

Understanding and Addressing Emotional Monitoring Deficits in Autism Spectrum Disorder: Current Evidence and Intervention Approaches

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Abstract: Children with Autism Spectrum Disorder (ASD) exhibit significant impairments in emotion monitoring, which disrupts their social interactions, and has a lasting impact on their overall development. Therefore, examining the emotion monitoring deficits in children with ASD and assessing the effectiveness of educational intervention strategies are essential for enhancing their social adaptation. This study aims to review the theoretical foundations of emotion monitoring in children with ASD, analyze the manifestations and causes of these deficits, and assess the effectiveness of existing educational interventions. Through a review and analysis of relevant literature, it explores the main challenges children with ASD face in emotion recognition, emotion regulation, and emotional expression in social contexts. Also, it summarizes key educational interventions, including cognitive-behavioral therapy, social skills training, and emotion regulation training, evaluating their effectiveness, especially when combined with visual supports and structured learning environments. The findings indicate that these interventions are generally effective in improving emotion monitoring abilities in children with ASD. However, gaps remain, such as the lack of standardized assessments and limited validation of long-term outcomes. Future research should focus on developing more comprehensive assessment frameworks, conducting longitudinal studies to verify intervention effectiveness, and exploring the potential of technological innovations (such as artificial intelligence and virtual reality) in intervention implementation.

Keywords: Autism Spectrum Disorder, Emotional Monitoring, Educational Intervention, Social Cognition, Social Skills Training

1. Introduction

Autism Spectrum Disorder (ASD) is a heterogeneous neurodevelopmental disorder characterized by impairments in social communication and interaction [1]. Recent studies have highlighted emotion monitoring as a key deficit in children with autism, particularly in emotion recognition, regulation, and expression [2,3]. Despite research focusing on these deficits, there are still significant gaps in understanding the cognitive mechanisms behind emotion monitoring and in developing effective interventions [4,5]. Current research tends to focus on emotion recognition and regulation, with less attention given to integrating the cognitive mechanisms of emotion monitoring and individualized intervention strategies. In addition, there is a lack of sufficient validation of long-term intervention outcomes. Therefore, exploring the deficits in emotion monitoring among children with autism and

the underlying mechanisms is essential for developing more effective interventions. This paper aims to examine the existing research on emotion monitoring deficits in children with ASD, analyzing the theoretical framework, cognitive mechanisms, and key deficits, while also evaluating current intervention strategies and identifying gaps in the literature. Besides, it seeks to offer a theoretical foundation for the development of individualized intervention strategies, particularly those focused on emotion monitoring. This study helps to improve emotion monitoring abilities in children with ASD, providing practical references for educational and therapeutic interventions, and offering new directions for future research, particularly in exploring the application of technologies like artificial intelligence and virtual reality in interventions.

2. The theoretical basis of emotional monitoring ability in children with ASD

2.1. The concept of emotional monitoring

Emotion monitoring refers to the ability to recognize, understand, and respond to emotional states in oneself or others. And it includes three main components: detecting emotional signals, interpreting their meaning, and providing suitable responses [6]. For children in social environments, emotion monitoring is a crucial skill for developing social functions. Research shows that children with ASD process emotional cues from the external world differently, particularly in social interactions, with their attention deficits manifesting as difficulty focusing on emotional facial features [7]. Further research suggests that deficits in emotion monitoring can have a profound effect on the social outcomes of children with ASD. Children with better emotion monitoring abilities tend to have greater success in forming and maintaining peer relationships [8]. According to Wetherby, children who excel in emotion monitoring are more capable of maintaining lasting friendships [9]. Besides, children with well-developed emotion monitoring skills tend to adapt more easily to complex environmental changes and are less prone to anxiety [10]. These studies highlight the critical role of emotion monitoring in the social competence and psychological development of children.

2.2. The cognitive and affective foundations of emotional monitoring

The development of emotional monitoring in children depends on the integration of cognitive and affective nervous systems. From a cognitive perspective, emotional monitoring involves executive functions like working memory, cognitive flexibility, and inhibitory control [11]. These cognitive processes facilitate children's ability to perceive emotional cues, regulate emotional responses, and adapt to changing emotional states. The biological foundation of the affective nervous system in emotional monitoring is primarily supported by the collaboration between the limbic system and cortical regions [12]. The limbic system plays a key role in the rapid processing of emotions and generating initial emotional responses, while cortical regions are responsible for further analysis and regulation of emotional signals. This interaction between the emotional and cognitive systems supports the effectiveness of emotional monitoring [13]. Furthermore, recent research indicates that the development of emotional monitoring is not solely dependent on neurobiological maturation; environmental experiences also play a significant role in enhancing this ability in children [14]. This insight is crucial for the development of educational intervention strategies, particularly for children with autism spectrum disorders, as they often exhibit significant differences in neurological functions compared to typically developing children.

3. Manifestation and causes of emotional monitoring deficits in children with ASD

3.1. Deficits in emotion recognition and understanding

A major deficit in emotional monitoring among children with ASD is their inability to effectively recognize and understand others' emotional expressions [15]. Studies have shown that children with autism exhibit different responses when interpreting facial expressions, particularly in complex situations that require the integration of multiple facial features simultaneously [16]. This issue stems from less efficient communication between the brain regions responsible for processing facial features and emotions compared to typically developing children [7]. And this can be compared to trying to assemble a puzzle when the pieces do not fit together smoothly. Further research using eye-tracking technology has revealed defects in the facial feature recognition of children with autism, showing that they pay less attention to facial areas that highlight emotional features, such as the eyes and mouth, making it difficult for them to recognize emotions in real time [7]. In addition, children with autism also struggle to understand how emotions change in response to environmental factors [17]. For example, they often have trouble understanding why the same event makes one person happy and another person sad. This difficulty arises because the brain areas responsible for understanding others' perspectives and thoughts do not activate the same way they do in typically developing children. [18].

3.2. Deficits in emotion regulation and management

Emotional regulation is another huge difficulty in emotional monitoring for children with autism [2]. This challenge is mainly manifested in the difficulty that children with autism have in regulating their emotional responses to meet the demands of different environments. Research has pinpointed several areas where emotional regulation is impaired. Firstly, children with ASD often struggle with flexibility in applying emotion regulation strategies, relying on a limited range of responses while overlooking their effectiveness [3]. Secondly, they have trouble using emotional coping strategies, like rethinking emotional challenges or approaching problem-solving from different angles [18]. Finally, physiological studies have revealed distinct differences in the nervous system function of children with ASD, contributing to their emotional regulation difficulties [19]. These challenges are particularly evident under stress, where they find it hard to effectively calm down or relax.

3.3. Deficits in emotional expression in social contexts

In everyday situations, children with ASD often struggle to express their emotions appropriately, particularly in more complex social settings [8]. In group activities, children with ASD may focus on topics they find interesting, ignoring others' hints that they want to change the subject [20,21]. The challenge becomes even more apparent in situations where a quick emotional adjustment is required. For example, children with ASD may display inappropriate emotional responses, such as reacting with excitement to others' distress or maintaining a neutral expression when others express happiness [22]. These difficulties are mainly due to the challenges they face in coordinating their emotional recognition and regulation systems. Studies have shown through neuroimaging that the nervous systems responsible for recognizing the emotions of others and regulating their own emotional responses are interconnected [22]. When these systems do not work together, it can lead to children with autism expressing inappropriate emotional responses, often resulting in difficulty matching emotional expression with the prevailing demands of society.

4. Educational intervention strategies for emotional monitoring deficits

4.1. Cognitive behavioral interventions

Among the various strategies aimed at improving emotional monitoring abilities in children with autism, cognitive behavioral interventions are considered an effective and promising approach [23]. The core of this intervention lies in enhancing children's cognitive awareness of their emotional states, thereby improving their emotional monitoring abilities. Studies have shown that cognitive behavioral therapy can significantly improve emotional understanding and regulation in children with autism. Cognitive behavioral interventions utilize personalized visual support and customized learning environments to address challenges in emotional recognition and regulation, thereby facilitating children's adaptation to complex social contexts [24]. Moreover, Wood emphasized that combining visual support with concrete examples in teaching can effectively enhance social skills in children with autism, making them more flexible and adaptive in understanding and responding to others' emotions [25]. Practical experience shows that theoretical guidance alone is inadequate for full skill development. Real-world social training environments are crucial for the transfer and application of skills [26]. Practicing emotional monitoring in real social situations helps children apply learned skills, enhancing their emotional understanding and management.

4.2. Social skills training interventions

Social skills training (SST) for emotional monitoring ability is also considered to be one of the most important means to improve emotional monitoring ability deficits in children with autism. Such interventions typically use a more systematic training approach to enhance children's emotional understanding and expression in social Settings [27]. This training is usually divided into several phases, each of which requires the establishment of clear learning objectives for the child, followed by a standardized assessment of the outcome of the intervention. Training usually starts with basic facial emotion recognition and gradually transitions to self-emotion management in complex social situations, eventually practicing the learned skills in a real-world environment. Several studies have identified more effective ways to implement this strategy. First, providing clear explanations during emotion recognition training helps children develop a fundamental understanding of emotional cues, such as how facial expressions, body language, and tone of voice indicate different emotional states [28]. Second, successful SST strategies emphasize fostering children's emotional reciprocity. This involves teaching children how to appropriately respond to others' emotions, express their own, and share their feelings in socially acceptable ways. Williams White [29] found that involving a partner or close individual can greatly enhance autistic children's understanding of emotional reciprocity.

4.3. Emotion regulation training

Emotional regulation training is a distinct intervention compared to the previous two strategies. This intervention primarily targets both the cognitive and physiological aspects of emotion regulation [30]. Interventions usually begin by helping children with autism identify their emotional states and physiological responses to different emotions. This includes helping the child become aware of what causes an individual's outbursts and further identify warning signs of abnormal emotional escalation [31]. Visual support and standardized assessment can help children with autism spectrum disorders better report their emotional state to others [32]. In addition, an extremely important aspect of emotional regulation training is the development of instructional specific strategies for managing emotional responses. These strategies typically involve two components. Cognitively, cognitive restructuring techniques for autistic children, combined with perspective-taking exercises, can improve emotional understanding. Physically, children with autism can learn deep breathing

techniques to alleviate external stress or practice mindfulness exercises, which involve focusing on being acutely aware of one's emotions and sensations in the present moment, without judgment or explanation. Moreover, research highlights the importance of prevention and response strategies in emotional regulation training. Prevention strategies help children with autism recognize and prepare for challenging emotions, while reactive strategies offer tools for managing intense emotions when they arise [33].

5. Current limitations and future directions

5.1. Current limitations

Despite the identification of several effective interventions, there are notable limitations in the existing research. One significant issue is the considerable variability in how emotion monitoring skills are assessed across studies, which complicates the comparison of outcomes from different interventions. For example, Mazefsky [2] conducted research in a laboratory setting, which does not fully capture the emotional challenges that children with autism face in real-world social contexts. Additionally, the follow-up periods in most studies are relatively short, typically ranging from 3 to 6 months, which leaves the long-term sustainability of intervention effects unclear. Since emotion monitoring skills evolve over the course of childhood and adolescence, short-term studies fail to capture these developmental changes. Furthermore, individual responses to the same intervention can vary significantly, and the factors contributing to these differences remain poorly understood, limiting the ability to optimize interventions for specific children [34]. Another significant gap is the predominant focus on school-aged children, with insufficient attention given to adolescents, a group that encounters unique challenges in emotional regulation within increasingly complex social contexts.

5.2. Future prospects

To overcome these limitations, future research should prioritize several key areas. The development of standardized measurement tools is significant for enhancing the accuracy and consistency of evaluating intervention outcomes. The research by Szatmari suggests that combining naturalistic observation with physiological monitoring can provide a more comprehensive and reliable approach to assessing emotion monitoring in children with ASD [34]. Besides, the integration of personalized intervention strategies, such as combining cognitive behavioral therapy, social skills training, and emotion regulation techniques, holds promise for addressing the diverse needs of children with ASD. And Gates has demonstrated that a combination of cognitive-behavioral approaches with structured social skills training and emotion regulation strategies leads to improved emotion monitoring outcomes across multiple domains [27]. Furthermore, longitudinal studies are crucial for understanding the long-term trajectory of emotion monitoring skills, as well as for assessing the sustained effectiveness of interventions over extended periods. This is particularly important for adolescents, as their emotional regulation skills develop significantly in the context of increasingly complex and dynamic social environments. By investigating these areas, future research can provide deeper insights into optimizing intervention strategies and better support the developmental needs of children and adolescents with ASD.

6. Conclusion

This paper highlights three key emotion monitoring challenges in children with ASD: recognition, regulation, and expression in social contexts. These deficits impact their daily social interactions. In addressing this issue, the study explored three primary intervention strategies: cognitive-behavioral

therapy, social skills training, and emotion regulation training, thus showing that these strategies contribute to improving different aspects of emotion monitoring. However, current research has several limitations. Specifically, most studies focus on school-aged children, while the adolescent group, who face more complex challenges in emotion regulation and social environments, has received less attention. Additionally, many studies have short follow-up periods, making it difficult to assess the long-term effects of interventions. Finally, the lack of standardized assessment tools hinders effective comparison between studies.

Future research can focus on several areas. The development of standardized assessment tools is essential for improving the comparability and accuracy of evaluating intervention outcomes. In addition, longitudinal studies should be conducted to assess the development of emotion monitoring skills and the sustainability of intervention effects. Further studies should also consider individual differences and investigate how to personalize interventions for each child. With technological advances, the use of artificial intelligence and virtual reality in emotion monitoring interventions should be a key focus of future research.

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