After confirming participants meet inclusion criteria (i.e., a diagnosis of ASD, and cognitive abilities no lower than two SDs below average) they were randomly assigned at the class level into either the intervention group or the control group. The intervention was employed during 50-minute lessons, twice a week, over a period of 22 weeks. Participants were evaluated before and immediately after the intervention using the evaluation protocol validated in the pilot phase, including a multimodal emotion recognition task, a cognitive empathy task, an emotional language task, and natural observation during free playtime to assess social functioning. At the conclusion of the intervention, teachers provided feedback on its usability via online questionnaire and participated in a personalized interview with the research coordinator.

4.1.2 The EmotiPlay School-based Program

EmotiPlay is a computer-based program designed to teach autistic children to recognize and understand emotions within social contexts. Based on findings from the pilot study described in Chapter 2, the school-based version of EmotiPlay focuses on seven emotions: five basic emotions—happiness, sadness, anger, fear, and surprise—and two complex emotions—boredom and interest.

The program is organized into structured instructional units. It begins with an introductory unit that presents core emotional concepts, followed by five units—each dedicated to one basic emotion. A summary unit then reviews all basic emotions through two interactive quizzes, and the program concludes with a unit on complex emotions - boredom and interest.

Each basic emotion is taught over three lessons:

1. **Facial cues** – introducing the emotion and identifying it through facial expressions.
2. **Vocal and verbal cues** – recognizing the emotion through tone of voice and relevant emotional vocabulary.
3. **Body language** – interpreting physical posture and gestures associated with the emotion.

The complex emotions are addressed through four lessons, beginning with a more in-depth introduction to their nuanced nature.

The program follows a narrative featuring Professor Zinkman and his assistant Max, who invite students to become "emotional explorers" at a research camp. Each lesson includes:

* A short, animated video where the characters introduce the topic
* Interactive quizzes using cross-culturally validated videos and audio clips of actors expressing emotions
* Individual practice, where students apply newly learned cues on themselves and compare expressions with peers
* Pair and group activities, such as partner interviews about emotional experiences, role-playing social scenarios, and group games
* Group discussions, in which students analyze characters’ emotions in short video clips of social situations and reflect on their underlying causes
* A final interactive quiz to consolidate learning

Screenshots from the program are presented in Appendix 1. For more information, visit: [www.emotiplay.com](http://www.emotiplay.com)

4.1.3 Measures

*4.1.3.1* Screening Measures. All participants completed two subsets of the Wechsler Intelligence Scales for Children (WISC-IV) (Wechsler, 2003). The Vocabulary and Matrix Reasoning subsets were used to represent verbal and performance IQ, respectively. Parents filled the survey form of the ABAS-II, which provides a comprehensive norm-referenced assessment of an individual’s adaptive skills (Harrison & Oakland, 2003), and the Social Responsiveness Scale, 2nd edition (SRS-2) to assess participants’ level of autism traits (Bölte et al, 2008; Constantino & Gruber, 2012). In addition, participants were administered the ADOS-2 to verify their ASD diagnosis (Lord et al., 2012).

4.1.3.2 Evaluation measures. Emotion recognition from nonverbal sensory cues, cognitive empathy, ED and social functioning in free playtime tasks were tested using the same tasks from the baseline study:

4.1.3.2.1 Emotion Recognition from Nonverbal Cues. (Fridenson-Hayo et al., 2016). This test includes 4 tasks to examine **e**motion recognition: 1. facial expression videos 2. decontextualized vocal utterances 3. body language videos 4. Integrative video clips presenting all modalities in context, with muffled speech to exclude semantic information, while keeping prosodic cues. For the current study, the task included seven emotions taught in the program (happiness, sadness, anger, fear, surprise, boredom and interest) presented with novel videos and recordings not previously included in the training, for the evaluation of proximal generalization, and five emotion not-taught in the program (pride, kindness, unfriendliness, shame, and disappointment) for the evaluation of distal generalization. For each stimulus, 4 potential answers were presented. Participants received a score of 1 for each correct answer, with a score range of 0-12 for each subtest and 0-48 for the entire test. In the current study, the test showed good internal consistency, with α=.74. The test was validated against the FEFA-2, an established facial ER task (Fridenson-Hayo, 2016). Two versions of the test were used to assess participants emotion recognition before and after the intervention. Version order was counterbalanced.

4.1.3.2.2 Test of Emotion Competence – TEC. (Pons & Harris, 2000). The TEC was used in the current study to assess cognitive empathy. Designed for children aged 3 to 12, the TEC evaluates foundational components of cognitive empathy, including the ability to understand the causes of emotions (e.g., desires, beliefs, and memory), to recognize the influence of contextual factors (e.g., external causes, moral considerations), and to grasp the complexity of emotional experiences (e.g., mixed emotions, emotional regulation). The TEC consists of short stories with gender-matched illustrations lacking nonverbal emotional cues. The child is asked to choose how a protagonist feels from four options. Scores range between 0-21. TEC is reported to have high test-retest reliability (.84; Pons et al, .2002) and good compatibility to cognitive and verbal skills (Tenenbaum et al., 2016).

4.1.3.2.3 Emotional language. The Emotion Definition (ED) task, originally developed by Golan et al. (2010), was utilized to examine participants' expressive emotional language. The task comprised 12 emotions, including six emotions taught in the program (happiness, sadness, anger, fear, surprise, and boredom) for evaluating proximal generalization, and six emotions not taught in the program (pride, kindness, unfriendliness, shame, disappointment, and frustration) for assessing distal generalization. Participants were asked to define the emotion (for example: “please explain what happy is”) and to give examples to personalize experience related to each of the emotions (e.g.: “can you describe a situation in which you felt happy?”). The definition and examples were audiotaped, and transcribed verbatim. Following Gev et al., (2017) scores of 0, 1, or 2 were given for each emotion. Hence, task scores ranged from 0 to 24, with an average inter-rater agreement of 0.98 between the two judges.

4.1.3.2.4 Social Functioning. Evaluating distal generalization of learning into everyday life settings, social functioning was evaluated by playground observation and coded by POPE - Playground Observation of Peer Engagement (Kasari et al, 2005). This instrument is a time-interval behavior coding system. Twelve independent, blind observers from the research team rated children on the playground for a total of 10 minutes. Each minute was subdivided into 40 consecutive seconds of observation, followed by coding for the subsequent 20 seconds during the school recess. The observers noted the child’s engagement states with peers on the playground (solitary, proximity, onlooking, parallel, parallel aware, involved in games and rules and joint engaged with peers) in each interval. Following Kasari et al., (2005) Playground engagement states were summed for a total proportion of interval in each engagement state and then divided into two styles: unengaged (incorporating solitary and proximity) and engaged (incorporating joint engagement and games and rules). Coders also noted positive and negative initiations of the child towards other children, and positive and negative responses to a peer’s social overtures. observers underwent eight sessions of training administered by the research coordinator and attained a reliability level of at least 80% reliability in taped video observations prior to the beginning of the study. In line with earlier research employing the POPE (Gilmore et sl., 2019; Locke et al., 2016; Santillan et al., 2019) reliability was collected on 20% of sessions during the study. The Intraclass Correlation Coefficients (ICCs) were notably high for engagement styles, positive and negative initiations, and responses, demonstrating an average percent agreement score of 0.96. The ICCs ranged from 0.90 to 1.00, indicating strong agreement across the board.

4.1.3.3 Implementation measures.

4.1.3.3.1 Fidelity. To assess the fidelity of the intervention's delivery by teachers, the research team conducted observations every other week. For each activity within the lesson, the team documented its duration, the level of student participation, any technical difficulties encountered, and general comments or insights. Additionally, at the end of the lesson, the team completed a lesson summary report (see Appendix 5), recording key details such as total lesson duration, number of staff members present, each staff member's role in delivering the program, and any technical issues encountered. The team coded the quality of specific implementation indicators. Quality of Implementation (QoI) included: (1) Children's participation level in class, rated on a scale from 1 (low) where less than half of the students participated, to 5 (very high) where most students engaged in the majority of activities. (2) Teacher's familiarity with the activities, rated from 1 (low) where the teacher struggled with implementing most activities and relied on written instructions, to 3 (good) where the teacher was proficient in implementing all activities. (3) The teacher's efforts to ensure understanding among all participants, rated from 1 (very low) where the teacher did not ensure understanding for each child, to 4 (good) where the teacher made at least three attempts to clarify the material for each child. And (4) the extent to which the teacher connected the material to students' individual experiences, rated from 1 (low) where there was no connection made, to 4 (very good) where the teacher made at least three attempts to relate the material to individual experiences.

4.1.3.3.2 Intervention Usability. Teachers completed the Usage Rating Profile Intervention Rating (URP-IR; Chafouleas et al., 2009; Revised, Briesch et al., 2013) via Qualtrics. The questionnaire includes 29 items on a 6-point Likert scale ranging from 1 (strongly disagree) to 6 (strongly agree). The questionnaire covers six dimensions: acceptability, understanding, feasibility, system climate, system support, and home-school collaboration. The latter dimension was not used in this study, as it was deemed irrelevant. Therefore, teachers provided feedback on 26 items pertaining to the intervention process (see Appendix 6). The subscales demonstrate acceptable internal consistency (Cronbach’s alpha - .86).

4.1.3.3.3 Semi-structured Interviews.To gain a deeper understanding of the implementation processes in each classroom, interviews were conducted with teachers. The open-ended questions for the interviews were co-developed with the doctoral advisors to encourage teachers to reflect on EmotiPlay’s integration in their classrooms, share their perceptions of their work environment, and discuss the program's impact on their students' emotional and social skills. The questions also explored the program's accessibility and feasibility within special education settings (see Appendix 7).

4.1.4 Participants

Out of 140 families agreed to take part in the study, 126 met the inclusion criterion of at least two standard deviations below the mean on each of the two subtests of the Wechsler intelligence Scale. All autistic children received clinical diagnoses of autism by a child psychiatrist/neurologist and a psychologist, according to DSM-5 criteria (American Psychiatric Association, 2022). The diagnosis was confirmed using the ADOS-2 (Lord et al., 2012). Ten additional participants were excluded from the analysis due to the presence of extreme values, identified as outliers. Ultimately, the study included a total of 116 autistic children (17 girls) aged *M* = 8.26, *SD* = .76 (see Figure 2).

Participants were selected from ten elementary schools located in central Israel, where special education classes for autistic students are integrated in mainstream schools. Socioeconomic factors were addressed in the study by balancing schools based on the nurture index. The 26 classes were randomly assigned to either the intervention group (n = 59, 8 girls) or the waiting-list control group (n = 57, 9 girls). The groups were comparable on age, gender, cognitive and verbal abilities, and adaptive functioning (see table 5).

Figure 2

*CONSORT Diagram of the Study Design and Randomization of Participants Into the Intervention and Control Groups*

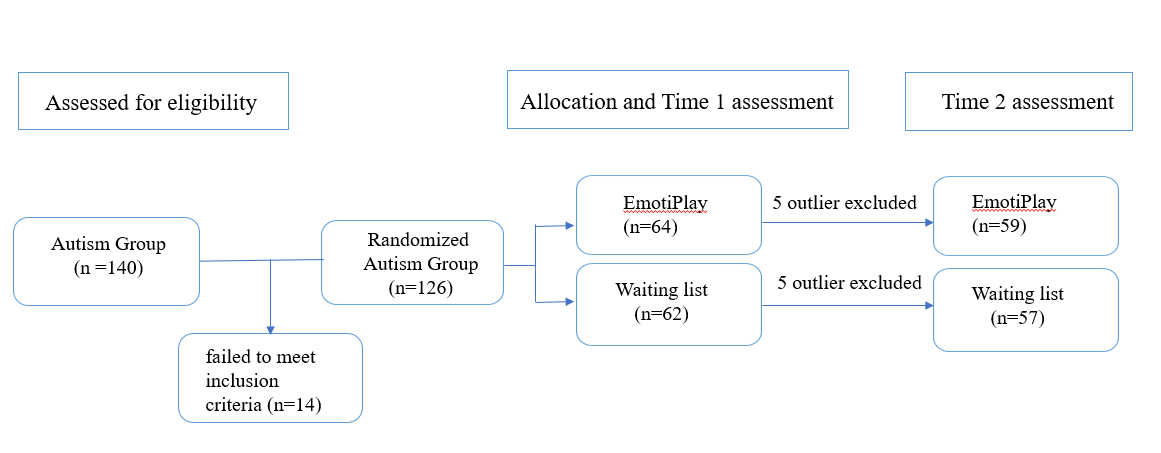


Table 5

*Background Characteristics by Group*

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | ***Research***  **(*n* = 59)** | |  | ***Control***  **(*n* = 57)** | |  |  |  |
| ***Background characteristics*** | ***M*** | ***SD*** |  | ***M*** | ***SD*** | ***t*** | ***p*** | **Cohen's d** |
| Gender (Males/Females)1 | 51/8 | |  | 48/9 | | χ² (1) =.73, *p* = .734 | | |
| Age | 8.27 | 0.70 |  | 8.24 | 0.82 | .24 | .123 | 0.04 |
| WISC vocabulary | 7.12 | 3.02 |  | 7.12 | 2.87 | 0.01 | .994 | 0.00 |
| WISC matrix | 6.53 | 3.41 |  | 7.35 | 3.30 | 1.32 | .188 | 0.25 |
| ***Screening tasks*** |  |  |  |  |  |  |  |  |
| SRS- SCI 2 | 65.93 | 9.39 |  | 65.06 | 9.28 | .49 | .950 | 0.09 |
| SRS- RRB 2 | 67.20 | 11.92 |  | 65.79 | 11.06 | .64 | .503 | 0.12 |
| SRS TOTAL 2 | 66.55 | 9.53 |  | 65.53 | 9.35 | .57 | .863 | 0.11 |
| ABAS total3 | 73.19 | 18.01 |  | 71.96 | 14.58 | .38 | .077 | 0.07 |

1Nominal variable χ² analysis was conducted; 2Applicable for 109 participants; 3Applicable for 104 participants.

***Note.*** WISC -Wechsler Intelligence Scales (4th Ed.); SRS - Social Responsiveness Scale; ABAS - Adaptive Behavior Assessment System (2nd Ed)

In addition, 16 teachers participated in the evaluation of the program’s feasibility and accessibility within the school system. All teachers were female, ranging in age from 26 to 52 years (*M* = 33.75, *SD* = 12.28). All held at least a bachelor’s degree, and five had completed a master’s degree in their respective fields. On average, the teachers had 8.94 years of teaching experience *(SD* = 9.47, range = 1–28) and 3.06 years of experience specifically working with autistic children (*SD* = 2.79, range = 1–13).

Regarding technological support, most schools reported having a designated staff member responsible for managing classroom technology. However, out of the 16 teachers, only seven received formal training in techno-pedagogical practices. Teachers reported their frequency of use of various digital platforms (e.g., messaging apps, email, social media, educational tools) on a 0–6 scale, with a mean score of 4.7 (*SD* = 1.28), indicating frequent weekly use.

4.1.5 Procedure

The study received approval from the Bar-Ilan university IRB and the Chief Scientist of the Ministry of Education. We established contact with elementary schools in the central region of the country, where special education classes are integrated. After obtaining approval from the school administrations, letters were sent to parents requesting consent for their child's participation. Upon receiving informed written consent from the parents, trained professionals administered the two WISC**-**IV subtests - Vocabulary and matrix reasoning (Wechsler, 2003) and the ADOS-2 to all participants. Additionally, parents were asked to complete the ABAS-II and the SRS-2 questionnaires.

Next, a research team of trained psychology undergraduates conducted two visits to the schools, in each of the two assessments (before and immediately after the intervention) to administer the evaluative assessments. Each research assistant was blindly assigned 10-12 participants, ensuring a balanced distribution between the groups. During these sessions, participants completed the emotion recognition, TEC, and ED tasks. Tasks were administered individually in counterbalanced order, with each session held in a quiet room at the school premises. Administration lasted 40 minutes on average. Additionally, each assistant individually observed each of their assigned participants for 10 minutes during free play at recess, as part of the POPE task. Observations were scheduled randomly across the two visits to ensure even distribution within the available time.

Each special education class accommodated 5-9 students, and participation in the study was contingent upon obtaining majority parental approval. The intervention was implemented across 12 special education classes and administered to all students in the class, including both study participants and non-participating students. However, those not involved in the study did not take part in assessments.

During the pre-intervention, teachers of the intervention group received an individual instructional session on the EmotiPlay program (see Appendix 7) and were directed to schedule two 40-minute lessons per week for its administration. The research team was available for teachers throughout the program for technical and curricular queries. Every other week, a research assistant observed one of these lessons to ensure fidelity in implementation. The intervention commenced in December 2022 and concluded in June 2023. Twelve weeks into the program, the teachers underwent a second instructional session focused on teaching complex emotion units and addressing any queries or challenges that emerged in the first phase of the program. This guidance was conducted in a group meeting, facilitating peer learning and interaction.

4.1.6 Statistical Analysis

To evaluate the program’s effects, three sets of multilevel modeling (MLM) analyses were conducted using the lme4 package in R, accounting for the nested structure of children within classrooms and controlling for background characteristics (age, gender, WISC scores, SRS, and ABAS). For Hypothesis 1, MLMs assessed changes in children's performance on the emotion recognition, TEC, and ED tasks, testing for group × time interactions. Analyses included both emotions explicitly taught in the program and additional, untaught emotions to evaluate whether the intervention's effects generalized beyond the specific content covered. For Hypothesis 2, MLMs examined changes in social functioning using the four POPE task measures: positive initiatives, positive responses, engagement, and disengagement. Group × time interactions tested the program’s effect on real play - time. For Hypothesis 3, MLMs were conducted within the research group to explore whether children’s background characteristics moderate their improvement.

In addition, to assess the accessibility and feasibility of implementing the EmotiPlay program in a school setting, qualitative data were collected through teacher interviews. The data were analyzed using Braun and Clarke’s (2006) six-phase thematic analysis framework. This process involved familiarization with the transcripts, initial coding using Microsoft Word, and the development and refinement of themes through grouping and reviewing codes. To ensure trustworthiness, several strategies were employed, including member-checking, investigator and data triangulation, persistent observation, and a code-recode procedure.

Two researchers independently coded the data and resolved discrepancies through discussion. Transcripts were verified by an independent peer, and intra-coder reliability was assessed by re-coding after a three-month interval. Descriptions were used to support the transferability of findings

4.2 Results

4.2.1 Descriptive Statistics

Mean and SD of the children's performance on each of the evaluative measures (in percentage), at each time point, are presented in Table 6.

Table 6

*Mean and SD of Children’s Performance on Emotion Recognition, TEC, and ED and Social Functioning at Each Time Point*

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  |  | Time points | | | | |
|  | **Group** | **Pre-intervention** | |  | **Post-intervention** | |
| *Study measure* |  | ***M*** | ***SD*** |  | ***M*** | ***SD*** |
| Emotion Recognition | | | | | | |
| Taught emotions | Research (*n* = 59) | 67.43 | 13.51 |  | 74.39 | 12.55 |
|  | Control (*n* = 57) | 68.92 | 11.59 |  | 69.11 | 12.33 |
| Not- taught  emotions | Research (*n* = 59) | 57.97 | 14.27 |  | 64.83 | 13.58 |
| Control (*n* = 57) | 60.26 | 15.07 |  | 63.25 | 15.51 |
| Cognitive Empathy | | | | | | |
| TEC | Research (*n* = 59) | 76.92 | 11.42 |  | 82.81 | 7.81 |
|  | Control (*n* = 57) | 77.94 | 9.34 |  | 79.53 | 8.86 |
| Emotional Language1 | | | | | | |
| ED - Taught | Research (*n* = 54) | 38.58 | 27.15 |  | 55.25 | 25.71 |
| emotions | Control (*n* = 56) | 43.90 | 25.15 |  | 48.51 | 24.47 |
| ED – Not-taught  motions | Research (*n* = 54) | 25.46 | 25.00 |  | 40.28 | 28.31 |
| Control (*n* = 56) | 28.24 | 26.87 |  | 35.19 | 26.39 |
| Social functioning | | | | | | |
| PI | Research (*n* = 59) | 6.93 | 5.42 |  | 6.02 | 4.75 |
|  | Control (*n* = 57) | 6.60 | 5.17 |  | 6.40 | 5.22 |
| PR | Research (*n* = 59) | 7.46 | 5.16 |  | 6.29 | 4.53 |
|  | Control (*n* = 57) | 6.33 | 4.69 |  | 6.51 | 4.77 |
| Engaged | Research (*n* = 59) | 6.22 | 3.55 |  | 5.20 | 3.90 |
|  | Control (*n* = 57) | 5.72 | 3.63 |  | 5.53 | 3.33 |
| Unengaged | Research (*n* = 59) | 1.76 | 2.55 |  | 2.24 | 3.04 |
|  | Control (*n* = 57) | 2.18 | 2.62 |  | 2.04 | 3.00 |

**1**Applicablefor 110 participants.

***Note.*** ED – Emotion Definition, PI - Positive Initiative; PR **-** Positive Response

4.2.1 Children's Performance on EU Tasks

Hypothesis 1 predicted that autistic children in the research group would show greater improvement in emotion recognition, TEC, and ED tasks compared to the control group. The MLM results testing this hypothesis are presented below. To evaluate generalizability, performance comparisons in the emotion recognition and ED tasks included both emotions explicitly taught in the program and those that were not.

Since not all parents completed the SRS and ABAS questionnaires, and these variables served as explanatory factors in the MLM analyses, t-tests for two independent samples were conducted to determine whether the missing data from these parents was completely random. The results indicated no significant difference in children's performance on the emotion recognition, TEC, and ED tasks between parents who completed the SRS and ABAS and those who did not (see Supplementary A). This indicates that the missing data are completely random, and thus, we proceeded with the analysis among 103 autistic children who had complete data. Results are presented in Table 7 and illustrated in Figure 3.

Table 7

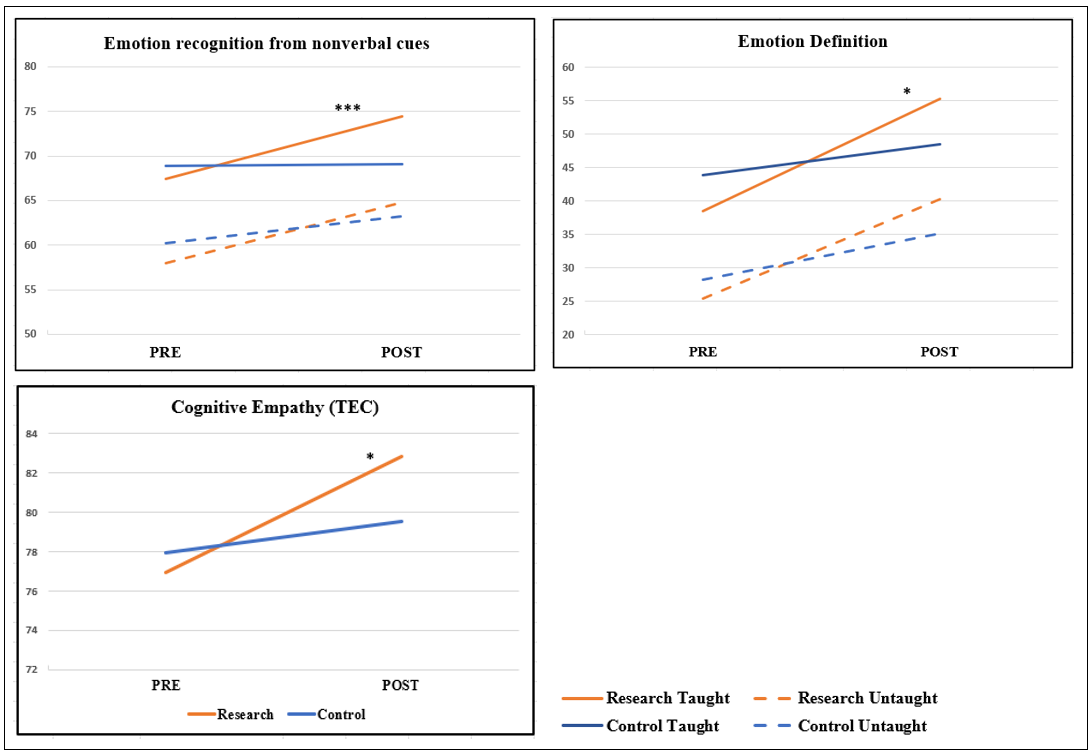
*MLM Results for Children's Performance on Emotion Recognition, TEC, and ED Tasks*

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | ***Emotion Recognition*** | | | | | | |  | ***Cognitive Empathy*** | | |  | ***Emotional Language*** | | | | | | |
|  | *Taught emotion* | | |  | *Not-taught emotion* | | |  | *TEC* | | |  | *Taught emotion* | | |  | *Not-taught emotion* | | |
|  | **B** | **SE.B** | **t** |  | **B** | **SE.B** | **t** |  | **B** | **SE.B** | **t** |  | **B** | **SE.B** | **t** |  | **B** | **SE.B** | **t** |
| ICC | 0.53 | | |  | 0.30 | | |  | 0.27 | | |  | 0.43 | | |  | 0.42 | | |
| Time | 6.54 | 1.45 | 4.52\*\*\* |  | 6.89 | 1.96 | 3.52\*\*\* |  | 5.93 | 1.28 | 4.65\*\*\* |  | 16.92 | 3.51 | 4.83\*\*\* |  | 13.06 | 3.51 | 3.73\*\*\* |
| Group | 7.04 | 3.73 | 1.89 |  | 5.21 | 4.99 | 1.05 |  | 3.81 | 3.19 | 1.20 |  | 14.95 | 8.74 | 1.71 |  | 6.90 | 8.63 | 0.80 |
| Time\*group | 6.11 | 2.08 | 2.94\*\*\* |  | 3.09 | 2.81 | 1.10 |  | 3.93 | 1.83 | 2.15\* |  | 10.67 | 4.96 | 2.15\* |  | 5.88 | 5.00 | 1.18 |
| Gender | 2.50 | 2.72 | 0.92 |  | 2.62 | 3.08 | 0.85 |  | 1.54 | 1.91 | 0.80 |  | 5.06 | 5.87 | 0.86 |  | 8.73 | 5.62 | 1.55 |
| Age | 4.63 | 1.38 | 3.35\*\*\* |  | 4.80 | 1.70 | 2.82\*\* |  | 3.66 | 1.04 | 3.52\*\*\* |  | 7.49 | 3.09 | 2.42\*\* |  | 11.51 | 2.92 | 3.94\*\*\* |
| Matrix | 0.95 | 0.31 | 3.07\*\*\* |  | 1.07 | 0.34 | 3.16\*\*\* |  | 0.29 | 0.21 | 1.38 |  | 1.72 | 0.66 | 2.61\*\* |  | 1.19 | 0.64 | 1.88 |
| Vocabulary | 0.96 | 0.36 | 2.66\*\* |  | 1.36 | 0.40 | 3.43\*\*\* |  | 1.25 | 0.25 | 5.04\*\*\* |  | 1.90 | 0.77 | 2.46\* |  | 3.39 | 0.74 | 4.57\*\*\* |
| ABAS-2 | 0.06 | 0.07 | 0.91 |  | 0.08 | 0.08 | 0.96 |  | 0.08 | 0.05 | 1.71 |  | -0.07 | 0.15 | 0.48 |  | 0.10 | 0.14 | 0.68 |
| SRS-2 | -0.19 | 0.12 | 1.61 |  | -0.08 | 0.13 | 0.65 |  | -0.07 | 0.08 | 0.83 |  | -0.11 | 0.25 | 0.45 |  | 0.00 | 0.24 | 0.00 |

\**p* < .05, \*\**p* < .01, \*\*\**p* < .001

Figure 3

*MLM Results for Children's Performance on Emotion Recognition, TEC, and ED Tasks*

\**p* < .05, \*\*\**p* < .001

The results of the MLM analyses indicate that, consistent with our hypothesis, a significant interaction effect of time and group was found for children's performance on learned emotion in the emotion recognition task, on the TEC task, and on learned emotion in the ED task. As presented in Figure 3, these significant interactions suggest that autistic children assigned to the research group showed greater improvement in their performance on learned emotion tasks in the emotion recognition and ED tasks, as well as on the TEC task, compared to the control group. No significant interaction was found for children's performance on unlearned emotion tasks in the emotion recognition and ED tasks.

Regarding children's background characteristics, age and vocabulary showed positive coefficients in explaining performance across all emotion recognition, TEC, and ED tasks. This indicates that older children and those with higher vocabulary test scores performed better on the emotion recognition, TEC, and ED tasks. Additionally, performance on the matrix test showed a positive coefficient in explaining performance on both learned and unlearned emotion tasks in the ER and on learned emotion tasks in the ED. This suggests that autistic children who performed better on the matrix test also performed better on the ER task and on learned emotion in the ED task. Finally, the screening tasks completed by parents (SRS and ABAS) did not contribute significantly to explaining children's performance on the emotion recognition, TEC, and ED tasks.

4.2.2 Children's Social Functioning

Hypothesis 2 predicated that autistic children assigned to the research group would show greater improvement in their social functioning compared to the control group. The MLM results for the four measures of the POPE task: positive initiative, positive response, engagement, and disengagement, are presented in Table 8.

Table 8

*MLM Results for Children's Social Functioning (POPE Task)*

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | *Positive initiative* | | |  | *Positive response* | | |  | *Engage* | | |  | *Unengaged* | | |
|  | **B** | **SE.B** | **t** |  | **B** | **SE.B** | **t** |  | **B** | **SE.B** | **t** |  | **B** | **SE.B** | **t** |
| ICC | 0.13 | | |  | 0.00 | | |  | 0.09 | | |  | 0.06 | | |
| Time | 1.26 | 0.89 | 1.42 |  | 1.30 | 0.90 | 1.45 |  | 1.26 | 0.64 | 1.99 |  | 0.57 | 0.50 | 1.14 |
| Group | 1.50 | 2.06 | .73 |  | 3.03 | 2.05 | 1.48 |  | 1.74 | 1.47 | 1.18 |  | 1.41 | 1.19 | 1.19 |
| Time\*group | 0.90 | 1.28 | .71 |  | 1.50 | 1.29 | 1.16 |  | 1.00 | 0.91 | 1.10 |  | 0.81 | 0.71 | 1.13 |
| Gender | 0.13 | 1.02 | .13 |  | 1.09 | 0.90 | 1.21 |  | 0.42 | 0.71 | .59 |  | -0.14 | 0.59 | .24 |
| Age | 0.29 | 0.51 | .56 |  | 0.15 | 0.45 | .33 |  | 0.18 | 0.36 | .50 |  | -0.15 | 0.33 | .47 |
| Matrix | 0.04 | 0.12 | .34 |  | 0.19 | 0.10 | 1.83 |  | 0.14 | 0.08 | 1.70 |  | -0.09 | 0.07 | 1.40 |
| Vocabulary | 0.31 | 0.14 | 2.29\* |  | 0.13 | 0.12 | 1.04 |  | 0.09 | 0.09 | .95 |  | -0.01 | 0.08 | .19 |
| ABAS | -0.01 | 0.03 | .32 |  | 0.00 | 0.02 | .16 |  | 0.00 | 0.02 | .13 |  | -0.01 | 0.02 | .96 |
| SRS | -0.11 | 0.04 | 2.45\* |  | -0.10 | 0.04 | 2.64\*\* |  | -0.05 | 0.03 | 1.61 |  | 0.03 | 0.02 | 1.32 |

\**p* < .05, \*\**p* < .01

MLM analyses showed no significant time-by-group interaction across all four POPE task measures. Among background characteristics, higher vocabulary test performance was associated with greater positive initiative, while higher parental SRS scores were linked to lower levels of positive initiative and positive response.

4.2.3 The Contribution of Background Characteristics in Explaining the Benefit from the Intervention

To examine Hypothesis 3, which explores whether any of the children's background characteristics contributes to explaining the benefit from the teacher-mediated EU program, additional MLM analyses were conducted exclusively within the research group. We examined which of the children's background characteristics (age, gender, cognitive abilities, adaptive functioning, and autism symptom severity) significantly interacted with time. Given that the research group demonstrated greater improvement in their performance on taught emotion measure in the emotion recognition and ED tasks, as well as on the TEC task compared to the control group, we focused this analysis specifically on these three measures. The MLM results for children's performance on emotion recognition, TEC, and ED (in percentage) among autistic children assigned to the research group are presented in Table 9.

Table 9

*MLM Results for Children's Performance on emotion recognition, TEC, and ED (%) Among Autistic Children in the Research Group*

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  |  | ***ER task*** | | |  | ***TEC*** | | |  | | ***ED task*** | | |
|  |  | *Taught emotion* | | |  | *TEC* | | |  | *Taught emotion* | | | |
|  |  | **B** | **SE.B** | **t** |  | **B** | **SE.B** | **t** |  | **B** | | **SE.B** | **t** |
| ICC |  | 0.52 | | |  | 0.23 | | |  | 0.46 | | | |
| Time\*Gender |  | -3.53 | 4.33 | .82 |  | -0.52 | 3.80 | .14 |  | -0.58 | | 9.79 | .06 |
| Time\*Age |  | 1.81 | 2.29 | .79 |  | 0.53 | 2.01 | .26 |  | 2.48 | | 5.51 | .45 |
| Time\*Matrix |  | -0.83 | 0.50 | 1.67 |  | 0.25 | 0.44 | .58 |  | 0.99 | | 1.11 | .89 |
| Time\*Vocabulary |  | 0.45 | 0.52 | .89 |  | -0.70 | 0.45 | 1.53 |  | -2.69 | | 1.18 | 2.29\* |
| Time\*ABAS |  | 0.07 | 0.20 | .36 |  | -0.02 | 0.18 | .13 |  | 0.27 | | 0.46 | .59 |
| Time\*SRS |  | 0.14 | 0.11 | 1.24 |  | -0.04 | 0.10 | .44 |  | 0.03 | | 0.24 | .13 |

\**p* < .05

***Note.*** ER – Emotion recognition; ED – Emotion definition

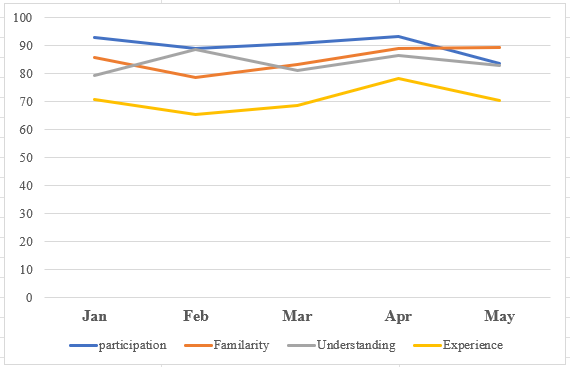
The results indicated that none of the background characteristics showed a significant interaction with time except for children's performance on the vocabulary test. Specifically, WISC-Vocabulary had a significant effect on intervention outcomes in the ED task for taught emotions (B = -2.69, SE.B. = 1.18, *t* = 2.29, *p* = .025). The negative coefficient suggests that children with lower vocabulary showed greater emotional vocabulary benefits from the teacher-mediated EU program

4.2.4 Implementation Results

4.2.4.1 Fidelity.The research team's assessment of the Quality of Implementation (QoI) revealed high scores across four key areas. The children's participation level received an average score of 90.06%, indicating strong engagement. Teachers' familiarity with the activities averaged 85.15%, reflecting a solid understanding of the program. The effort made by teachers to ensure all participants grasped the material received an average score of 83.84%. However, the lowest average score, 70.83%, was for how effectively teachers connected the material to students' individual experiences. Figure 4 illustrates the quality of program implementation by teachers from January to May, based on the four aspects.

Figure 4

Quality of Implementation Over Time (%)



Overall, the quality of the EmotiPlay program’s implementation by teachers remained stable throughout the process, with only minor fluctuations. This consistency suggests that teachers maintained steady and effective delivery, while student participation remained consistently high.

4.2.4.2 Usage rating profile - intervention revised (URP-IR). Teachers’ ratings on the URP-IR questionnaire at the conclusion of the intervention were consistently high in several key areas, including acceptability (*M* = 4.82, *SD* = .58), understanding (*M* = 5.10, *SD* = .39), feasibility (*M* = 4.79, *SD* = .46) and system climate (*M* = 5.05, *SD* = .28). However, ratings for system support were lower (*M* = 3.56, *SD* = 1.04). These findings indicate that the teachers viewed the intervention as highly usable for school implementation, considering it acceptable, understandable, and feasible, while perceiving a lesser need for additional system support.

4.2.4.3 Semi-structured Interviews. In addition to the quantitative results, teachers provided positive feedback on implementing the EmotiPlay program, describing it as practical, easy to integrate, and aligned with their educational goals. One teacher shared, “It was comfortable and enjoyable for me to deliver, and it greatly helps by saving hours of preparation”. Teachers also noted high student engagement, with many students eagerly anticipating lessons. One teacher reflected - “The children thoroughly enjoyed the lessons, participated actively, and were quite disappointed when they ended”. Another teacher added, “It was incredibly difficult for us when the program ended—they didn’t want it to stop”. These responses underscore the program’s potential to foster an engaging learning environment. while highlighting key strengths and challenges in implementing EmotiPlay across diverse classroom settings.

4.2.4.3.1 Strengths in Implementing the Program.

**Building Emotional Teaching Competence:** The program significantly enhanced teachers' ability to teach emotional understanding to autistic students, providing a structured approach to nonverbal cues and social contexts. This framework helped teachers gain confidence in conveying emotions effectively. As one teacher observed, "*It really helped me teach them how to respond and be more observant. For the staff, it provided a common language, guiding children to focus on facial expressions and cues.*” Another teacher added, “*The program was enlightening for me—I realized how much we need to explicitly teach these cues and be precise.*” Similarly, another teacher noted, “*The distinction between emotions helped us guide children to focus on facial features and cues.*” These insights highlight EmotiPlay's role in strengthening teachers' skills, offering a lasting toolkit for emotional education that can help shaping future teaching practices.

**Normalization of Emotional Dialogue:** According to teachers, the program fostered a shift in students’ approach to emotional experiences. Whereas they originally tended to avoid addressing others and their own emotional experiences, following the program they became more actively engaged in emotional discussions. This shift also helped transform classroom dynamics. Teachers observed that emotions became a more integrated part of conversations, with students showing improved abilities to express their feelings. One teacher illustrated this change: “*Talking about emotions used to be very difficult, especially around negative feelings. If a student was upset, they would withdraw. But now, I have students who talk about their emotions instead of running away—they no longer avoid confrontation with staff or peers*”.

The program helped normalize emotional dialogue, encouraging students to recognize and express their emotions comfortably. This shift not only expanded students' emotional vocabulary but also made emotional conversations a natural part of classroom life, advancing both their emotional development and social comfort.

4.2.4.3.2 Challenges in Implementing the Program

**Navigating heterogeneous classroom needs:**

While teachers were enthusiastic about using the EmotiPlay program in a group setting and appreciated its structured approach, they noted challenges due to the wide range of abilities in their classrooms. One teacher remarked, “*We needed to ensure that the more able children wouldn’t dominate and that those facing more challenges could still grasp the content*”. Another teacher added, “*Some children were less focused and simply mirrored others without full understanding, sometimes requiring individual attention*”. These reflections highlight the difficulty of meeting diverse needs in a single classroom, as teachers often had to adjust content individually, adding to their workload. Additionally, since the program was implemented as part of the overall classroom curriculum, some students who did not meet the study’s inclusion criteria, due to cognitive or language challenges, still participated in the lessons. While this holistic approach aimed to present the material to the entire class, it may have placed additional demands on teachers, and have consequently hindered the progress of the students who participated in the study.

4.3 Discussion

This study examined the effectiveness of EmotiPlay, a teacher-led, computerized program designed to enhance EU among autistic children. Utilizing a block randomized controlled trial within special education classes integrated into mainstream schools, the study found that children in the intervention group showed significant improvements in recognizing emotions from nonverbal cues, understanding other perspectives in various social contexts and using emotional language, compared to the control group of children who did not participate in the program. These findings support our first hypothesis that the intervention enhances aspects of emotional understanding and align with previous research demonstrating the efficacy of CBIs for developing social-emotional skills in autistic individuals (Fridenson-Hayo et al., 2017; Gev et al., 2017; Tang et al., 2019; Wang et al., 2025). Furthermore, the results provide novel evidence for the feasibility of implementing such programs in school settings under teacher facilitation. The positive outcomes of this teacher-mediated approach underscore its potential for broader implementation. Teachers’ familiarity with their students’ needs and their ability to adapt the program to the classroom environment likely contributed to its success. This approach addresses logistical and financial barriers often associated with clinic-based interventions, offering a scalable and accessible alternative. High levels of student participation and favorable social validity ratings from teachers further emphasize the program's acceptability and practicality. To our knowledge, this is the first study to demonstrate the feasibility of teachers implementing a computerized social-emotional intervention program for autistic children in special education classrooms, extending the scope of research in this field.

Although children in the intervention group demonstrated significant improvements in EU tasks related to the program content and were able to generalize the learned material to new contexts involving different people and activities, these gains did not extend to emotions that were not covered in the program or translate into broader social functioning, as observed during free-play time. This outcome contrasts with the second hypothesis, which anticipated that children in the intervention group would show improvements in their social functioning. This expectation was based on the presumed benefits of integrating the program within schools, a natural social environment that could potentially support the application of learned skills in real-world interactions (Hugh et al., 2021; Sutton et al., 2019). However, this finding aligns with previous research indicating that autistic individuals have specific challenges in transferring learned social-emotional skills to unstructured novel situations (Berggren et al., 2018). One potential explanation is the program's emphasis on teaching specific aspects of emotional understanding, rather than directly targeting broader social skills. Additionally, the program materials focused on five basic emotions and only two complex emotions, which require advanced cognitive processing and are critical for navigating nuanced social interactions (Chaidi & Drigas., 2020; Ekman, 1999). This limited scope may have hindered the program's impact on broader social behaviors. Furthermore, while the purpose of incorporating social-emotional learning in schools was to equip teachers with the tools to facilitate learning and support generalization in social contexts, these findings suggest a potential gap in the staff’s ability to integrate the program's material into settings beyond designated lesson times. These results highlight the need for future adaptations of EmotiPlay to incorporate explicit strategies for generalization, expand its focus on complex emotions and social interaction skills, and provide additional training for teachers to support its application in unstructured and dynamic social situations.

The analysis of individual differences in the intervention group indicated that the intervention's benefits were generally effective across a wide range of participants, regardless of their age, cognitive abilities, or adaptive functioning. This demonstrates the program's versatility and its potential to address the needs of diverse ASD populations. An exception was observed in the emotional language task, where children with lower vocabulary scores experienced greater improvements. This finding suggests that the program's structured approach may provide significant advantages for those with greater potential for growth in emotional language. Notably, our sample only included children with no intellectual disability (ID). The utility of the program in an ASD + ID sample should be examined in future studies.

Additional limitations include the absence of maintenance data, which precludes conclusions about the long-term effects of the intervention. The national security challenges disrupting school attendance during the study period also limited the opportunity to assess sustained benefits. Additionally, the gender imbalance in the sample reflects broader trends in ASD research (Barsotti et al., 2023; Loomes et al., 2017) but limits the ability to assess how interventions like EmotiPlay may impact autistic girls. Future studies should prioritize gender-balanced samples and consider the unique needs of underrepresented populations in ASD research.

4.3.1 Conclusions

This study offers valuable insights into the effectiveness and feasibility of implementing a computerized teacher-mediated intervention for autistic children. EmotiPlay has shown significant potential as a tool for enhancing EU in autistic children by leveraging technology to facilitate the structured and logical processing of social-emotional information. Notably, the program is designed to be accessible for ease of use by teachers in special education settings, making it an accessible and practical solution. The integration of social-emotional programs like EmotiPlay into the educational system holds substantial promise for advancing the emotional and social development of autistic children. These interventions not only benefit individual students but also contribute to fostering a more inclusive and supportive educational environment. By equipping teachers with effective tools and strategies, programs like EmotiPlay can improve educators’ confidence and ability to address the unique needs of neurodiverse learners, thereby positively influencing overall classroom dynamics.

However, for these interventions to achieve their full potential, continued refinement is essential. Expanding the program’s scope to include complex emotions and incorporate strategies for the generalization of skills to broader social contexts could enhance its impact. Moreover, further adaptations, such as additional training for educators and the inclusion of gender-balanced samples, are necessary to ensure these programs are effective across diverse populations.

5. General Discussion

The final chapter of this work will provide a summary of the key findings and delve deeper into the effectiveness of integrating a computerized EU intervention in special education classes for autistic students. Additionally, it will examine the clinical implications derived from the complete work and outline future directions for research and practical applications.

5.1 A Summary of the Study’s Main Findings

The current study aimed primarily to evaluate a computerized, teacher-mediated intervention designed to improve EU abilities in school-age autistic children (Chapter4). Additionally, it extended the understanding of the association between emotion recognition from nonverbal cues and social functioning among autistic children (baseline intervention study presented in Chapter 3).

Findings of baseline study suggest that emotion recognition alone is not sufficient to directly improve social functioning in autistic children, as its impact is mediated by cognitive empathy. Furthermore, emotional language plays a significant role in enhancing cognitive empathy, thereby further contributing to social functioning. Autistic children may rely more heavily on linguistic pathways to process emotional states, potentially contributing to reduced efficiency in social-emotional behaviors. These results highlight the importance of targeting emotion recognition, cognitive empathy, and emotional language in interventions designed to enhance social communication and adaptive social skills in this population.

The Intervention study evaluated the effectiveness of EmotiPlay, a computerized, teacher-mediated EU program, when implemented in a school setting. The results showed that autistic students who participated in the program demonstrated improved abilities in interpreting emotion recognition from non-verbal cues, cognitive empathy, and emotional language compared to control group of autistic students that maintained their routine special education program. However, these improvements did not significantly generalize to emotions not explicitly taught in the program or to broader social behaviors. Notably, the findings provide novel evidence supporting the feasibility of implementing such programs in school settings with teacher facilitation.

5.2 Implementation of EU Program in the Educational System

The challenges autistic individuals face in EU are well-documented in the research literature (Fridenson-Hayo et al., 2016; Lartseva et al., 2015; Todorova et al., 2019). These challenges lead to the development of numerous intervention programs across various platforms (Atkinson‐Jones & Hewitt, 2019; Sutton et al., 2019; Tang et al., 2019). This study adopts a unique ecological approach by combining the advantages of computerized systems with group practice within the children’s natural social setting: the school environment. Schools are where children and adolescents spend most of their time, making them essential not only for academic growth but also for fostering social and emotional development (Eccles & Roeser, 2015). Moreover, for autistic children, elementary schools frequently act as the main source of special education services and interventions (Kasari & Smith, 2013).

A substantial body of research demonstrates that young autistic students can develop social and emotional competencies through skill-based programs implemented in schools. These programs have been shown to increase both the frequency and duration of initiating and responding behaviors in elementary-aged autistic students (Dean & Chang., 2021; Sutton et al., 2019). However, educational interventions are often implemented outside the classroom through individualized sessions or small groups tailored to children’s abilities and delivered by external professionals (Sutton et al., 2019). While these approaches can lead to initial improvements, they may limit the continuity and generalization of learned skills to broader contexts (Goldberg et al., 2019). Excluding teachers who interact with the child daily and failing to equip them with the necessary tools to facilitate the transfer of acquired skills, may undermine the effectiveness of intervention approaches. Nevertheless, implementing a social-emotional program within the educational system, mediated by teachers, poses significant logistical and practical challenges. These challenges include high staff turnover, competing priorities within the school environment, and varying levels of teacher commitment to such initiatives. Furthermore, inconsistencies in teachers’ professional expertise, coupled with disparities in the quality and availability of classroom assistants, further complicate program integration process (Cramer, et al., 2021; Durlak, 2016). These challenges highlight the need for a comprehensive approach that addresses systemic limitations while leveraging the existing strengths of the educational framework.

The current study embraced the inherent conditions of the educational context, leveraging its strengths while addressing its constraints, and prioritized the active involvement of teachers as a central component of the implementation process. To achieve this, an important part of the study was the preliminary pilot study, which examined the alignment between the program and the educational framework. The pilot findings led to adjustments at both the program and staff levels. At the program level, cognitive and linguistic requirements were adjusted, and the nature of the activities in lessons and the pace of delivery were balanced and adapted. At the staff level, guidance and instructions were tailored for the teachers before and during the program. Operating within the constraints of the existing educational system provided an opportunity to explore scalable implementation. Embedding the program into the natural social environment of schools aligns with the broader goal of developing impactful and practical interventions for real-world educational settings.

The results of the intervention study highlight the benefits of integrating a computerized intervention program into special education classrooms for autistic children. Participants in the research group demonstrated significant improvements in the program's three key areas: emotion recognition, cognitive empathy, and emotional language. The EmotiPlay program was received with great enthusiasm and motivation from both teachers and students. Teacher feedback indicated that its integration into the educational framework was highly effective, both in terms of operational ease and alignment with educational objectives. Educators stressed the importance of research-based programs for teaching social-emotional skills to autistic children, noting the benefits of group classroom learning while acknowledging the challenges posed by the diverse functional abilities of students in special education classes for autistic children.

These findings advocate for incorporating such programs into school curricula and underscore the value of structured, evidence-based approaches to fostering social-emotional development in autistic children within inclusive educational settings. However, although the program showed promising outcomes in enhancing EU abilities, the evidence regarding its generalization was mixed.

5.3 Generalization in ASD

A primary measure of a program's success lies in its ability to promote generalization, the ability to apply learned skills in contexts beyond those in which they were initially taught. This includes transferring skills across different subjects, people, settings, behaviors, or times without requiring additional training in these new contexts (Stokes & Baer 1977). However, generalization tends to be particularly challenging for autistic individuals, especially in social-emotional contexts, which tend to be less structured and more context-dependent (Berggren et al., 2018; Neely et al., 2016). These challenges make generalization a central focus in autism intervention research (Gunning et al., 2019) which pursue effective strategies to support generalization within this population.

The EmotiPlay program was adapted to maximize its technological advantages alongside strategies to promote generalization. The program's technological components enable the breakdown of emotional concepts into small, manageable units, facilitating gradual and repetitive learning. The scenarios presented in the program feature diverse characters and varied social situations, further encouraging the transfer of skills across different contexts. These technological components were complemented by the unique adaptation in the current study, which tailored the program to the children’s social environment within the school setting. Incorporating stimuli from the natural environment is crucial for ensuring that skills practiced during the intervention phase can be flexibly applied in real-life contexts, empowering individuals to navigate a wide range of social situations ( Arnold-Saritepe et al., 2023). The current study examined two levels of generalization: proximal and distal transfer. This dual focus aimed to provide a comprehensive evaluation of the program’s effectiveness in promoting emotional and social competencies beyond the intervention’s scope. Results demonstrated that autistic students in the research group successfully achieved proximal-transfer generalization. They were able to apply taught skills to unfamiliar characters and novel social situations that were not directly practiced during the intervention. However, the findings did not indicate evidence of distal-transfer generalization. This refers to broader applications, such as improvements in recognizing and defining emotions not explicitly taught in the program or enhancements in social functioning, as observed during free-play time. This limitation is noteworthy, as an important goal of enhancing EU abilities and embedding practice within a social environment, such as the school system, is to improve social functioning, which is the broader challenge faced by autistic children:.

Several factors may account for the program's limited impact on social functioning. One explanation arises from the findings of the baseline study, which indicate that the relationship between emotion recognition and social functioning is mediated by emotional language and cognitive empathy, rather than being direct. While the program incorporates all three components of EU, it predominantly emphasizes recognition of non-verbal cues. Most activities focus on teaching students to identify non-verbal signals across various modalities, such as those demonstrated by actors in the program, children’s own expressions, and those of their peers. Cognitive empathy is mainly targeted in the two concluding activities of each lesson, while emotional language receives relatively little explicit attention, with concepts embedded within the material. This imbalance is evident in the intervention group's significant progress in emotion recognition, contrasted with significant, though less pronounced, improvements in cognitive empathy and emotional language. These findings underscore the need for a more balanced approach for all key aspects of EU to better support the improvement in social functioning.

Another explanation lies in the complex demands of real-world social interactions. Research has shown that while autistic individuals may perform well on standardized tests of cognitive empathy, they often struggle to apply these skills in dynamic social contexts (Morrison et al., 2020; Senju., 2013). Social interactions require the rapid and simultaneous processing of socially relevant information and the ability to adapt behavior to the social situation. These abilities are influenced by additional skills not included in the model presented in the baseline studyor addressed within the intervention program, such as emotion regulation and executive functioning. Emotion regulation, which enables individuals to manage emotional responses in social situations, and executive functioning, which is essential for goal-directed behavior and effective communication, may play significant roles in bridging the gap between emotion understanding and social abilities (Cibralic et al., 2019; Goldsmith & Kelley, 2018; Bottema‐Beutel et al., 2019).

5.4 Clinical Implications

Findings of the current study on the integration of the EmotiPlay intervention within the classrooms and involving the form teachers in its implementation yield several clinical implications.

Ecological approaches highlight the importance of extending interventions beyond the school environment, recognizing that children's development is influenced by interactions within their families, communities, and broader social systems. A prominent example of such an approach in education is the Whole School Approach (WSA), which aims to embed skill development into everyday interactions and routines through a collaborative effort involving all staff, teachers, families, and students (Zhou et al., 2025). The World Health Organization defines a WSA as involving coordination between three key components (Goldberg et al., 2019), namely: (i) curriculum, teaching, and learning; (ii) school ethos and environment; and (iii) family and community partnerships. Effective curriculum teaching and learning involve teaching skills through evidence-based programs, modeling social-emotional competencies, and providing continuous and consistent opportunities to practice these skills during everyday classroom situations, extending learning to the home and community contexts. According to this approach, improving the generalization of learned skills may therefore require a school-wide commitment that includes not only classroom teams but also other educational stakeholders and families. A broader, inclusive strategy can better support the transfer of competencies to various social contexts outside the classroom (Goldberg et al., 2019; Zhou et al., 2025).

These ecological principles have also been applied in interventions for autistic children, which emphasize the importance of engaging multiple systems in the educational process (Predescu et al., 2018). Studies among autistic children show that parental involvement enhances outcomes when integrated with school-based delivery (Azad et al., 2021). Moreover, a supportive school climate, particularly strong leadership, has been shown to enable educators to implement and sustain evidence-based practices (Melgarejo et al., 2020). Applying an ecological lens may therefore be especially valuable in promoting the generalization of social-emotional skills among autistic children. Considering this, future adaptations of the program should aim to extend its reach into the child’s broader environment. This could involve structured home-based activities, parent training, and intentional collaboration between families and schools in the shared goal of enhancing EU.

Another important clinical consideration involves expanding the scope of the intervention itself. While the EmotiPlay program effectively promotes EU within varied social contexts, it does not explicitly or systematically address social behavior. Although the program encourages reflection on appropriate responses to emotional scenarios, it lacks direct instruction and practice in social interaction skills. Therefore, it may be necessary to integrate structured social skills training (SST) components to complement the program. These components focus on teaching specific, practical social behaviors and have been shown to be effective for autistic children (Chester et al., 2019). While EmotiPlay promotes EU, this alone may not be sufficient to bring about behavioral change. For autistic children, combining EU with guided and repeated practice of social behaviors could provide the essential bridge to improved social functioning in everyday situations. Moreover, to further extend the reach of the program and ensure it benefits a wider range of students, the following future directions should be examined: (1) Applicability in older age groups: Expanding the program's focus to include EU of complex emotions, such as shame and pride, while balancing emotion recognition and cognitive empathy components, may better address the developmental and emotional needs of older students. (2) Inclusion of students with intellectual disabilities: Developing a platform that combines individual sessions with group practice could provide customized support for autistic students and comorbid ID, promoting both personalized learning and meaningful social inclusion.

Finally, learning new skills and generalizing them takes time, both for children and teachers. Shifting the focus of their work and the mediation they provide is a gradual process. In the current study, evaluations of long-term effects were not conducted due to the October 7th war during the final assessment period. Additionally, the program largely operated independently, with limited guidance provided to the teachers. Teacher feedback highlighted a significant need for greater support and underscored the importance of more comprehensive training and guidance, particularly in applying the program's content beyond the classroom. Providing ongoing support and professional development for educators, along with establishing clear guidelines for promoting behavioral changes in social situations, could significantly enhance the program's effectiveness.

5.5 Future Research Directions

The current findings provide a solid foundation for continued exploration into both the methodological design and practical application of computerized EU interventions for autistic children in school settings. Several avenues for future research can further enhance the development, evaluation, and implementation of such programs.

First, follow-up assessments conducted several months after the intervention would allow researchers to examine the long-term effects of the program. This is not only important for assessing the durability of EU gains but also for capturing delayed behavioral changes. Improvements in EU may require time to translate into observable shifts in social behavior and peer interactions (Gunning et al., 2019). Such longitudinal assessments are therefore essential for evaluating the full developmental trajectory and sustained impact of the intervention. Second, future studies should explore potential gender differences in response to the intervention. Research suggests that autistic girls have a unique manifestation of social-emotional profiles (Wood-Downie et al., 2021). These differences could influence how girls engage with and benefit from EU training, underscoring the importance of gender-sensitive evaluation and program adaptation. Moreover, given the 3:1 male-to-female ratio in autism diagnoses, most interventions were developed with boys in mind. This gender imbalance in research (Barsotti et al., 2023) underscores the need for gender-sensitive program design and evaluation.

A third direction involves using a comparison group that receives a non-technological version of EU intervention. This would help isolate the unique contribution of digital components and clarify whether technology adds measurable value to emotional and social learning outcomes.

Expanding the program’s reach to more diverse populations is another valuable research path. Specifically, adapting and testing the intervention with children who have ASD and comorbid intellectual disabilities could broaden its accessibility. Tailoring the program to accommodate a wider range of cognitive and communicative needs would increase its inclusivity and relevance across varied educational contexts.

Methodologically, integrating technology-based tools into the assessment protocol could yield more accurate and ecologically valid measures of emotional and social functioning. For example, video recordings of classroom or playground interactions could be analyzed using standardized behavioral coding systems or machine learning algorithms. These methods can detect subtle and dynamic patterns of social engagement that may not be captured through teacher ratings or standardized tests, offering a more comprehensive and objective picture of intervention outcomes.

Finally, combining the current EU program with SST may enhance its effectiveness (Bauminger-Zviely et al., 2020; Chester et al., 2019). Investigating how these two approaches work together could offer insights into optimizing support for autistic children across both emotional and social domains

5.6 Conclusion

In summary, EmotiPlay marks a significant step forward in the development of accessible and scalable interventions for autistic children. By integrating technology with educational practices, it offers a promising model for promoting EU and fostering inclusive, supportive learning environments for neurodiverse students.

6. References

Aal I.H., Weglarz‐Ward, J. M., & Sarisahin, S. (2022). Teaching social initiations to elementary ‐ aged children with autism: A systematic review. *Behavioral Interventions*, *37*(4), 1181-1205.‏ [DOI:10.1002/bin.1898](https://doi.org/10.1002/bin.1898)

Altschuler, M. R., Trevisan, D. A., Wolf, J. M., Naples, A. J., Foss-Feig, J. H., Srihari, V. H., & McPartland, J. C. (2021). Face perception predicts affective theory of mind in autism spectrum disorder but not schizophrenia or typical development. *Journal of Abnormal Psychology*, *130*(4), 413-422.‏ DOI:[10.1037/abn0000621](https://doi.org/10.1037/abn0000621)

American Psychiatric Association. (2022). *Diagnostic and statistical manual of mental disorders,* *(5th ed., text rev.; DSM-5-TR). American Psychiatric Publishing.* DOI:10.1176/appi.books.9780890425787

Andrés-Roqueta, C. & Katsos, N. (2017). The contribution of grammar, vocabulary and theory of mind in pragmatic language competence in children with autistic spectrum disorders. *Frontiers in Psychology*, *8*, 996.‏ DOI:10.3389/fpsyg.2017.00996

Arnold-Saritepe, A. M., Phillips, K. J., Taylor, S. A., Gomes-Ng, S., Lo, M., & Daly, S. (2023). Generalization and maintenance. In J. L. Matson (Ed.), *Handbook of applied behavior analysis for children with autism: Clinical guide to assessment and treatment* (pp. 415–433). Springer Nature Switzerland AG. [DOI:10.1007/978-3-031-27587-6\_21](https://psycnet.apa.org/doi/10.1007/978-3-031-27587-6_21)

Atkinson‐Jones, K., & Hewitt, O. (2019). Do group interventions help people with autism spectrum disorder to develop better relationships with others? A critical review of the literature. *British Journal of Learning Disabilities*, *47*(2), 77-90.‏  [DOI:10.1111/bld.12258](https://doi.org/10.1111/bld.12258)

Azad, G. F., Marcus, S. C., & Mandell, D. S. (2021). Partners in school: Optimizing communication between parents and teachers of children with autism spectrum disorder. *Journal of Educational and Psychological Consultation*, *31*(4), 438-462. [DOI:10.1080/10474412.2020.1830100](https://doi.org/10.1080/10474412.2020.1830100)

Bamicha, V., & Drigas, A. (2022). ToM & ASD: The interconnection of theory of mind with the social-emotional, cognitive development of children with autism spectrum disorder. The use

of ICTs as an alternative form of intervention in ASD. *Technium Social Science Journal*, *33*, 42-72.‏ [DOI:10.47577/tssj.v33i1.6845](https://doi.org/10.47577/tssj.v33i1.6845)

Barry, M.M., Clarke, A.M., & Dowling, K. (2017). Promoting social and emotional wellbeing in schools. *Health Education, 117*(5), 434–451. DOI:[10.1108/HE-11-2016-0057](http://dx.doi.org/10.1108/HE-11-2016-0057)

Barsotti, J., Mangani, G., Nencioli, R., Narzisi, A., Pfanner, L., Chilosi, A. M., Cipriani, P., Mancini, A., Cosenza, A., Tancredi, E. & Calderoni, S. (2023). Sex/Gender differences in the language profiles of Italian children with autism spectrum disorder: A retrospective study. *Journal of Clinical Medicine*, *12*(15), 4923.‏ DOI:10.3390/jcm12154923

Bauminger-Zviely, N., Eytan, D., Hoshmand, S., & Rajwan Ben–Shlomo, O. (2020). Preschool Peer Social Intervention (PPSI) to enhance social play, interaction, and conversation: Study outcomes. *Journal of Autism and Developmental Disorders*, *50*(3), 844-863. ‏DOI:10.1007/s10803-019-04316-2

Bauminger-Zviely, N., & Shefer, A. (2021). Naturalistic evaluation of preschoolers’ spontaneous interactions: The autism peer interaction observation scale. *Autism*, *25*(6), 1520-1535.‏  [DOI:10.1177/1362361321989919](https://doi.org/10.1177/1362361321989919)

Ben-Itzchak, E., Abutbul, S., Bela, H., Shai, T., & Zachor, D. A. (2016). Understanding one’s own emotions in cognitively-able preadolescents with autism spectrum disorder. *Journal of Autism and Developmental Disorders, 46* (7), 2363-2371.

DOI:[10.1007/s10803-016-2769-6](https://link.springer.com/article/10.1007/s10803-016-2769-6)

Ben-Itzchak, E., Kirzon, M., Peled, N., & Zachor, D. A. (2018). Coherence and content of relating emotions to life events in autism spectrum disorder and typical development: A cross-sectional age study. *Journal of Abnormal Child Psychology, 46*, 415-422. DOI: [10.1007/s10802-017-0302-9](https://doi.org/10.1007/s10802-017-0302-9)

Berggren, S., Fletcher-Watson, S., Milenkovic, N., Marschik, P. B., Bölte, S., & Jonsson, U. (2018). Emotion recognition training in autism spectrum disorder: A systematic review of challenges related to generalizability. *Developmental neurorehabilitation*, *21*(3), 141-154.‏  [DOI:10.1080/17518423.2017.1305004](https://doi.org/10.1080/17518423.2017.1305004)

Bishop-Fitzpatrick, L., Mazefsky, C. A., Eack, S. M., & Minshew, N. J. (2017). Correlates of social functioning in Autism Spectrum Disorder: The role of cognitive empathy. *Research in Autism Spectrum Disorders*, *35*, 25-34.‏ DOI:10.1016/j.rasd.2016.11.013

Bölte, S., Poustka, F., & Constantino, J. N. (2008). Assessing autistic traits: Cross‐cultural validation of the social responsiveness scale (SRS). *Autism Research*, *1*(6), 354-363.‏ DOI:10.1002/aur.49

Bottema‐Beutel, K., Kim, S. Y., & Crowley, S. (2019). A systematic review and meta‐regression analysis of social functioning correlates in autism and typical development. *Autism Research*, *12*(2), 152-175.‏ DOI: 10.1002/aur.2055

Baron-Cohen, S., Golan, O., Wheelwright, S., Granader, Y., & Hill, J. (2010). Emotion word comprehension from 4 to 16 years old: A developmental survey. *Frontiers in Evolutionary Neuroscience*, *2:*109. DOI:10.3389/fnevo.2010.00109

Bartsch, K., & Wellman, H. M. (1995). *Children talk about the mind* (1st ed.). Oxford University Press. DOIף10.1093/oso/9780195080056.001.0001

Braun, V., & Clarke, V. (2006). Using thematic analysis in psychology. *Qualitative research in psychology*, *3*(2), 77-101.‏ DOI:10.1191/1478088706qp063oa

Briesch, A. M., Chafouleas, S. M., Neugebauer, S. R., & Riley-Tillman, T. C. (2013). Assessing influences on intervention implementation: revision of the usage rating profile-intervention. *Journal of School Psychology*, *51*(1), 81–96.  [DOI:10.1016/j.jsp.2012.08.006](https://doi.org/10.1016/j.jsp.2012.08.006)

Camras, L. A., & Allison, K. (1985). Children's understanding of emotional facial expressions and verbal labels. *Journal of Nonverbal Behavior, 9*(2), 84–94. [DOI:10.1007/BF00987140](https://psycnet.apa.org/doi/10.1007/BF00987140)

Celeghin, A., Diano, M., Bagnis, A., Viola, M., & Tamietto, M. (2017). Basic emotions in human neuroscience: neuroimaging and beyond. *Frontiers in psychology*, *8*, 1432.‏ [DOI:10.3389/fpsyg.2017.01432](https://doi.org/10.3389/fpsyg.2017.01432)

Chafouleas, S. M., Briesch, A. M., Riley-Tillman, T. C., & McCoach, D. B. (2009). Moving beyond assessment of treatment acceptability: An examination of the factor structure of the Usage Rating Profile—Intervention (URP-I). School Psychology Quarterly, 24(1), 36–47. [DOI:10.1037/a0015146](https://psycnet.apa.org/doi/10.1037/a0015146)

Chaidi, I., & Drigas, A. (2020). Autism, expression, and understanding of emotions: Literature review.‏ *International Journal of Online Engineering, 16*(2), 94-111. DOI:[10.3991/ijoe.v16i02.11991](https://doi.org/10.3991/ijoe.v16i02.11991)

Chester, M., Richdale, A.L. & McGillivray, J. (2019). Group-based social skills training with play for children on the Autism Spectrum. *Journal of Autism and Developmental Disorders,* *49*, 2231–2242. DOI:10.1007/s10803-019-03892-7

Chiarotti, F., & Venerosi, A. (2020). Epidemiology of autism spectrum disorders: a review of worldwide prevalence estimates since 2014. *Brain sciences*, *10*(5), 274.‏ [[DOI:10.3390/brainsci10050274](https://doi.org/10.3390/brainsci10050274)](https://doi.org/10.3390/brainsci10050274)

Chiu, H.M., Chen, C.T., Tsai, C.H., Li, H.J., Wu, C.C., Huang, C.Y., Chen, K.L. (2023). Theory of mind predicts social interaction in children with autism spectrum disorder: A two-year follow-up study. *Journal of Autism and Development Disorder,53* (9). 3659-3669. DOI: [10.1007/s10803-022-05662-4](https://doi.org/10.1007/s10803-022-05662-4)

Cibralic, S., Kohlhoff, J., Wallace, N., McMahon, C., & Eapen, V. (2019). A systematic review of emotion regulation in children with autism spectrum disorder. *Research in Autism Spectrum Disorders*, *68*,1-21..‏ [DOI:10.1016/j.rasd.2019.101422](https://doi.org/10.1016/j.rasd.2019.101422)

Constantino, J. N., & Gruber, C. P. (2012). *Social Responsiveness Scale: SRS-2*.‏ Torrance, CA: Western Psychological Services.

Cramer, T., Ganimian, A., Morris, P., & Cappella, E. (2021). The role of teachers' commitment to implement in delivering evidence-based social-emotional learning programs. *Journal of School Psychology*, *88*, 85–100. DOI:10.1016/j.jsp.2021.08.003

Dash, B., & Davis, K. (2022). Significance of nonverbal communication and paralinguistic features in communication: A critical analysis. *International Journal for Innovative Research in Multidisciplinary Field*, *8*(4), 172-179.‏ DOI:[10.2015/IJIRMF/202204029](http://dx.doi.org/10.2015/IJIRMF/202204029)

de Marchena, A. B., Eigsti, I. M. & Yerys, B. E. (2015). Brief report: Generalization weaknesses in verbally fluent children and adolescents with Autism Spectrum Disorder. *Journal of Autism and Development Disorder, 45*, 3370–3376. DOI:10.1007/s10803-015-2478-6

Dean, M., & Chang, Y. C. (2021). A systematic review of school-based social skills interventions and observed social outcomes for students with autism spectrum disorder in inclusive settings. *Autism*, *25*(7), 1828-1843.‏ DOI:10.1177/13623613211012886

Delehanty, A. D., Stronach, S., Guthrie, W., Slate, E., & Wetherby, A. M. (2018). Verbal and nonverbal outcomes of toddlers with and without autism spectrum disorder, language delay, and global developmental delay. *Autism & Developmental Language Impairments*, *3,* 1-19. DOI:10.1177/2396941518764764

Denham, S.A. (2019). Emotional competence during childhood and adolescence*.* In V. LoBue, K. Pérez-Edgar, & K. A. Buss (Eds.), *Handbook of Emotional Development* (pp. 493–541). Springer. DOI:10.1007/978-3-030-17332-6\_20

Denham, S., Mason, T., Caverly, S., Schmidt, M., Hackney, R., Caswell, C., & DeMulder, E. (2001). Preschoolers at play: Co-socialisers of emotional and social competence.  *International Journal of Behavioral Development*, *25*(4), 290-301.‏ [DOI:10.1080/016502501143000067](https://psycnet.apa.org/doi/10.1080/016502501143000067)

Didehbani, N., Allen, T., Kandalaft, M., Krawczyk, D., & Chapman, S. (2016). Virtual reality cognitive empathy training for children with high functioning autism. *Computers in Human Behavior*, *62*, 703-711. DOI:10.1016/j.chb.2016.04.033

Dinstein, I., Solomon, S., Zats, M., Shusel, R., Lottner, R., Gershon, B. B., Meiri, G., Menashe, I. & Shmueli, D. (2024). Large increase in ASD prevalence in Israel between 2017 and 2021. *Autism Research*, *17*(2), 410-418.‏ [DOI:10.1002/aur.3085](https://doi.org/10.1002/aur.3085)

Dorris, L., Young, D., Barlow, J., Byrne, K., & Hoyle, R. (2022). Cognitive empathy across the lifespan. *Developmental Medicine & Child Neurology*, *64*(12), 1524-1531.‏ [DOI:10.1111/dmcn.15602](https://onlinelibrary.wiley.com/doi/10.1111/dmcn.15602)

Dovidio, J. F., & Banfield, J. C. (2015). Prosocial behavior and empathy. In J. D. Wright (Ed.): *International Encyclopedia of the Social & Behavioral Sciences* (2nd. Ed., pp. 216-220). [DOI:10.1016/B978-0-08-097086-8.24024-5](https://doi.org/10.1016/B978-0-08-097086-8.24024-5)

Dowdy, E., Twyford, J., & Sharkey, J. D. (2013). Methods of assessing behavior: Observations and rating scales. In D. H. Saklofske, C. R. Reynolds, V. L. Schwean, D. H. Saklofske, C. R. Reynolds, & V. L. Schwean (Eds.), *The Oxford handbook of child psychological assessment* (pp.623-650). Oxford University Press.

Duradoni, M., Gursesli, M. C., Fiorenza, M., Donati, A., & Guazzini, A. (2023). Cognitive empathy and the dark triad: A literature review. European Journal of Investigation in Health, Psychology and Education, 13(11), 2642-2680. DOI:10.3390/ejihpe13110184

Durlak, J. A. (2016). Programme implementation in social and emotional learning: basic issues and research findings. *Cambridge Journal of Education, 46*(3), 333-345, ‏ DOI: 10.1080/0305764X.2016.1142504

Durrleman, S., & Franck, J. (2015). Exploring links between language and cognition in autism spectrum disorders: Complement sentences, false belief, and executive functioning.  *Journal of Communication Disorders*, *54*, 15–31. DOI:10.1016/j.jcomdis.2014.12.001

Eccles, J. S., & Roeser, R. W. (2015). School and community influences on human development. In R. M. Lerner (Ed.), *Developmental science* (pp. 645–728). Psychology Press.

Eden, S., & Oren, A. (2021). Computer‐mediated intervention to foster prosocial ability among children with autism. *Journal of Computer Assisted Learning*, *37*(1), 275-286.‏  [DOI:10.1111/jcal.12490](https://doi.org/10.1111/jcal.12490" \t "_blank)

Eigsti, I. M., Stevens, M. C., Schultz, R. T., Barton, M., Kelley, E., Naigles, L., Orinstein, A., Troyb, E., & Fein, D. A. (2016).  Language comprehension and brain function in individuals with an optimal outcome from autism. *NeuroImage: Clinical*, *10*, 182-191.‏ DOI:[10.1016/j.nicl.2015.11.014](https://doi.org/10.1016/j.nicl.2015.11.014)

Eigsti, I. M., & Irvine, C. A. (2021). Verbal mediation of theory of mind in verbal adolescents with autism spectrum disorder. *Language Acquisition*, *28*(2), 195-213.‏

DOI: [10.1080/10489223.2021.1877705](https://doi.org/10.1080/10489223.2021.1877705)

Ekman, P. (1999). Basic emotions. In T. Dalgleish & M. J. Power (Eds.), *Handbook of Cognition and Emotion* (pp. 45–60). Wiley.

Escoffery, C., Lebow-Skelley, E., Udelson, H., Böing, E. A., Wood, R., Fernandez, M. E., & Mullen, P. D. (2019). A scoping study of frameworks for adapting public health evidence-based interventions. *Translational Behavioral Medicine*, *9*(1), 1-10.‏ DOI: 10.1186/s13012-018-0815-9

Feldman -Barrett, L. (2017). The theory of constructed emotion: an active inference account of interoception and categorization. *Social Cognitive and Affective Neuroscience*, *12*(1), 1-23.‏ [DOI:10.1093/scan/nsw154](https://doi.org/10.1093/scan/nsw154)

Ferman, S., & Segal, O. (2024). The face of autism in Israel. *Neuropsychiatric Disease and Treatment*, *20*, 1677–1692. DOI:10.2147/NDT.S466420

Fitzpatrick, P., Frazier, J. A., Cochran, D., Mitchell, T., Coleman, C., & Schmidt, R. C. (2018). Relationship between theory of mind, emotion recognition, and social synchrony in adolescents with and without autism. *Frontiers in Psychology*, *9*, 1337.‏ [DOI:10.3389/fpsyg.2018.01337](https://doi.org/10.3389/fpsyg.2018.01337)

Freeman, L. M., Locke, J., Rotheram-Fuller, E., & Mandell, D. (2017). Brief report: Examining executive and social functioning in elementary-aged children with Autism. *Journal of Autism and Developmental Disorders*, *47*(6), 1890–1895. DOI:10.1007/s10803-017-3079-3

Fridenson-Hayo, S., Berggren, S., Lassalle, A., Tal, S., Pigat, D., Bölte, S., Baron-Cohen, S., & Golan, O. (2016). Basic and complex emotion recognition in children with autism: Cross-cultural findings. *Molecular Autism*, *7*, Article 52).  [DOI:10.1186/s13229-016-0113-9](https://doi.org/10.1186/s13229-016-0113-9)

Fridenson-Hayo, S., Berggren, S., Lassalle, A., Tal, S., Pigat, D., Meir-Goren, N., O'Reilly, H., Ben-Zur, S., Bölte, S., Baron-Cohen, S., & Golan, O. (2017). EmotiPlay: a serious game for learning about emotions in children with autism: results of a cross-cultural evaluation. *European Child & Adolescent Psychiatry*, *26*(8), 979–992. DOI:10.1007/s00787-017-0968-0

Gates, J. A., Kang, E., & Lerner, M. D. (2017). Efficacy of group social skills interventions for youth with autism spectrum disorder: A systematic review and meta-analysis. *Clinical Psychology Review*, *52*, 164–181. [DOI:10.1016/j.cpr.2017.01.006](https://doi.org/10.1016/j.cpr.2017.01.006)

Gavazzi, I.G. & Ornaghi, V. (2011) Emotional state talk and emotion understanding: a training study with preschool children*. Journal of Child Language, 38*(5), 1124-1139. DOI:10.1017/S0305000910000772.

Gendron, M., & Feldman-Barrett, L. (2018). Emotion perception as conceptual synchrony.  *Emotion Review*, *10*(2), 101-110.‏ [DOI:10.1177/1754073917705717](https://doi.org/10.1177/1754073917705717)

Gev, T., Rosenan, R., & Golan, O. (2017). Unique effects of The transporters animated series and of parental support on emotion recognition skills of children with ASD: Results of a randomized controlled trial. *Autism Research*, *10*(5), 993–1003. [DOI:10.1002/aur.1717](https://doi.org/10.1002/aur.1717)

Gilmore, S., Frederick, L. K., Santillan, L., & Locke, J. (2019). The games they play: Observations of children with autism spectrum disorder on the school playground. *Autism*, *23*(6), 1343–1353. DOI:10.1177/1362361318811987

Golan, O., Ashwin, E., Granader, Y., McClintock, S., Day, K., Leggett, V., & Baron-Cohen,

S. (2010). Enhancing emotion recognition in children with autism spectrum conditions: An intervention using animated vehicles with real emotion-al faces. *Journal of Autism and Developmental Disorders,40*, 269–279. DOI: [10.1007/s10803-009-0862-9](https://doi.org/10.1007/s10803-009-0862-9)

Golan, O., Baron-Cohen S. (2006). Systemizing empathy: Teaching adults with Asperger

syndrome or high-functioning autism to recognize complex emotions using interactive multimedia. *Development and Psychopathology*;*18*(2), 591-617. DOI:10.1017/S0954579406060305

Golan, O., Sinai-Gavrilov, Y., & Baron-Cohen, S. (2015). The cambridge mindreading face-voice battery for children (CAM-C): Complex emotion recognition in children with and without autism spectrum conditions. *Molecular Autism*, *6*(1). DOI:10.1186/s13229-015-0018-z

Goldberg, J. M., Sklad, M., Elfrink, T. R., Schreurs, K. M., Bohlmeijer, E. T., & Clarke, A. M. (2019). Effectiveness of interventions adopting a whole school approach to enhancing social and emotional development: a meta-analysis. *European Journal of Psychology of Education*, *34*, 755-782.‏   [DOI:10.1007/s10212-018-0406-](https://doi.org/10.1007/s10212-018-0406-)9

Goldsmith, S. F., & Kelley, E. (2018). Associations between emotion regulation and social impairment in children and adolescents with autism spectrum disorder. *Journal of Autism and Developmental Disorders*, *48*, 2164-2173.‏ DOI:[10.1007/s10803-018-3483-3](https://doi.org/10.1007/s10803-018-3483-3)

Gray, S.A.O., Carter, A.S. (2013). Adaptive Behavior Assessment System, Second Edition. In F. R. Volkmar (Ed.),*Encyclopedia of Autism Spectrum Disorders.* Springer.  [DOI:10.1007/978-1-4419-1698-3\_223](https://doi.org/10.1007/978-1-4419-1698-3_223)

Griffiths., P.E. (1997) *What Emotions Really Are: The Problem of Psychological Categories*. University of Chicago Press. DOI**:** 10.7208/chicago/9780226308760.001.0001

Grosse, G., Streubel, B., Gunzenhauser, C.  & Saalbach, H. (2021). Let’s talk about emotions: The development of children’s emotion vocabulary from 4 to 11 years of Age. *Affective Science,2*, 150–162. DOI:10.1007/s42761-021-00040-2

Gunning, C., Holloway, J., Fee, B., Breathnach, Ó., Bergin, C. M., Greene, I., & Ní Bheoláin, R. (2019). A systematic review of generalization and maintenance outcomes of social skills intervention for preschool children with autism spectrum disorder. *Review Journal of Autism and Developmental Disorders*, *6*, 172-199.‏  [DOI:10.1007/s40489-019-00162-1](https://doi.org/10.1007/s40489-019-00162-1)

Hair, J. F., Black, W. C., Babin, B. J., & Anderson, R. E. (2010). *Multivariate data analysis: A global perspective* (7th ed.). Pearson Education.

Harrison, P., & Oakland, T. (2003). *Adaptive Behavior Assessment System (ABAS-II).* The Psychological Corporation.

Hayes, A. F. (2018). Partial, conditional, and moderated moderated mediation: Quantification, inference, and interpretation. *Communication Monographs*, *85*(1), 4-40.‏ [DOI: 10.1080/03637751.2017.1352100](https://doi.org/10.1080/03637751.2017.1352100)

Herlitz, L., MacIntyre, H., Osborn, T., & Bonell, C. (2020). The sustainability of public health interventions in schools: A systematic review. *Implementation Science*, *15*, 4, 1-28.‏ Doi:10.1186/s13012-019-0961-8

Hoyle, R.H. (1995) The structural equation modeling approach: Basic concepts and fundamental issues. In R. H. Hoyle (Ed.), *Structural Equation Modeling: Concepts, Issues, and Applications*, Sage Publications, Thousand Oaks, 1-15.

Hugh, M. L., Ahlers, K., Joshi, M., & Locke, J. (2021). School-implemented interventions for preschool to high school students with autism: an update on recent research. *Current Psychiatry Reports*, *23*, 1-11. DOI: [10.1007/s11920-021-01266-4](https://doi.org/10.1007/s11920-021-01266-4)

Itskovich, E., Zyga, O., Libove, R. A., Phillips, J. M., Garner, J. P., & Parker, K. J. (2021). Complex interplay between cognitive ability and social motivation in predicting social skill: A unique role for social motivation in children with autism. *Autism Research*, *14*(1), 86–92. DOI:10.1002/aur.2409

Jones, S. M., Barnes, S. P., Bailey, R., & Doolittle, E. J. (2017). Promoting social and emotional competencies in elementary school. *The Future of Children*, 49-72.‏ DOI:[10.1353/foc.2017.0003](http://dx.doi.org/10.1353/foc.2017.0003)

Jonsson, U., Choque Olsson, N., & Bölte, S. (2016). Can findings from randomized controlled trials of social skills training in autism spectrum disorder be generalized? The neglected dimension of external validity. *Autism*, *20*(3), 295-305.‏  [DOI:10.1177/1362361315583817](https://doi.org/10.1177/1362361315583817)

Kasari, C., Rotheram-Fuller, E., & Locke, J. (2005). *The development of the playground observation of peer engagement (POPE) Measure*. [Unpublished manuscript.],University of California Los Angeles.

Kasari, C., & Smith, T. (2013). Interventions in schools for children with autism spectrum disorder: Methods and recommendations. *Autism*, *17*(3), 254-267.‏  [DOI:10.1177/136236131247049](https://doi.org/10.1177/1362361312470496)6

Kauschke, C., van der Beek, B., & Kamp-Becker, I. (2016). Narratives of girls and boys with autism spectrum disorders: gender differences in narrative competence and internal state language. *Journal of Autism and Developmental Disorders*, *46*, 840-852.‏ [DOI:10.1007/s10803-015-2620-5](https://doi.org/10.1007/s10803-015-2620-5)

Khan, K., Hall, C. L., Davies, E. B., Hollis, C., Glazebrook, C. (2019). The effectiveness of web-based interventions delivered to children and young people with neurodevelopmental disorders: Systematic review and meta-analysis. *Journal of Medical Internet Research, 21* (11), e13478.  [DOI:10.2196/13478](https://doi.org/10.2196/13478).

Kline, R. B. (2005). *Principles and practice of structural equation modeling* (2nd ed.). The Guilford Press.

Koltcheva, N., & Popivanov, I. D. (2025). Development and validation of the children’s emotions database (CED): Preschoolers’ basic and complex facial epressions. *Children*, *12*(7), 816. [DOI: 10.3390/children12070816](https://doi.org/10.3390/children12070816)

Kostelnik, M. J., Soderman, A. K., Whiren, A. P., & Rupiper, M. (2016). *Guiding children's social development and learning*. Cengage Learning.‏

Kou, J., Yang, M., Wei, Z., & Lei, Y. (2023). The social motivation theory of autism spectrum disorder: Exploring mechanisms and interventions. *Advances in Psychological Science*, *31*(1), Article 20. DOI: [10.3724/SP.J.1042.2023.00020](https://doi.org/10.3724/SP.J.1042.2023.00020)

‏LaCava, P. G. (2007). *Social/emotional outcomes following a computer-based intervention for three Students with autism spectrum disorder* [Doctoral dissertation]University of Kansas.‏

Lane, J. D., & Bowman, L. C. (2021). How children’s social tendencies can shape their theory of mind development: Access and attention to social information. *Developmental Review, 61,* Article 100977. [DOI:10.1016/j.dr.2021.100977](https://psycnet.apa.org/doi/10.1016/j.dr.2021.100977)

Lartseva, A., Dijkstra, T., & Buitelaar, J. K. (2015). Emotional language processing in autism spectrum disorders: a systematic review. *Frontiers in Human Neuroscience*, *8,* 991.

Lee, C. S., Lam, S. H., Tsang, S. T., Yuen, C. M., & Ng, C. K. (2018). The effectiveness of technology-based intervention in improving emotion recognition through facial expression in people with autism spectrum disorder: A systematic review. *Review Journal of Autism and Developmental Disorders*, *5*, 91-104.‏  [DOI:10.1007/s40489-017-0125-1](https://doi.org/10.1007/s40489-017-0125-1)

Lemler, M. (2024). Discrepancy between parent report and clinician observation of symptoms in children with autism spectrum disorders. *Discussions*, *8*(2), Article 5. [DOI:10.28953/2997-2582.1145](https://doi.org/10.28953/2997-2582.1145)

Leung, F. Y. N., Sin, J., Dawson, C., Ong, J. H., Zhao, C., Veić, A., & Liu, F. (2022). Emotion recognition across visual and auditory modalities in autism spectrum disorder: A systematic review and meta-analysis. *Developmental Review*, *63*, 101000.‏ [DOI:10.1016/j.dr.2021.101000](https://doi.org/10.1016/j.dr.2021.101000)

Lindquist, K. A. (2017). The role of language in emotion: Existing evidence and future directions. Current Opinion in Psychology, 17, 135-139. [DOI:10.1016/j.copsyc.2017.07.006](https://psycnet.apa.org/doi/10.1016/j.copsyc.2017.07.006)

Locke, J., Shih, W., Kretzmann, M., & Kasari, C. (2016). Examining playground engagement between elementary school children with and without autism spectrum disorder.  *Autism*, *20*(6), 653-662.‏ [DOI:10.1177/1362361315599468](https://doi.org/10.1177/1362361315599468)

Loomes, R., Hull, L., Mandy, W.P.L. (2017). What is the male-to-female ratio in autism spectrum disorder? A systematic review and meta-analysis. *Journal of the American Academy of Child & Adolescent Psychiatry, 56*(6), 466-474. DOI:10.1016/j.jaac.2017.03.013.

Lopata, C., Thomeer, M. L., Rodgers, J. D., Donnelly, J. P., & McDonald, C. A. (2016). RCT of mind reading as a component of a psychosocial treatment for high-functioning children with ASD. *Research in Autism Spectrum Disorders, 21,* 25–36.

[DOI:10.1016/j.rasd.2015.09.003](https://doi.org/10.1016/j.rasd.2015.09.003)

Lord, C., Rutter, M., DiLavore, P. C., Risi, S., Gotham, K., & Bishop, S. (2012). *Autism Diagnostic Observation Schedule, 2nd Edition (ADOS-2).* Torrance: Western Psychological Services.

עד פה בדקתי מקורות

Maenner, M. J. (2023). Prevalence and characteristics of autism spectrum disorder among children aged 8 years—Autism and developmental disabilities monitoring network, 11 sites, United States, 2020. *Morbidity and Mortality Weekly Report. Surveillance Summaries*, *72*(2), 1-14.‏ [DOI:10.15585/mmwr.ss7202a1](http://dx.doi.org/10.15585/mmwr.ss7202a1)

Mao, S. Y., Chiu, H. M., Yu, Y. T., & Chen, K. L. (2023). The associations of theory of mind with both general and theory-of-mind-related social interaction in children with autism spectrum disorder. *Research in Autism Spectrum Disorders*, *102*, 102107.‏ [DOI:10.1016/j.rasd.2023.102107](https://doi.org/10.1016/j.rasd.2023.102107)

Marino, F., Chilà, P., Sfrazzetto, S. T., Carrozza, C., Crimi, I., Failla, C., Busà, M., Bernava, G., Tartarisco, G., Vagni, D., Ruta, L., & Pioggia, G. (2019). Outcomes of a robot-assisted social-emotional understanding intervention for young children with autism spectrum disorders. *Journal of Autism and Developmental Disorders, 50*(6), 1973–1987.  [DOI:10.1007/S10803-019-03953-X](https://doi.org/10.1007/S10803-019-03953-X)

May, K. E., Martino, M. A., & Kana, R. K. (2022). Emotional cognition, theory of mind, and face recognition in individuals with Autism and PDDs. In *Handbook of Autism and Pervasive Developmental Disorder: Assessment, Diagnosis, and Treatment* (pp. 113-133). Springer International Publishing.‏ DOI: 10.1007/978-3-030-88538-0\_5.

Melgarejo, M., Lind, T., Stadnick, N. A., Helm, J. L., & Locke, J. (2020). Strengthening capacity for implementation of evidence-based practices for autism in schools: The roles of implementation climate, school leadership, and fidelity. *American Psychologist*, *75*(8), 1105. ‏<DOI:10.1037/amp0000649>

Metcalfe, D., McKenzie, K., McCarty, K., & Pollet, T. V. (2019). Emotion recognition from body movement and gesture in children with Autism Spectrum Disorder is improved by situational cues. *Research in Developmental Disabilities, 86, 1–10.* DOI:*10.1016/j.ridd.2018.12.008*Mitchell, R. L., & Phillips, L. H. (2015). The overlapping relationship between emotion perception and theory of mind. *Neuropsychologia*, *70*, 1-10.‏ [DOI:10.1016/j.neuropsychologia.2015.02.018](https://doi.org/10.1016/j.neuropsychologia.2015.02.018)

Moens, M. A., Weeland, J., Van der Giessen, D., Chhangur, R. R., & Overbeek, G. (2018). In the eye of the beholder? Parent-observer discrepancies in parenting and child disruptive behavior assessments. *Journal of Abnormal Child Psychology*, *46*, 1147-1159.‏ DOI: [10.1007/s10802-017-0381-7](https://doi.org/10.1007/s10802-017-0381-7)

Mohammadzaheri, F., Koegel, L. K., Bakhshi, E., Khosrowabadi, R., & Soleymani, Z. (2021). The effect of teaching initiations on the communication of children with Autism Spectrum Disorder: A randomized clinical trial. *Journal of Autism and Developmental Disorders*, *52*(6), 2598–2609.. DOI:10.1007/s10803-021-05153-y

Moore, G., Campbell, M., Copeland, L., Craig, P., Movsisyan, A., Hoddinott, P. Littlecott, H., O’Cathain, A., Pfadenhauer, L., Rehfuess, E., Segrott, J., Hawe, P., Kee, F., Couturiaux, D., Hallingberg, B., & Evans, R. (2021). Adapting interventions to new contexts—the ADAPT guidance. *The* *BMJ*, *374*, n1679  [DOI:10.1136/bmj.n1679](https://doi.org/10.1136/bmj.n1679)

Morrison, K.E., DeBrabander, K.M., Jones, D.R., Ackerman, R.A., & Sasson, N.J. (2020). Cognitive empathy, social skill, and social motivation minimally predict social interaction outcomes for autistic and non-autistic adults. *Frontiers in Psychology, 11*, 591100. DOI:10.3389/fpsyg.2020.591100

Neely, L.C., Ganz, J.B., Davis, J.L.Boles, M.B., Hong, E.R., Ninci, J., & Gilliland, W.D. (2016). Generalization and maintenance of functional living skills for individuals with Autism Spectrum Disorder: A review and meta-analysis. *Review Journal of Autism Development Disorders, 3*, 37–47. DOI:10.1007/s40489-015-0064-7

Nook, E. C., Stavish, C. M., Sasse, S. F., Lambert, H. K., Mair, P., McLaughlin, K. A., & Somerville, L. H. (2020). Charting the development of emotion comprehension and abstraction from childhood to adulthood using observer-rated and linguistic measures. *Emotion, 20*(5), 773–792. [DOI:10.1037/emo0000609](https://psycnet.apa.org/doi/10.1037/emo0000609)

Ogren, M., & Sandhofer, C. M. (2022). Emotion words link faces to emotional scenarios in early childhood. *Emotion, 22*(1), 167–178. [DOI:10.1037/emo0001063](https://psycnet.apa.org/doi/10.1037/emo0001063)

O’Hearn, K., & Lynn, A. (2023). Age differences and brain maturation provide insight into heterogeneous results in autism spectrum disorder. *Frontiers in Human Neuroscience*, *16*, 957375.‏  [DOI:10.3389/fnhum.2022.957375](https://doi.org/10.3389/fnhum.2022.957375)

Øzerk, K., Özerk, G., & Silveira-Zaldivar, T. (2021). Developing social skills and social competence in children with autism. *International Electronic Journal of Elementary Education*, *13*(3), 341-363.‏ DOI:10.26822/iejee.2021.195

Pallathra, A. A., Calkins, M. E., Parish-Morris, J., Maddox, B. B., Perez, L. S., Miller, J., Gur, R. C., Mandell, D. S., Schultz, R. T., & Brodkin, E. S. (2018). Defining behavioral components of social functioning in adults with Autism Spectrum Disorder as targets for treatment. *Autism Research*, *11*(3), 488–502. DOI:10.1002/aur.1910

Pedreño, C., Pousa, E., Navarro, J. B., Pàmias, M., & Obiols, J. E. (2017). Exploring the components of advanced theory of mind in autism spectrum disorder. *Journal of Autism and Developmental Disorders*, *47*(8), 2401-2409.‏  DOI: [10.1007/s10803-017-3156-7](https://doi.org/10.1007/s10803-017-3156-7)

Peterson, C., Slaughter, V., Moore, C., & Wellman, H. M. (2016). Peer social skills and theory of mind in children with autism, deafness, or typical development. *Developmental Psychology, 52*(1), 46–57. [DOI:10.1037/a0039833](https://psycnet.apa.org/doi/10.1037/a0039833)

Pham, L. N., Lee, A. K., Estes, A., Dager, S., Hemingway, S. J., Thorne, J. C., & Lau, B. K. (2022). Comparing narrative storytelling ability in individuals with Autism Spectrum Disorder and fetal alcohol spectrum disorder. *medRxiv*, Article 22280501.‏ DOI:10.1101/2022.09.20.22280005

Pons, F. & Harris, P. (2000). *Test of Emotion Comprehension – TEC*. Oxford University Press .

Pons, F., Harris, P. L., & Doudin, P. A. (2002). Teaching emotion understanding. *European Journal of Psychology of Education*, *17*(3), 293-304.‏ <http://www.jstor.org/stable/23420425>

Predescu, M., Al Ghazi, L., & Darjan, I. (2018). An ecological approach of Autism Spectrum Disorders. *Journal of Educational Sciences*, *19*, 31-43.‏ DOI:[10.35923/JES.2018.2.03](http://dx.doi.org/10.35923/JES.2018.2.03)

Raamkumar, A. S., & Yang, Y. (2022). Empathetic conversational systems: A review of current advances, gaps, and opportunities. *IEEE Transactions on Affective Computing*, *14*(4), 2722-2739.‏ DOI: 10.1109/TAFFC.2022.3226693.

Radley, K. C., Dart, E. H., Brennan, K. J., Helbig, K. A., Lehman, E. L., Silberman, M., & Mendanhall, K. (2020). Social skills teaching for individuals with autism spectrum disorder: A systematic review. *Advances in Neurodevelopmental Disorders*, *4*, 215-226.‏

[DOI:10.1007/s41252-020-00170-x](https://doi.org/10.1007/s41252-020-00170-x)

Ramdoss, S., MacHalicek, W., Rispoli, M., Mulloy, A., Lang, R., & O’Reilly, M. (2012). Computer-based interventions to improve social and emotional skills in individuals with autism spectrum disorders: A systematic review. *Developmental Neurorehabilitation*, *15*(2), 119–135. DOI:10.3109/17518423.2011.651655

Ravid, D., & Egoz-Leibstein, T. (2012). Mental verbs in the Hebrew dictionary. *Chelkat Lashon*, *38,*224-241. [in Hebrew]

Rice, L. M., Wall, C. A., Fogel, A., & Shic, F. (2015). Computer-assisted face processing instruction improves emotion recognition, mentalizing, and social skills in students with ASD. *Journal of Autism and Developmental Disorders*, *45*(7), 2176–2186. [DOI:10.1007/S10803-015-2380-2](https://doi.org/10.1007/S10803-015-2380-2)

Riddell, C., Nikolić, M., Dusseldorp, E., & Kret, M. E. (2024). Age-related changes in emotion recognition across childhood: A meta-analytic review. *Psychological Bulletin, 150*(9), 1094–1117. DOI:10.1037/bul0000442

Ronchi, L., Banerjee, R., & Lecce, S. (2020). Theory of mind and peer relationships: The role of social anxiety. *Social Development*, *29*(2), 478-493.‏  [DOI:10.1111/sode.12417](https://doi.org/10.1111/sode.12417)

Rosello, B., Berenguer, C., Baixauli, I., García, R., & Miranda, A. (2020). Theory of mind profiles in children with autism spectrum disorder: Adaptive/social skills and pragmatic competence. *Frontiers in Psychology*, *11*, 567401. DOI:10.3389/fpsyg.2020.567401

Rueda-Gallego, P., Fernández-Berrocal, P., & Baron-Cohen, S. (2015). Dissociation between cognitive and affective empathy in youth with asperger syndrome.‏ *European Journal of Developmental Psychology, 12*(1), 85–98. [DOI:10.1080/17405629.2014.950221](https://dx.doi.org/10.1080/17405629.2014.950221)

Russo-Ponsaran, N. M., Evans-Smith, B., Johnson, J., Russo, J., & McKown, C. (2016). Efficacy of a facial emotion training program for children and adolescents with autism spectrum disorders. *Journal of Nonverbal Behavior*, *40*, 13-38.‏ DOI:10.1007/s10919-015-0217-5

Santillan, L., Frederick, L., Gilmore, S., & Locke, J. (2019). Brief report: Examining the association between classroom social network inclusion and playground peer engagement among children with Autism Spectrum Disorders. *Focus on Autism and Other Developmental Disabilities*, *34*(2), 91-96.‏ [DOI:10.1177/1088357619838275](https://doi.org/10.1177/1088357619838275)

Sasson, N. J., Morrison, K. E., Kelsven, S., & Pinkham, A. E. (2020). Cognitive empathy as a predictor of functional and social skills in autistic adults without intellectual disability. *Autism Research: Official Journal of the International Society for Autism Research, 13*(2), 259–270.  [DOI:10.1002/aur.2195](https://doi.org/10.1002/aur.2195)

Schlegel, K., Palese, T., Mast, M. S., Rammsayer, T. H., Hall, J. A., & Murphy, N. A. (2019). A meta-analysis of the relationship between emotion recognition ability and intelligence. *Cognition and Emotion*, *34*(2), 329–351. DOI:10.1080/02699931.2019.1632801

Schurz, M., Radua, J., Tholen, M. G., Maliske, L., Margulies, D. S., Mars, R. B., Sallet, J., & Kanske, P. (2021). Toward a hierarchical model of social cognition: A neuroimaging meta-analysis and integrative review of empathy and theory of mind. *Psychological bulletin*, *147*(3), 293–327. DOI:10.1037/bul0000303

Senju, A. (2013). Atypical development of spontaneous cognitive empathy in autism spectrum disorders. *Brain and Development*, *35*(2), 96-101.‏ [DOI:10.1016/j.braindev.2012.08.002](https://doi.org/10.1016/j.braindev.2012.08.002)

Siller, M., Swanson, M. R., Serlin, G., & Teachworth, A. G. (2014). Internal state language in the storybook narratives of children with and without autism spectrum disorder: Investigating relations to theory of mind abilities. *Research in Autism Spectrum Disorders*, *8*(5), 589-596.‏ [DOI:10.1016/j.rasd.2014.02.002](https://doi.org/10.1016/j.rasd.2014.02.002)

Smogorzewska, J., Szumski, G., & Grygiel, P. (2020). Theory of mind goes to school: Does educational environment influence the development of theory of mind in middle childhood?. *Plos One*, *15*(8), e0237524.‏ [DOI:10.1371/journal.pone.0237524](https://doi.org/10.1371/journal.pone.0237524)

Solari, E. J., Henry, A. R., McIntyre, N. S., Grimm, R. P., & Zajic, M. (2020). Testing the effects of a pilot listening comprehension and vocabulary intervention for individuals with autism. *Research in Autism Spectrum Disorders*, *71*, 101501.‏  [DOI:10.1016/j.rasd.2019.101501](https://doi.org/10.1016/j.rasd.2019.101501)

Soto-Icaza, P., Aboitiz, F., & Billeke, P. (2015). Development of social skills in children: neural and behavioral evidence for the elaboration of cognitive models. *Frontiers in neuroscience*, *9*, 333. DOI:10.3389/fnins.2015.00333

Steiger, J. H. (2007). Understanding the limitations of global fit assessment in structural equation modeling. *Journal of Personality and Individual Differences, 42*(5), 893–898.  [DOI:10.1016/j](https://doi.org/10.1016/j). paid.2006.09.017.

Stokes, T. F., & Osnes, P. G. (1989). An operant pursuit of generalization. *Behavior Therapy*, *20*(3), 337-355. [DOI:10.1016/S0005-7894(89)80054-1](https://doi.org/10.1016/S0005-7894(89)80054-1)

Sturrock, A., & Freed, J. (2023). Preliminary data on the development of emotion vocabulary in typically developing children (5-13 years) using an experimental psycholinguistic measure. *Frontiers in psychology*, *13*, Article 982676. DOI:10.3389/fpsyg.2022.982676.

Suhaimi, N. S., Mountstephens, J., & Teo, J. (2020). EEG-based emotion recognition: A state-of-the-art review of current trends and opportunities. *Computational Intelligence and Neuroscience*, 8875426.[DOI:10.1155/2020/8875426](https://doi.org/10.1155/2020/8875426)

Sundell, K., Beelmann, A., Hasson, H., & von Thiele Schwarz, U. (2016). Novel programs, international adoptions, or contextual adaptations? Meta-analytical results from German and Swedish intervention research. *Journal of clinical child and adolescent psychology: the official journal for the Society of Clinical Child and Adolescent Psychology, American Psychological Association, Division 53*, *45*(6), 784–796. DOI:10.1080/15374416.2015.1020540

Sutton, B. M., Webster, A. A., & Westerveld, M. F. (2019). A systematic review of school-based interventions targeting social communication behaviors for students with autism. *Autism*, *23*(2), 274-286.‏ DOI:10.1177/1362361317753564

Tager‐Flusberg, H., Paul, R., & Lord, C. (2005). Language and communication in autism. In F. R. Volkmar, R. Paul, A. Klin, & D. Cohen (Eds.)*, Handbook of autism and pervasive developmental disorders: Diagnosis, development, neurobiology, and behavior (3rd Ed., pp. 335–364). John Wiley.* DOI:10.1002/9780470939345

Tang, J. S., Chen, N. T., Falkmer, M., Bӧlte, S., & Girdler, S. (2019). A systematic review and meta-analysis of social emotional computer-based interventions for autistic individuals using the serious game framework. *Research in Autism Spectrum Disorders, 66*, 101412.‏  [DOI:10.1016/j.rasd.2019.101412](https://doi.org/10.1016/j.rasd.2019.101412)

Teh, E. J., Yap, M. J., & Rickard Liow, S. J. (2018). Emotional processing in autism spectrum disorders: Effects of age, emotional valence, and social engagement on emotional language use. *Journal of Autism and Developmental Disorders*, *48*(12), 4138–4154. DOI:10.1007/S10803-018-3659-X

Tenenbaum, H. R., Visscher, P., Pons, F., & Harris, P. L. (2016). Emotional understanding in Quechua children from an agro-pastoralist village. *International Journal of Behavioral Development*, *28*(5), 471–478. DOI:10.1080/01650250444000225

Todorova, G. K., Hatton, R. E. M. B., & Pollick, F. E. (2019). Biological motion perception in autism spectrum disorder: A meta-analysis. *Molecular Autism*, *10*(1). [DOI:10.1186/s13229-019-0299-8](https://doi.org/10.1186/s13229-019-0299-8)

Torng, P. C., & Sah, W. H. (2019). Narrative abilities of Mandarin-speaking children with and without specific language impairment: macrostructure and microstructure. *Clinical Linguistics & Phonetics*, *34*(5), 453–478. DOI:10.1080/02699206.2019.1655097

Trevisan, D. A., & Birmingham, E. (2016). Are emotion recognition abilities related to everyday social functioning in ASD? A meta-analysis. *Research in autism spectrum disorders*, *32*, 24-42.‏ [DOI:10.1016/j.rasd.2016.08.004](https://doi.org/10.1016/j.rasd.2016.08.004)

Vivanti, G. (2020) Ask the editor: What is the most appropriate way to talk about individuals with a diagnosis of autism?. *Journal of Autism and Developmental Disorders* *50,* 691–693. DOI:10.1007/s10803-019-04280-x

Vogindroukas, I., Stankova, M., Chelas, E. N., & Proedrou, A. (2022). Language and speech characteristics in Autism. *Neuropsychiatric Disease and Treatment,18*, 2367-2377.‏ DOI: [10.2147/NDT.S331987](https://doi.org/10.2147/NDT.S331987)

Wang, X., Auyeung, B., Pan, N., Lin, L. Z., Chen, Q., Chen, J. J., Liu, S. Y., Dai, M. X., Gong, J. H., Li, X. H., & Jing, J. (2022). Empathy, theory of mind, and prosocial behaviors in autistic children. *Frontiers in psychiatry*, *13*, 844578. [DOI:10.3389/fpsyt.2022.844578](https://doi.org/10.3389/fpsyt.2022.844578)

Wang, T., Ma, H., Ge, H., Sun, Y., Kwok, T. T., Liu, X., Wang, Y., Lau, W. K. W., & Zhang, W. (2025). The use of gamified interventions to enhance social interaction and communication among people with autism spectrum disorder: A systematic review and meta-analysis. *International journal of nursing studies*, *165*, 105037. Advance online publication. DOI: 10.1016/j.ijnurstu.2025.105037

Wechsler, D. (2003). *Wechsler intelligence scale for children–Fourth Edition (WISC-IV).* The Psychological Corporation.

Wellman, H. M. (2014). *Making minds: How theory of mind develops*. Oxford University Press.

Widen, S. C., & Russell, J. A. (2008). Young children’s understanding of other’s emotions. In M. Lewis, J. M. Haviland-Jones, & L. Feldman Barrett (Eds.), *Handbook of emotions* (3rd ed., pp. 348–363). Guilford Press.

Wolstencroft, J., Robinson, L., Srinivasan, R., Kerry, E., Mandy, W., Skuse, D. (2018) A systematic review of group social skills interventions, and meta-analysis of outcomes, for children with high functioning ASD. *Journal Autism Developmental Disorder;48*(7) 2293-2307. DOI:10.1007/s10803-018-3485-1.

Wood-Downie, H., Wong, B., Kovshoff, H., Mandy. W., Hull, L & Hadwin, J.A. (2021) Sex/Gender differences in camouflaging in children and adolescents with autism. *Journal of Autism Developmental Disorders, 51,* 1353–1364. DOI: 10.1007/s10803-020-04615-z

Zhang, Q., Wu, R., Zhu, S., Le, J., Chen, Y., Lan, C., Yao., S., Zhao, W., & Kendrick, K. M. (2021). Facial emotion training as an intervention in autism spectrum disorder: A meta‐analysis of randomized controlled trials. *Autism Research*, *14*(10), 2169-2182.‏   [DOI:10.1002/aur.2565](https://doi.org/10.1002/aur.2565" \t "_blank)

Zhang, M., Chen, Y., Lin, Y., Ding, H., & Zhang, Y. (2022). Multichannel perception of emotion in speech, voice, facial expression, and gesture in individuals with autism: A scoping review. *Journal of Speech, Language, and Hearing Research*, *65*(4), 1435-1449.  [DOI: 10.1044/2022\_JSLHR-21-00438](https://doi.org/10.1044/2022_JSLHR-21-00438)

Zhou, W., Taylor, L., Boyle, L., Funk, S., DeBorst, L., & De Neve, J-E. (2025). *Whole School Approach to Wellbeing in Childhood and Adolescence: Literature Review*. International Baccalaureate Organization

Appendix no. 1: Screenshots and Examples of EmotiPlay Activities

|  |  |
| --- | --- |
| 1. **Home Screen** | 1. **Lessons for each emotion** |
| 1. **Opening activity – From heart to heart** | |
| 1. **Screenshot from Animated videos** | |
| 1. **Interactive quiz** | |
| 1. **Individual practice** | |
| 1. **Group practice** | |
| 1. **Social scenes - Group discussion** | |

Appendix No. 2: Teachers’ Lesson Report – Pilot Study

#### **Lesson Details**

* **Unit No.:** \_\_\_\_\_\_
* **Lesson Topic:** Introduction, Facial Expression, Voice and Speech, Body Language

#### **Student Attendance**

* Were all the students present for the lesson? **Yes / No**
  + If not, please indicate which students were absent.

#### **Lesson Implementation**

* Were all activities in the lesson completed? **Yes / No**
  + If not, please describe which activities were not completed and explain why.
* Were the lesson guidelines clear to you? **Yes / No**
  + If not, please clarify which aspects were unclear.
* Were all the necessary materials provided for the lesson? **Yes / No**
  + If not, please mention what was missing.

#### **Technical Issues**

* Did you encounter any technical difficulties? **Yes / No**
  + If yes, please describe the type of issue.
* Did you upload data to the EmotiPlay program? **Yes / No**

#### **Student Engagement and Observations**

* Please describe the students' behavior during the lesson.

#### **Additional Notes and Suggestions**

* We appreciate any further comments or recommendations for improvement.

Appendix no. 3: The Teacher-Students EmotiPlay Guide

This guide, originally developed by Fridenson-Hayo et al. (2017) for parents of autistic children, has been adapted for special education teachers to support the administration of the program in a group setting. It is designed to provide an overview of the unique computerized EmotiPlay program, its objectives, and practical strategies for effectively implementing it in the classroom.

Children with autism spectrum disorder (ASD) often have difficulties correctly identifying the emotions expressed by another person or even noticing the changes in their moods. EmotiPlay aims to teach children to notice the non-verbal signs that characterize each emotion.

Emotions are characterized by a system of non-verbal cues, which together with the typical environmental context creates a unique combination for each emotion. Each emotion is characterized by facial expressions, vocal intonation and body language that accompany it. For example, when one is happy, they generally smile, their cheeks rise and small wrinkles form by their eyes. Usually, their voice becomes stronger, faster, and their tone changes quickly. When someone is happy, they typically turn towards the person with whom they are speaking and move quickly. Autistic children sometimes have difficulty expressing themselves that way, so people can correctly identify the emotional state they are in. The non-verbal signs they create when they are in an emotional state are often too small to notice, or to the contrary, exaggerated.

**Why are emotions important?**

The identification of the emotions of others and one’s own emotions is the first step in maintaining effective communication with the environment. When I correctly recognize what the other person is feeling I can reply in a manner appropriate to his current emotional state – a response he would perceive as acceptable. Similarly, when I learn to express my emotions in a manner easily identified by others, I increase my chances of being understood by them and getting from them a response appropriate to my needs.

Autistic children sometimes miss the clues to other’s emotions and thus act in a way that is perceived as odd and maladaptive by their surroundings. At times, the fact that children do not correctly interpret others’ emotions or do not understand the evolving social situation cause them to be exposed to situations in which they become the target of torment and ridicule.

Learning to identify the emotions of others and oneself is crucial to enhancing emotional moderation abilities and finding the suiting social response. For this reason – the work you will do with your students as part of EmotiPlay program will lay a vital and supporting foundation to all the future response he would perceive as acceptable.

**How was EmotiPlay built?**

Many teams around the world were involve in the development of EmotiPlay*,* including the leaders in studying and understanding ASD: Professor Simon Baron-Cohen from the Cambridge University in Great Britain, Professor Sven Bölte of the Karolinska institute in Sweden and Prof. Ofer Golan from Bar Ilan University. The Israeli Compedia company oversees the technical development of EmotiPlay as a computerized program.

EmotiPlay was originally designed as an individual practice to be conducted at home, and it was evaluated across three countries (Israel, Great Britain, and Sweden) among 6- to 9-year-old autistic children. The program was found to improve children's ability to recognize emotions from nonverbal cues and in various social contexts. However, the generalization of these skills to real-life social settings remained inconclusive. To address this, we adapted the program from a home-based individual intervention to a group-based, teacher-mediated format. As schools serve as the primary environment for children's social interactions and skill development, educational staff are uniquely positioned to customize the program for each child, considering classroom dynamics. Furthermore, they are well-equipped to help transfer the skills learned in lessons to broader social contexts.

The curriculum is structured progressively, with material presented in stages and broken down into smaller units to meet the high need for structure among autistic children. This approach leverages their enhanced capacity for systematic and organized learning. Each lesson combines interactive learning, individual practice, group activities, and class discussions, designed to align with the attentional characteristics common among autistic children.

EmotiPlay aims to achieve several therapeutic goals:

1. Teaching children about emotions - what they are and why they matter.
2. Familiarizing children with non-verbal emotional cues - such as facial expressions, vocal intonation, and body language - while encouraging them to focus on these signals.
3. Illustrating the context of emotions, including their causes and consequences.
4. Helping children acquire emotional and mental vocabulary and connecting these verbal concepts to their own personal experiences.

EmotiPlays storyline presents professor Zinkman and his assistant, Max, inviting the students to be explorers of emotions, and investigate together various emotional scenarios. The curriculum begins by introducing children to the concept of emotions and their significance. From there, each emotion is taught in its own dedicated unit, starting with basic emotions such as happiness, sadness, anger, fear, and surprise, before moving on to more complex emotions like shame, kindness, and unfriendliness. Within each lesson, four main components are included: 1. A short-animated video of the professor and Max to introduce lesson subject 2. Human actors’ videos/recordings to observe and explore the target emotion cues 3. Interactive activities designed for practicing emotional cues. For example, the teacher gives each child a small mirror and asks them to display a happy face and then an ecstatic expression. The teacher then photographs the children and uploads the photos to EmotiPlay. 4. Group discussions. For example: the children watch a short video depicting a social scenario with multiple characters, then discuss how each character might have felt in the situation and explore the reasons behind their emotions.

**Activities for Generalizing the Identification, Understanding, and Expression of Emotions**

As teachers to autistic students, you play an essential role in maximizing the therapeutic potential of EmotiPlay. The impact of this program goes beyond classroom lessons; your involvement in incorporating EmotiPlay’s objectives into daily interactions is crucial for students to apply their learning in real-world situations.

Everyday moments present valuable opportunities for reinforcing emotional understanding, as children are always experiencing some emotional state, which directly influences their behavior. Whether during a class activity, recess, or a quiet moment between tasks, students are constantly interacting with their surroundings and peers, providing numerous chances to practice identifying and expressing emotions.

For example, if a student seems frustrated while working on a task, this presents a chance to guide them through the process of recognizing their frustration. You might say, "It looks like you're feeling frustrated because this problem is challenging. Can you tell me what you're feeling right now?" This not only helps the child verbalize their emotions but also builds their ability to connect emotions with specific situations.

By consistently using these natural interactions to highlight emotional states and encourage verbal expression, you can significantly enhance the generalization of skills learned in EmotiPlay, helping students better navigate and understand their emotional world both inside and outside the classroom.

***General Guidelines:***

To administer the program in your class, you will need to schedule two lessons per week with the entire class. Each unit is divided into separate activities, organized by their order of administration. Detailed instructions for each activity are provided within the program. Additional prompts and resources can be found in a folder designated for each class.

1. Consider ***each child’s personal progression rate*** so that he will feel capable and successful on the one hand and won’t feel frustrated on the other. A significant advantage to administering the program in a classroom setting is peer learning, that enhances social interaction and enables students to model behaviors from their peers. This approach makes learning more engaging, offering a natural and supportive environment for both academic and social growth.
2. **Use Repetition –** It’s important to allow students to revisit steps if you notice the material is unclear. Watching animated videos or retaking the quizzes a second time can help reinforce their understanding of emotions and social interactions.
3. **Name and Mirror Emotions and Ask About Them –** Try to name emotions during daily routines in naturally occurring situations, addressing both the students' emotions and those of others. Increase the frequency of naming your own emotions and discuss the reasons and social situations that led to those emotions. (For example: “I felt frustrated earlier when we couldn’t start the lesson on time because the projector wasn’t working").
4. **Focus on non-verbal aspects of emotion –** turn your child’s attention to changes in the facial expressions, vocal intonation and body language he and the people surrounding him are exhibiting. Tie it into things learned in the program (For example: “Look at your classmate’s face. He looks bored because the activity is taking too long, just like the character we saw in the game when he wasn’t interested in the task").
5. **Point out the importance of the direction of the eyes and expression –** for example “Were you sad earlier? It’s easier for me to tell how you are feeling if you turn your expression towards me.” While a highly emotional event unfolds, whether it is positive or negative, your student isn’t available to work. This is not the right time to learn…the child is now *highly excited*. At that moment you can leave it at naming the emotion (“I see you are very excited”). Wait till your student calms down, and is available to listen to you, then remind him of the event and analyze it more deeply - what were the causes for the emotional outburst? (“I saw you were very insulted before…I think it was because you really wanted to play with the toy and Ariel wouldn’t share with you”), what in the child’s behavior helped you identify the emotion? (“I saw you were excited because you had a very big smile on your face, and you became very energetic and were jumping around from place to place”).
6. **Moderate your students’ emotional expressions**: sometimes your students express their emotions correctly, but they do it in a way too obvious or too obscure in comparison to most children their age. Help your students tune themselves better: In the case of vocal expressions, for example, you can use the metaphor of increasing and decreasing the volume like a radio or like the remote of a television set. You could even demonstrate increasing and decreasing the volume on the tv and at the same time increasing and decreasing the volume of your voice, talking more loudly and more softly accordingly. Practice is important and helpful – but it shouldn’t be overdone.

**We thank you for your participation in the study and hope you and your students benefit as much as possible from the therapeutic intervention we have created.**

Appendix No. 4: Adaptations to the Intervention Program Following the Pilot Implementation

Based on insights during the pilot study, several adaptations were made to improve the accessibility, engagement, and effectiveness of the intervention for elementary school students. The modifications are detailed below:

**1. Enhancing Accessibility Across Diverse Learning Levels**

1.1 Simplified Interactive Quizzes:

* The number of response options per question was reduced to three to simplify choices and minimize potential confusion.
* Question wording was simplified to enhance clarity and accessibility.
* The number of questions per quiz was reduced to five - six questions, to prevent cognitive overload and maintain student engagement.

1.2 Systematic Addition of Punctuation:

* Punctuation was added to all program content to support reading fluency and comprehension, particularly for younger learners or those with reading difficulties.

**2. Balancing Emotional Content Complexity**

* 1. Restructuring of the basic emotion units:
* Removal of the Introductory Lesson: The general introduction to basic emotions was removed to streamline the sequence. Each basic emotion (happiness, sadness, anger, fear, surprise) now includes three targeted lessons focusing on: facial expressions, tone of voice and speech, and body language
* Reintegration of Introductory Content: To preserve essential content from the original introduction, selected elements—including a short video, quiz, and one key activity—were integrated into the beginning of each emotion’s lesson sequence.
  1. New Summary Unit for Basic Emotions:
* An integrative summary unit was added following the basic emotions lessons. This unit includes two interactive quizzes that require recognizing various nonverbal emotional cues for all five basic emotions, preparing students for the transition to complex emotions.

2.3 Introduction to Complex Emotions:

* For the complex emotion unit, the introductory lesson was maintained to facilitate gradual learning and reinforce previously acquired skills.

**3. Optimizing Activity Design for Increased Engagement**

* 1. “From Heart to Heart” Emotional Check-In:
* A new activity was introduced at the start of each session - a brief check-in activity where the teacher engages students in a short discussion about how they are feeling. This activity has three key purposes:
  + Facilitates a smooth emotional transition from the regular school curriculum into the EmotiPlay program.
  + Encourages students to use emotional vocabulary by providing a consistent, supportive space for self-expression.
  + Allows for the recording of student attendance directly within the system, enabling the research team to track participation throughout the program.

3.2 Reduction and reorganization of core activities:

* The number of activities per lesson was reduced to better align with classroom time constraints and allow for a more focused instructional flow.
* Each core lesson now follows a consistent structure:
  + Animated Video to introduce key content.
  + Short comprehension quiz based on the video.
  + Two interactive quizzes focusing on emotional cue recognition, instead of three.
  + One individual practice activity
  + One group-based practice activity (e.g., role-play, drawing).
  + A class discussion.
  + A summary quiz.

Activities that were removed from the standard lesson sequence remain accessible in the system as optional resources; to provide teachers with flexible tools they could apply based on student needs. They included a third interactive quiz and worksheet-based cue recognition exercises.

Appendix no. 5: Lesson Summary Report – Research Team

Total number of activities delivered in the lesson: \_\_\_\_\_\_\_\_\_\_\_\_

Total duration of the lesson (in minutes): \_\_\_\_\_\_\_\_\_\_\_

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | Homeroom teacher | Co-teacher | Teaching assistant | Second teaching assistant | Additional educational staff |
| Delivery of content and activities |  |  |  |  |  |
| Computer operation |  |  |  |  |  |
| Personal support for students during the lesson |  |  |  |  |  |
| Distributing equipment and materials |  |  |  |  |  |
| Present but did not participate |  |  |  |  |  |

**Children's participation level in class**

1. Very low - where less than half of the students participated

2. Low - less than half of the children participated in some activities

3. Moderate - at least half of the children participated in most activities

4. High - most of the students in the class participated in most activities

5. Very high - where most students engaged in most activities.

**Teacher's familiarity with the activities**

1. Low - where the teacher struggled with implementing most activities and relied on written instructions.
2. Moderate – was familiar with most activities but needed to review the instructions for some during the lesson or was unsure how to deliver them.
3. High - the teacher was proficient in implementing all activities.

**The teacher's efforts to ensure understanding among all participants**

1. Very low - the teacher did not verify understanding for each student
2. Low – understanding of the material in the lesson was assessed only through the quizzes embedded in the program
3. Moderate – there were several questions that assessed each child's understanding specifically, aside from the quizzes
4. High - the teacher made at least three attempts to clarify the material for each child.

**The extent to which the teacher connected the material to students' personal experiences**

1. Low - There were no connections made between the material and the students' personal experiences
2. Slightly – connections to personal experiences were made only at the beginning of the lesson during the 'From Heart to Heart' activity
3. High – there were several instances where connections were made to personal experiences or feelings
4. Very high – the teacher made at least three attempts to connect the material to students' personal experiences

**Technical difficulties in delivering the lesson**

1. There were no technical difficulties at all
2. There were a few technical difficulties, but they did not disrupt the flow of the lesson
3. There were several technical difficulties that affected the flow of the lesson
4. There were significant technical difficulties that impacted on the delivery of the lesson

Appendix no.6: Usage Rating Profile-Intervention Revised (URP-IR)

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| מאוד מסכים/ה | מסכים/ה | מסכים/ה במידה מועטה | לא מסכים/ה במידה מועטה | לא מסכים/ה | מאוד לא מסכים/ה |  |
| 6 | 5 | 4 | 3 | 2 | 1 | 1. אמוטיפליי יעילה עבור מגוון קשיים לתלמידים עם אוטיזם |
| 6 | 5 | 4 | 3 | 2 | 1 | 1. אני זקוקה למקורות תמיכה נוספים ליישום של התכנית |
| 6 | 5 | 4 | 3 | 2 | 1 | 1. אני יכולה להקצות את הזמן המתאים ליישום התכנית |
| 6 | 5 | 4 | 3 | 2 | 1 | 1. אני מבינה איך להשתמש בתכנית |
| 6 | 5 | 4 | 3 | 2 | 1 | 1. קשר חיובי בין בית הספר והבית נחוץ ליישום של התכנית |
| 6 | 5 | 4 | 3 | 2 | 1 | 1. יש לי את הידע הנחוץ להעברת הפעילויות בתכנית |
| 6 | 5 | 4 | 3 | 2 | 1 | 1. התכנית מאפשרת הכלים טובים להתמודדות עם קשיים התנהגותיים של הילדים |
| 6 | 5 | 4 | 3 | 2 | 1 | 1. הזמן הכולל הדרוש ליישום התכנית אפשרי במסגרת תכנית הלימודים |
| 6 | 5 | 4 | 3 | 2 | 1 | 1. אני לא מעוניינת ביישום התכנית |
| 6 | 5 | 4 | 3 | 2 | 1 | 1. צוות הנהלת בית הספר יתמוך ביישום התכנית |
| 6 | 5 | 4 | 3 | 2 | 1 | 1. יש לי גישה חיובית ליישום התכנית בכיתה |
| 6 | 5 | 4 | 3 | 2 | 1 | 1. תכנית זו הינה דרך טובה להתמודדות עם קשיי התנהגות של התלמידים |
| 6 | 5 | 4 | 3 | 2 | 1 | 1. הכנת החומרים הדרושים לתכנית היתה מינימלית |
| 6 | 5 | 4 | 3 | 2 | 1 | 1. התכנית תואמת למטרות החינוכיות בכיתה |
| 6 | 5 | 4 | 3 | 2 | 1 | 1. שיתוף הפעולה של ההורים חיוני ליישום של התכנית |
| 6 | 5 | 4 | 3 | 2 | 1 | 1. יישום התכנית תואם למה שמצופה ממני בעבודתי כמחנכת |
| 6 | 5 | 4 | 3 | 2 | 1 | 1. החומרים הדרושים להעברת התכנית הינם הגיוניים |
| 6 | 5 | 4 | 3 | 2 | 1 | 1. יש לי מוטיבציה גבוהה ליישום את התנכית בכיתה |
| 6 | 5 | 4 | 3 | 2 | 1 | 1. התכנית הזו היתה מורכבת להעברת בצורה מדויקת |
| 6 | 5 | 4 | 3 | 2 | 1 | 1. פעילויות התכנית תואמות את הדרך שבה אנו מתנהלים בכיתה |
| 6 | 5 | 4 | 3 | 2 | 1 | 1. התכנית לא תפריע לתלמידים אחרים |
| 6 | 5 | 4 | 3 | 2 | 1 | 1. אני מחויבת להעביר את התכנית |
| 6 | 5 | 4 | 3 | 2 | 1 | 1. הפעיליות בתכנית מתשלבים בדרך העבודה בכיתה |
| 6 | 5 | 4 | 3 | 2 | 1 | 1. אני זקוקה לייעוץ ותמיכה להעביר את התכנית |
| 6 | 5 | 4 | 3 | 2 | 1 | 1. אני מבינה את ההליך של התכנית |
| 6 | 5 | 4 | 3 | 2 | 1 | 1. סביבת הכיתה הינה מעילה ליישום תכנית זו |
| 6 | 5 | 4 | 3 | 2 | 1 | 1. הזמן הדרוש לתיעוד בתכנית הינו הגיוני |
| 6 | 5 | 4 | 3 | 2 | 1 | 1. תקשורת שוטפת בין הבית ובית הספר דרושה ליישום של התנכית |
| 6 | 5 | 4 | 3 | 2 | 1 | 1. אני זקוקה להכשרה מקצועית נוספת כדי ליישם את התכנית |

Appendix no. 7: Semi-structured Interviews with Educational Staff

1. Can you share your experience with delivering the program in your classroom?
2. How did the students engage with the computerized program, and what was their overall response?
3. Have you observed any changes in the students' ability to identify and understand emotions? If yes, could you share some examples?
4. Have you observed any changes in the students' social skills? If yes, could you provide some examples?
5. Would you recommend incorporating EmotiPlay program into other special education classes for autistic students, why or why not?

# Hebrew Abstract

תקציר

**רקע מדעי**

אוטיזם היא תסמונת נוירו-התפתחותית מתמשכת, ומתאפיינת באתגרים משמעותיים בתקשורת חברתית, דפוסי התנהגות נוקשיים וחזרתיים ורגישות חושית. מחקרים שנערכו באוכלוסייה אוטיסטית מצביעים על אתגרים נרחבים בהבנה רגשית המתבטאים בקשיים בזיהוי רגשות מרמזים לא מילוליים, הבנת מצב רגשי ומנטלי של אדם אחר - קרי, אמפתיה קוגניטיבית, ובשימוש מופחת בשפה רגשית. ממצאים באוכלוסיה נוירוטיפיקלית מציעים קשר פוטנציאלי בין יכולת זיהוי רגשות לבין תפקוד חברתי, קשר שעשוי להיות מתווך דרך שפה רגשית ואמפתיה קוגניטיבית. עם זאת, קשר זה טרם נבדק בקרב ילדים אוטיסטים. לפיכך, מטרתה הראשונה של עבודה זו היא לבחון כיצד יכולת זיהוי רגשות תורמת לתפקוד חברתי יעיל בקרב ילדים אוטיסטים , דרך תיווך של שפה רגשית ואמפתיה קוגניטיבית.

במהלך השנים פותח מגוון רחב של תוכניות התערבות לשיפור כישורים רגשיים-חברתיים בקרב אנשים אוטיסטים. בשנים האחרונות, התערבויות מבוססות מחשב זוכות לעניין גובר, בשל יכולתן לפרק, להנגיש ולהבהיר את המורכבות של העולם החברתי-רגשי. גישה שיטתית זו מתאימה במיוחד לסגנונות הלמידה המאפיינים ילדים אוטיסטים. מחקרים עדכניים מצביעים על כך שהתערבויות ממוחשבות עשויות לתרום לשיפור משמעותי בהבנה הרגשית ובזיהוי רגשות. עם זאת, רוב התוכניות הקיימות מתמקדות בעיקר בזיהוי רגשות דרך הבעות פנים, תוך התעלמות מרמזים לא מילוליים חשובים נוספים כגון שפת גוף וטון דיבור. בנוסף, רבות מהתוכניות שמות דגש על זיהוי רגשות "בסיסיים" בלבד (שמחה, עצב, פחד, כעס, גועל והפתעה) וממעטות לעסוק ברגשות "מורכבים" יותר (כגון אכזבה, בושה, גאווה) הדורשים עיבוד קוגניטיבי של מצבים מנטליים וסוציאליים מורכבים. על מנת לתת מענה לפערים אלו, נעשה שימוש בתכנית EmotiPlay, תכנית ממוחשבת שנועדה ללמד זיהוי רגשות דרך האופנויות השונות: הבעות פנים, שפת גוף וטון דיבור. התכנית מתייחסת הן לרגשות בסיסיים והן לרגשות מורכבים. התוכנית עברה תיקוף בין-תרבותי רחב שהצביע על יעילותה בקרב ילדים אוטיסטים. עם זאת, בדומה לרבות מהתערבויות הטכנולוגיות, EmotiPlay פותחה במקור לשימוש פרטני, דבר שעשוי להגביל את ההכללה של מיומנויות רגשיות-חברתיות הנרכשות בה אל מצבים חברתיים בפועל .שילוב תכניות מסוג זה בהקשרים חברתיים טבעיים של הילדים, כגון מערכת החינוך, עשוי להגביר את השפעתן, באמצעות מתן הזדמנויות לתרגול ויישום של הכישורים הנלמדים בקרב קבוצת השווים ובסביבה אותנטית. בהתאם לכך, המטרה השנייה של עבודה זו היא בחינת יעילותה של גרסה בהנחיית מורים של תכנית EmotiPlay בשיפור זיהוי רגשות, אמפתיה קוגניטיבית, שפה רגשית ותפקוד חברתי בקרב ילדים אוטיסטים הלומדים בכיתות תקשורת.

המחקר כלל שלושה חלקים:

(1) **מחקר חלוץ** - שמטרתו היתה לבחון את ההתאמה של תכנית EmotiPlay להנחיית המורים ביישום בכיתות תקשורת.

(2) **מחקר קדם התערבות** - בחינת המסלול המקשר בין זיהוי רגשות לתפקוד חברתי דרך שפה רגשית ואמפתיה קוגניטיבית בקרב ילדים אוטיסטים.

(3) **מחקר ההתערבות** – בחינת יעילותה של תוכנית EmotiPlay בגרסה מותאמת להנחיית מורים, בהקשר של שיפור הבנת רגשות ותפקוד חברתי בקרב תלמידים אוטיסטים הלומדים בכיתות תקשורת.

**שאלות המחקר**

**מחקר חלוץ:**

1. באיזו מידה הגרסה המותאמת של תכנית EmotiPlay משתלבת באופן יעיל ונגישה ליישום במסגרת מערכת החינוך?
2. האם כלי ההערכה שנבחרו מתאימים למדידת היעילות של התוכנית?

**מחקר קדם התערבות:**

1. מהו המנגנון דרכו יכולת זיהוי רגשות תורמת לאינטראקציות חברתיות בקרב ילדים אוטיסטים?
2. מהו תפקידן של שפה רגשית ואמפתיה קוגניטיבית כמשתנים מתווכים בקשר בין זיהוי רגשות לתפקוד חברתי בקרב ילדים אוטיסטים?

**מחקר ההתערבות:**

1. באיזו מידה תוכנית התערבות ממוחשבת להבנת רגשות, בהנחיית מורים, תורמת לשיפור הבנת רגשות ותפקוד חברתי בקרב תלמידים אוטיסטים בכיתות תקשורת?
2. באיזו מידה משתנים אינדיבידואליים, כגון גיל, יכולות קוגניטיביות וכישורי שפה, משפיעים על מידת יעילות תוכנית EmotiPlay בשיפור הבנת רגשות ותפקוד חברתי?
3. עד כמה יישומית ויעילה תוכנית EmotiPlay במסגרת מערכת החינוך?

**השערות המחקר**

**מחקר קדם התערבות:**

* יימצא קשר חיובי בין מדדי הבנת רגשות למדדי תפקוד חברתי, כך שציונים גבוהים בזיהוי רגשות, אמפתיה קוגניטיבית ושפה רגשית ינבאו תפקוד חברתי גבוה יותר, כפי שייבחן באמצעות תצפיות בזמן משחק חופשי ודיווחי הורים.
* הקשר בין זיהוי רגשות לתפקוד חברתי יתווך באמצעות שפה רגשית ואמפתיה קוגניטיבית, תוך שליטה על גיל, יכולות קוגניטיביות ורמת מאפייני האוטיזם.

**מחקר ההתערבות:**

* ילדים אוטיסטים שישתתפו בתוכנית EmotiPlay יפגינו שיפור בזיהוי רגשות מרמזים לא מילוליים, באמפתיה קוגניטיבית ובשפה רגשית, בהשוואה לקבוצת הביקורת של ילדים אוטיסטים שתמשיך בתוכנית הלימודים הרגילה.
* ילדים אוטיסטים שישתתפו בתוכנית EmotiPlay יפגינו שיפור בתפקוד החברתי במהלך משחק חופשי, בהשוואה לקבוצת הביקורת.
* השפעת תוכנית ההתערבות תהיה תלוייה במאפיינים אישיים של הילדים, כגון גיל, יכולות קוגניטיביות וכישורי שפה.

**שלבי המחקר ותוצאות**

במסגרת **מחקר החלוץ** הוערכה האינטגרציה והנגישות של תכנית ההתערבות בתיווך מורים בסביבה בית -ספרית, ונבדקה היתכנות מדדי ההערכה.

המחקר נערך בחמש כיתות תקשורת, המשולבות בבתי ספר רגילים וכלל 24 ילדים אוטיסטים (4 בנות), בגיל 7-10 (*M* = 9.12, *SD* = 1.21), שהושוו ל-19 ילדים ללא אוטיזם (3 בנות), בגיל 7-9 (*M* = 7.92, *SD* = 0.83). הקבוצות היו ברות השוואה מבחינת מגדר ויכולות קוגניטיביות ומילוליות. הילדים עברו הערכה מקיפה שכללה מטלה של זיהוי רגשות מרמזים לא-מילוליים בשלושת האופנויות, מטלת אמפתיה קוגניטיבית, ושתי מטלות לשפה רגשית. בנוסף, התנהגות פרו - חברתית נצפתה במהלך זמן משחק חופשי. לאחר מכן, תלמידים בכיתות התקשורת השתתפו בגרסה מקוצרת של EmotiPlay בהנחיית המורה, שכללה 16 שיעורים שהועברו במהלך שלושה חודשים. נתונים נאספו באמצעות תצפיות דו-שבועיות על השיעורים, וכן דיווחים וראיונות עם המורים.

ממצאי המחקר הראו כי התוכנית זכתה למשוב חיובי מאוד מצד הצוות החינוכי והתלמידים כאחד. עם זאת, הוצעו מספר שינויים על מנת לשפר את התאמת התוכנית לטווח הגילאים ורמות התפקוד המגוונות של התלמידים. שינויים אלו כללו הפחתת הדרישות המילוליות והקוגניטיביות, כמו גם התאמת התוכן הרגשי. בנוסף, מרבית המדדים להערכת הבנת רגשות ותפקוד חברתי נמצאו כמדדים יעילים, והדגישו פערים משמעותיים בין משתתפים אוטיסטיים למשתתפים שאינם אוטיסטיים. עם זאת, משימת הסיפור, שנועדה להערכת שפה רגשית, נמצאה פחות מתאימה למטרה זו.

בהתבסס על ממצאי מחקר הפיילוט, שסללו את הדרך להערכת ההתערבות בהיקף מלא, תכנית EmotiPlay הותאמה ליישום בבתי הספר. בנוסף, הוחלט כי שפה רגשית תוערך דרך משימת הגדרת רגשות בלבד.

בהמשך, **מחקר קדם התערבות** בחן את הקשר בין זיהוי רגשות מתוך רמזים לא-מילוליים לתפקוד חברתי בפועל אצל ילדים אוטיסטים, תוך התמקדות בתפקידים המתווכים של שפה רגשית ואמפתיה קוגניטיבית. לשם כך נעשה שימוש בנתוני הבסיס של מחקר ההתערבות, שנאספו בקרב 116 ילדים אוטיסטים (17 בנות), בגיל 7-10 (*M* = 8.26, *SD* = 0.76). המשתתפים עברו הערכה שכללה משימות להערכת זיהוי רגשות דרך האפנויות השונות, אמפתיה קוגניטיבית ושפה רגשית. התפקוד החברתי הוערך באמצעות תצפיות במהלך משחק חופשי וכן דיווחי הורים.

תוצאות ניתוח הנתיבים הראו כי הקשר בין זיהוי רגשות לתפקוד חברתי מתווך על ידי קוגניציה חברתית, גם לאחר שליטה על משתני הגיל, יכולות קוגניטיביות ומילוליות, ובחומרת האוטיזם. כמו כן, נמצא כי שפה רגשית תורמת לחיזוק אמפתיה הקוגניטיבית ומחזקת את השפעתה על תפקוד חברתי .

ממצאים אלו מצביעים על קשר עקיף בין זיהוי רגשות לתפקוד חברתי, המתווך דרך שפה רגשית ואמפתיה קוגניטיבית, ומדגישים את חשיבות רכיבים אלו במסגרת התערבויות לשיפור תקשורת חברתית.

לבסוף, **מחקר ההתערבות** בחן את יעילותה של תכנית EmotiPlay בהנחיית מורים בשיפור הבנה רגשית ותפקוד חברתי של תלמידים אוטיסטים הלומדים בכיתות תקשורת. מאה ושישה עשר הילדים שתוארו לעיל שובצו אקראית, לפי כיתה, לקבוצת ניסוי (n = 59) שקיבלה שני שיעורים מדי שבוע של EmotiPlay לאורך 22 שבועות, או לקבוצת ביקורת (n = 57) שהמשיכה בשגרת הלימודים הרגילה. הוערכו יכולות זיהוי רגשות מרמזים לא-מילוליים, אמפתיה קוגניטיבית ושפה רגשית של המשתתפים, וכן נערכו תצפיות על כישוריהם החברתיים במהלך משחק חופשי. נוסף על כך, נאספו נתונים על אופן היישום ועל התקפות החברתית של ההתערבות באמצעות תצפיות שיעור, שאלוני מורים וראיונות.

ממצאי המחקר הראו כי קבוצת ההתערבות הפגינה שיפור מובהק בזיהוי רגשות מרמזים לא-מילוליים, באמפתיה קוגניטיבית ובשפה רגשית, בהשוואה לקבוצת הביקורת. עם זאת, השיפור לא הוכלל באופן משמעותי לרגשות שלא נלמדו ישירות בתוכנית או להתנהגות חברתית בפועל, דבר המעיד על השפעה ממוקדת של ההתערבות. הממצאים מאשרים את היתכנותה ויעילותה של התכנית במסגרת בית-ספרית ומצביעים על הפוטנציאל הגלום בשילוב התערבויות ממוחשבות בפיתוח כישורים חברתיים-רגשיים בקרב תלמידים אוטיסטית במסגרת החינוך המיוחד.

לסיכום, ממצאי המחקר מדגישים את חשיבותה המרכזית של ההבנה הרגשית בתפקוד חברתי - אתגר מהותי עבור ילדים אוטיסטים. המחקר מראה כי תכנית ממוחשבת, המיושמת על ידי מורים בכיתות תקשורת, יכולה להביא לשיפור ניכר ביכולת הבנת רגשות. עם זאת, הממצאים גם מצביעים על מגבלות בהעברת הכישורים למצבים חברתיים מורכבים יותר דבר שמחדד את הצורך בפיתוח וחקר נוסף של תכניות התערבות מקיפות וגמישות, שיקדמו הכללה ויישום של המיומנויות בעולם החברתי האמיתי.

**תוכן עניינים**

עבודה זו נעשתה תחת הדרכתם של פרופ' סיגל עדן מן הפקולטה לחינוך

ופרופ' עפר גולן מן המחלקה לפסיכולוגיה של אוניברסיטת בר אילן

**הבנת רגשות ותפקוד חברתי בילדים עם אוטיזם: האם ניתן לקדמם באמצעות תכנית התערבות ממוחשבת בתיווך מורים?**

חיבור לשם קבלת התואר "דוקטור לפילוסופיה"

מאת

יפעת בר – בן שבת

הפקולטה לחינוך

הוגש לסנט של אוניברסיטת בר – אילן

**רמת גן תשפ"ה**