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A SCOPING REVIEW OF EMOTION RECOGNITION TRAINING PROGRAM: IS SOCIAL COGNITION SKILL IMPROVE IN CHILDREN WITH AUTISM SPECTRUM DISORDER?

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Abstract

Background: The capacity to identify and interpret emotions is a fundamental requirement for the process of social cognition. In recent years, there has been an increasing use of Emotion Recognition Training (ERT) as a therapeutic intervention for children diagnosed with autism spectrum disorder (ASD). Nevertheless, there exists a dearth of empirical evidence pertaining to the fundamental constituents of ERT as well as the methodologies employed for its implementation. **Objectives:** This review aimed to investigate the underlying reasons for employing ERT and the essential components involved in its implementation for children diagnosed with ASD. Additionally, the research seeks to propose strategies for standardizing the features of ERT in order to enhance comprehension of its therapeutic effectiveness. **Methods:** The publications were obtained from MEDLINE/PubMed and Embase databases, and a total of six studies were found to meet the final qualifying requirements. **Results:** A significant amount of heterogeneity was seen in several components, such as the intervention program, individual versus group settings, delivery modality (online versus offline), and supervised versus unsupervised conditions. The diversity of other crucial characteristics, such as group size and session time is the significant importance. A diverse array of outcome measurement instruments is employed. **Conclusion:** Based on the extant body of research, it is evident that emotion recognition training has positive outcomes in terms of enhancing the social cognition and interaction skills of children who have received a diagnosis of ASD.

Keywords: Autism Spectrum Disorder, Social Cognition, Emotional Recognition Training Programs.

INTRODUCTION

Autism spectrum disorders (ASDs) are distinguished by the presence of repetitive, restricted, and impaired social behaviors (Lord et al., 2018). The term "autism" was initially used in 1911 by Swiss psychiatrist Eugene Bleuller (Evans, 2013). Subsequently, there have been notable advancements in the field. The DSM-III officially acknowledged the word "autism." The inclusion of novel category criteria was a notable addition in the fourth edition of the Diagnostic and Statistical Manual of Mental Disorders (DSM). In the fifth edition of the Diagnostic and Statistical Manual of Mental Disorders (DSM), the American Psychiatric Association (2022) consolidated the several areas of autism spectrum disorders (ASD) into a singular category, therefore including the whole spectrum. The data on the global prevalence of Autism, which has been recently updated to 2022, indicates that the prevalence rate ranges from 1.09 to 4.36 percent among a population of 10,000 individuals. When comparing

the 10-year median prevalence, which accounted for 62 percent of a population of 10,000, to the projected prevalence of 100 percent of the population in 2022, it was seen that the latter was much higher (Eslabagh et al., 2012). The increase in reported incidence can be attributed to several factors, including as improvements in diagnostic capacity within healthcare systems and increased awareness among various stakeholders, including parents and healthcare professionals. The volatility in reported prevalence rates of autism was influenced by several factors, including changes made to the classification of autism, methodological variations, and diverse sociocultural contexts (Zidane et al., 2022).

According to Shochet et al. (2020), autism is defined by symptoms and traits that often begin in childhood and steadily worsen over time without remission or recurrence. The majority of the time, symptoms appear before the age of three and last the remainder of a person's life. Autism's etiology is hereditary, altering multiple neurogenes and brain systems as a result. In addition to genetic variables, exposure to toxic substances, dysfunctions of the gut-brain and microbiome axis, immunological problems, etc. all have an impact on ASD (see Samsam et al., 2014; Heidari, 2021; James et al., 2021). Autism is frequently diagnosed clinically based only on a collection of social and behavioral abnormalities. According to Jannati et al. (2020), the analysis lacks a reliable biomarker. Asperger's syndrome, childhood disintegrative disorder (CDD), Rett's syndrome (Rett's, Pervasive) disorder (PDD), and other conditions are some of the variations of the term autism. Attempts have been made to combine these phrases into one period due to physicians' lack of consistency and the unreliability of their use in the past. A single case of autism spectrum disorder (ASD) is to be improved according to the fifth edition of the DSM-5 criteria from the American Psychiatric Association (APS) based only on the inclusion of two domains: social interaction and constrained (repetitive) or unusual (sensory-motor) behaviors (APA., 2013). Well-structured scientific rating measures, including the Childhood Autism Rating Scale (CARS) and the fourth edition of the Wechsler Intelligence Scale for Children (Schopler et al., 1980; Schopler et al., 2010). Watkins and Smith (2013) state that the Short Sensory Profile (SSP) (McIntosh et al., 1999) is often used in the diagnosis and research of sensory processing disorders.

Emotion recognition

The ability to recognize and interpret emotions, commonly referred to as emotion recognition (ER), plays a crucial role in facilitating effective social communication (Banziger, Grandjean, & Scherer, 2009). In order to facilitate effective interpersonal interactions in daily life, it is important to be attentive to socioemotional cues and respond in a suitable manner. For instance, the modification of vocal intonation, facial reactions or expressions, and bodily gestures (Golan et al., 2010; Golan, Baron-Cohen, & Golan, 2008; Golan, Baron-Cohen, Hill, & Rutherford, 2007; Philip et al., 2010). The ability to perceive and understand others' mental states, known as theory of mind, as well as the capacity for empathy and social awareness, have a significant influence on this skill. However, it has been shown that emotion recognition impairment in children with autism spectrum disorder (Baron-Cohen, Golan, Wheelwright, & Hill, 2004; Stewart et al., 2013). The challenges encountered in the emotion recognition are associated with certain cognitive requirements. Adjustments in event-related potentials over different phases have been extensively reported across the spectrum. However, it is worth noting that some atypicalities may also manifest as subtle or insignificant, maybe due to compensating mechanisms. The task

of discerning emotions through many areas such as facial expressions, voice intonation patterns, gestures, and bodily language, as well as combining multimodal emotional data, presents considerable challenges (Philip et al 2010). Research has demonstrated a significant correlation between theory of mind and the executing function in children with ASD (Pellicano, E. 2007).

Pervious intervention study

Pervious interventions have been identified that can effectively support autistic children in cultivating healthier lives and enhancing their overall community well-being. The investigation of social cognition and emotion detection has emerged as a central topic of interest in several therapies conducted among children diagnosed with ASD. Various treatments have been investigated in relation to present study, including deep Transcranial Magnetic Stimulation (dTMS) as discussed by Avirame et al. (2017), a diverse range of computer-based therapies as explored by Ramdoss et al. (2012), and advanced animated models with genuine emotional expressions, among others, as examined by Yan et al. (2018). Various studies have documented the therapeutic efficacy of various Structured Emotional Recognition Training (ERT) in children diagnosed with ASD. Nevertheless, there is a dearth of scholarly literature pertaining to the comprehensive trajectory of evidence, the inherent characteristics, and the constituent components of intervention studies, as well as the underlying justifications put forth. Therefore, the present review was conducted to examine the justification and fundamental components of ERT. The results of this study have the potential to contribute to the advancement of the conceptual framework ERT for children diagnosed with ASD, with the aim of enhancing their social cognitive abilities.

Objective:

The study's principal objective is,

1. To review the available recent literature for Emotional Recognition Training (ERT) used in ASD.
2. To review the key components domains to conceptualize the Emotional Recognition Training (ERT) to enhance social cognition in children with ASD.

METHODS

When listing this review, the Preferred Reporting Items (PRISMA) for systematic reviews and meta-analyses extension for scoping reviews (PRISMA-ScR) were followed. This study employed the Preferred Reporting Items (PRISMA) for systematic reviews and meta-analyses (Figure 1).

Information Resources and Search Technique:

The search methodology was devised in accordance with peer review norms established in 2015. The scoping review encompassed a comprehensive examination of research pertaining to the therapy of emotion recognition in children diagnosed with ASD and its impact on social cognition. The scoping review encompassed a comprehensive examination of the existing research pertaining to child emotion recognition and social cognitive training programmes specifically focused on individuals with ASD. The publications were sourced from the electronic databases MEDLINE/PubMed and Embase, respectively.

The acronym 'ASD' was employed as one of the keywords. The academic terms 'social cognition' and 'children's emotion recognition' pertain to the research question, searchable subjects, and free words, which are combined with proximity searching. Boolean operators are logical operators that are used to combine or modify the results of Boolean expressions. These operators include AND, OR, and The utilization of limiters, filters, and topic headers (unique to the database) will be employed as required. The search technique was enhanced by the involvement of a medical librarian, who identified the most appropriate medical topic headings phrases and made necessary modifications to optimize their compatibility with the selected databases. This collaborative effort resulted in the refinement of the search strings employed in the study. The process involved in this study included doing an electronic search to identify relevant papers. Subsequently, reference lists were examined to ensure comprehensive coverage. The articles obtained from each database were then evaluated based on their titles, abstracts, and index keywords.

Inclusion Criteria:

This study has integrated research on individuals with mild to moderate autism spectrum disorder (ASD). According to Avirame et al. (2017), the Childhood Autism Rating Scale (CARS) was utilized to assess the severity of autism spectrum disorder (ASD) in children with scores falling within the range of 25 to 35 indicating mild to moderate levels of impairment. Furthermore, the IQ assessment of children within the age range of 69 to 83 years has been conducted using the Wechsler (Fourth Edition) clinical psychological report.

Furthermore, a significant proportion of children, similar to the majority of their peers, engage in the utilization of the Short Sensory Profile (SSP) as described by McIntosh et al. (1999). Ultimately, the research encompassed a cohort of children who possessed a satisfactory level of proficiency in comprehending the spoken English language, so enabling them to understand the experimental protocols.

Exclusion Criteria: This review did not encompass the inclusion of individuals with visual and hearing impairments, participants with a medical history of epilepsy or cerebral palsy, participants with significant physical, cognitive, or language impairments, and participants who reported drug use within the past six months.

Concept: Studies assessing the effect of the Emotion Recognition Training (ERT) were included.

Comparative group: Autism Spectrum Disorders and Non-Autism Spectrum Disorders in Children

Language: English.

Study design: This research encompassed all experimental investigations, including non-randomized clinical trials. Furthermore, the study encompassed both prospective and retrospective observational research, which used several study designs such as case-control, cohort, case series, and cross-sectional studies. The review did not incorporate expert opinions and narrative evaluations.

Exclusion criteria: Research distinctive different than the English language

Study Selection:

A pair of impartial reviewers collected search results from designated databases and eliminated duplicate research obtained from several databases. Two independent assessment groups subsequently reviewed the titles and abstracts of the publications in order to exclude those that did not satisfy the qualifying requirements. Currently, the different viewpoints have been effectively reconciled by a mutually agreed upon resolution between the two reviewers. When faced with uncertainty, the challenge was previously maintained for a comparable assessment. A comprehensive search was conducted to identify full-text publications that satisfied the predetermined eligibility criteria. The selection of each literary material was based on three distinct categories, namely Yes, No, and Maybe. Consequently, issues were resolved through the involvement of a neutral third-party assessor. Historically, the completion of all records was achieved by the utilization of majority consensus within the team.

Data collection and charting

During the pre-scoping step, a data extraction framework was created that encompassed many categories. This framework was utilized to evaluate the literature in order to determine its eligibility for inclusion in the comprehensive review. The data extraction process used two reviewers who separately collected information from the literature. The retrieved data was then organized and presented using Microsoft Excel. In the case of each manuscript, two reviewers conducted independent data extraction and visualization using the prescribed data extraction approach. Any inconsistencies in the collected data were deliberated about until a consensus was achieved. Each article included standard bibliographic information such as authors, titles, journals, years of publication, study type, and country. Additionally, the articles provided information on the demographics of the study population, the description of the intervention (focused on ASD/social cognition), emotion recognition, the duration and type of the intervention, the outcomes evaluated, and the effectiveness of the interventions (measured by the difference in Pre and Post-Social Cognition Treatment Outcome and the difference in cognition outcome between children with and without ASD). The table also included information on facilitators and obstacles to implementation.

RESULTS

A thorough literature search was conducted on two databases, namely PubMed (n = 37) and EMBASE (n = 373), resulting in the identification of a total of 134 publications during the initial screening stage. Following the removal of redundant studies, a comprehensive assessment of the full texts resulted in the identification of 15 relevant publications, which were then incorporated into our analysis. In the second phase of screening, a total of six publications were selected for inclusion in our full evaluation (Figure 1).

Characteristics of the Included Studies:

The attributes of the six included research studies are depicted in Table 1. A total of three research studies were conducted in various locations within the United States, including Los Angeles, New York, and San Francisco. Additionally, one study focused on research conducted in the Netherlands, another in Korea, one in Australia, and one in Cambridge. Among the six studies conducted, one particular randomized control trial (RCT) examined the effects of an intervention on emotional perception and social

abilities in adolescents with autism ASD compared to typically developing children. In contrast, the remaining three RCTs focused on comparing the outcomes of two therapies specifically in children with ASD.

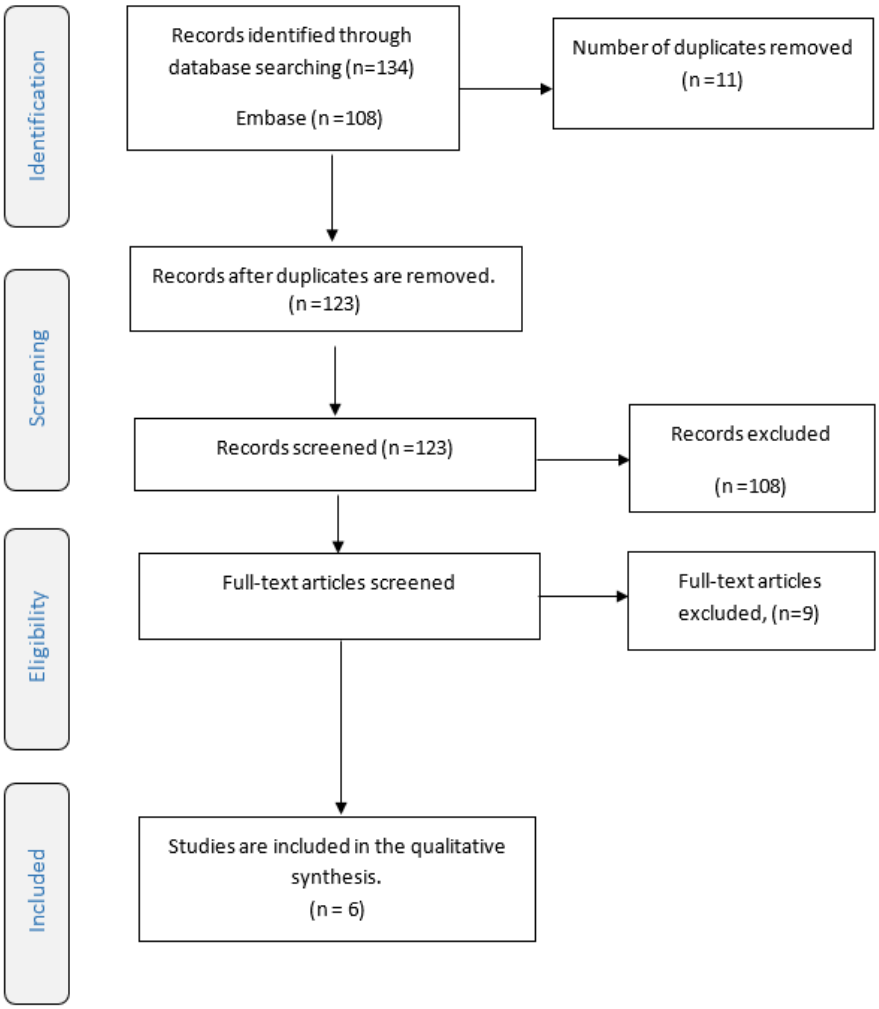

Figure 1: PRISMA Flow diagram of studies identified for inclusion emotion recognition training (ERT)

Sociodemographic Profile of Studies Population:

The minimum age recorded was 4 years, while the greatest age reported was 18. A total of five studies were undertaken on children below the age of 11, each with varying minimum age requirements. Additionally, one study specifically focused on teenagers aged between 12 and 18 years. All of the research had both male and female participants, with varying proportions of each gender.

Nature of Intervention:

A diverse array of therapies has been assessed in terms of their efficacy. Although there are certain similarities in the basic elements of the therapies, our research reveals that the interventions examined encompass a wide range of modalities. One research each employed Theory of Mind Training for Small Groups and Nonverbal Communication, as well as Emotion Recognition (NETT), whereas two studies each employed the Face Say approach. Additional programs that have been assessed

include Prosocial Online cognitive behavioral therapy (CBT), a comparative analysis of Watching Transporters against Thomas the Tank Engine, and an examination of the Theory of Mid-Based Program.

Theory of mind training (ToM):

A study was conducted to examine the efficacy of theory of mind (ToM) training in children diagnosed with ASD between the ages of 3 and 16. The intervention group receiving ToM training was compared to a control group. The 72 standardized interview questions that are employed to evaluate the Theory of Mind abilities in children with ASD. This study encompassed a total of 53 sessions conducted over a duration of 16 weeks. The primary focus was the development and enhancement of individuals' understanding and application of theory of mind (ToM) concepts. The children's focal point was significantly different between the groups, as they engaged in activities such as mimicking, hearing, focusing, and developing friendships. The present study investigated social cognition and the ability to see and understand the intents and emotions of other individuals. The results indicated that children diagnosed with autism spectrum disorder (ASD) had superior performance compared to typically developing children. Previously, Begeer et al. (2011) found no evidence of treatment influencing social competence as reported by parents.

Nonverbal communication, emotion recognition, and Theory of mind training (NETT):

The present study investigated the effectiveness of Neurofeedback Training (NET) in enhancing cognitive and behavioral outcomes among a cohort of children between the ages of 8 and 11 who have been diagnosed with ASD. The researchers conducted an investigation on the effects of the phenomena on individuals' social behavior, non-verbal communication abilities, degrees of empathy, and interpersonal connections. Furthermore, a comprehensive assessment was carried out to evaluate the influence of the intervention on social cognition in comparison to a control group. The study lasted for a period of 12 weeks, during which the participants were involved in several training programs that included ice breakers, presenting schedules, symbolic economy, gestural communication, visual discrimination, and other activities that were relevant to the study (Soorya et al., 2015).

Online Cognitive Behaviour Therapy (CBT) Intervention:

During the experimental procedure, the participants were placed in a controlled environment, namely an isolated room. They were given instructions to access an online gaming platform and actively participate in games for a predetermined period of time, which was set at one hour. The game employed for the purposes of this study was a prosocial game known as "poki-poki." Throughout the duration of the game, participants were had the opportunity to partake in a diverse array of interactive activities. These included engaging in textual dialogues, trading virtual tokens of appreciation, and assuming alternate personas of fellow players, all with the aim of augmenting their avatars and fostering social bonds. The study team implemented the cognitive behavioral treatment (CBT) according to the specified methodology in order to provide therapy to adolescents diagnosed with ASD. Based on the research conducted by Chung et al. (2016), the investigation encompassed a comprehensive series of 18 sessions dedicated to the exploration of social cognition, with an additional two sessions specifically focused on assessment. Furthermore, the study incorporated a total of 16 sessions that were based on the use of CBT.

Transporters Animated Television Series:

"Transporters" is an animated television program specifically developed to enhance emotional awareness among persons diagnosed with ASD. The series consists of a cumulative total of 15 episodes, with each individual episode having a runtime of 5 minutes. Every episode of the series extensively examines a total of 15 significant emotions, encompassing 6 fundamental emotions with 9 more complicated emotions, including but not limited to excitement, anger, pride, jealousy, and intellectual state. The program is loaded with interactive quizzes that have been particularly designed to augment emotional learning. Furthermore, the study by Williams et al. (2012) provides a comprehensive manual for parents to effectively assist their children in successfully completing the exam, while simultaneously fostering an enjoyable experience.

FaceSays:

In a similar vein, FaceSay is a computer-based approach utilized for the evaluation and improvement of social skills and emotional reactions in children who have received a diagnosis of ASD. A number of FaceSay games have been employed in the context of working children with autism spectrum disorder (ASD). These games include Amazing Gazing, Band-Aid clinic, and follow the leader. The interventions listed above have been utilized in a sample of children aged 5 to 11 years who have received a diagnosis of ASD (Rice et al., 2015; Hopkins et al., 2011).

Outcome measures used in ER training program interventions:

The research incorporated various assessment tools to measure outcomes, such as the Social Responsiveness Scale (SRS), Levels of Emotional Awareness for Children (LLEAS-C), Griffith Empathy Measure (Level of Empathy Measure), Korean Wechsler Adult Intelligence Scale (Level of Adult Intelligence Scale), and the Social Response Scale (SCQ-K). The research employed many assessment methods, such as the Social Skill Rating System (SRS) and Social Observation (SEO), along with the Childhood Autism Spectrum Test (CAST) and Wechsler Abbreviated Scale of Intelligence (WASI).

The therapeutic benefit of ER training program interventions:

Most of the studies analyzed in this research have documented therapeutic advantages in terms of emotion recognition and social interactions. The research involved a sample of teenagers aged 13 to 18 diagnosed with autism spectrum disorder who were divided into two groups. One group got cognitive behavior therapy in online groups with a prosocial focus, while the other group received the same therapy in offline groups. The final outcome was evaluated by the utilization of several assessment tools, including K-sADS-PL, ADOS, Social Communication Questionnaire - Korean version (SCQ-K), and a task involving the identification of emotional words and facial expressions, as well as functional magnetic resonance imaging (fMRI). A total of 16 sessions were conducted to provide cognitive behavior therapy targeting sociality. Social communication gains were reported in both the offline and online groups were measured at baseline and after a 6-week intervention period. According to a study conducted by Chung et al. in 2016, the online group exhibited higher scores in sociality and social interaction compared to the offline groups of study participants.

The emotional recognition skill training intervention DVD for autistic children aged 4 to 7 years old employed Thomas the Tank Engine as a point of reference. The assessment of social skills in the Vineland II evaluation was conducted by examining the several domains related to socialization. The assessment of social skills was conducted prior to the intervention, immediately following the intervention, and again three months after the intervention. The improvement observed in the experimental group is limited to the accurate matching of furious emotions, in comparison to the control group. There was a lack of advancement in the field of mindreading. According to a study conducted by Williams et al. (2012), the utilization of online, computer-based training has been found to enhance children's social skills through the improvement of emotion awareness. The present study assessed social responsiveness. The intervention conducted by Rice et al. (2015) resulted in enhancements in social cognition, communication, motivation, curiosity, and repeated behaviour.

A second randomized controlled trial (RCT) was conducted to assess the impact of Face Say intervention on the social skills of children between the ages of 6 and 10 who experience difficulties in this domain. A total of forty-nine youngsters successfully participated in an educational program called SayFace, which aimed to enhance their abilities in eye gazing, facial expression detection, as well as face and thinking attention. The primary objective of the coaching program was to augment social competences among youngsters diagnosed with ASD. Through the utilization of the Benton Facial Recognition Test, participants were instructed in the acquisition of the ability to discern and interpret facial emotions. This study has also utilized the social competence assessment system and social monitoring. Based on the study's findings, a significant disparity is observed between the intervention and control groups in terms of social capacities, assertion, autism self-management, and responsibility cooperation among children diagnosed with Low-Functioning Autism Spectrum Disorder (LFA). Children diagnosed with High Functioning Autism Spectrum Disorder (HFA) have deficits in their social skills. The findings of social commentary revealed that, as compared to the manipulated group, the intervention group had a reduced level of social interaction. There existed a substantial disparity in terms of common social interaction scores between the intervention and control groups. In comparison to the control group, each intervention agency reported a reduction in social interaction rating among individuals who no longer have HFA. There have been no significant differences in outcomes seen among the intervention group, control group, or HFA children in relation to the impact of a study on facial recognition skills among LFA children. Nevertheless, a significant disparity in performance was seen between the groups that exhibited higher ranks in both the intervention group and the training group (Hopkins et al., 2011).

A subsequent randomized controlled trial (RCT) investigated the social abilities of children aged 6 to 10 who experience difficulties. SayFace provided education to a cohort of 49 children, focusing on topics such as eye gazing, differentiation of facial expressions, and sensitivity to visual and mental cues. The coaching program employed for enhancing social skills in children with ASD. The Benton Facial Recognition Test facilitated individuals in acquiring knowledge and understanding of facial emotions. In addition to the aforementioned measures, this study also used assessments of social skill and direct observations of social behavior. The study revealed notable variations in social abilities, namely in areas such as assertiveness, autistic self-control, and responsible collaboration, among those classified as LFA

(Low Functioning autistic) children. Children with high-functioning autism often have challenges in developing social skills. The analysis of social commentary revealed that the intervention group had a lower level of interaction compared to the manipulated group. There was a significant disparity observed in the social interaction scores between the intervention group and the control group. The social interaction scores of each intervention agency were shown to be lower compared to both the control group and those without high-functioning autism. There were no significant differences seen in facial awareness competence among children with LFA in the intervention group, control group, and HFA children. However, there was a huge performance gap between groups with higher intervention and education crew rankings (Hopkins et al., 2011).

Table 1: Key components of intervention framework to be used for development & reporting of ER training program

Framework structure	Description
Task for ER training program	List of required domains – Mind body control – Body movements – Facial expression – Basic emotion skill – Perception skill (visual and auditory) – Cognitive skill (focus attention, working memory, episodic memory) – Nonverbal communication – Conversation attributes
Delivery method	Individual /group
Age range	4 – 18 years
Group size	Each session with rationale.
Duration of session	Minutes/session. (minimum 10 to 1 hour 15 min)
Total duration of training program	Frequency of sessions/ week. Total duration in weeks. (3 to 16 weeks)
Mode of delivery of intervention	Applicable in both online / offline
Outcome assessment	Validation of tools used to measure emotion, cognitive skills and social skills

DISCUSSION

The review suggests that a computer-based training program has demonstrated effectiveness in enhancing several aspects of social functioning in children with autism spectrum disorder. These aspects include social cognition, social skills, social talents, social reactions, social engagement, social awareness, and social communication. The implementation of non-computer-based training methods, such as the Theory of Mind and the Naturalistic Environment Training Technique, did not provide significant improvements in the result of sociality. This review conducted a comprehensive analysis of several computer-based training programs aimed at enhancing social cognition. The programs that were examined include the Prosocial online class, DVD-designed emotional recognition skill training, computer-based Face Say technique, and the new-battery task known as CAM-C Face & CAM-C speech. All the research incorporated in this review employed distinct scales for outcome measures in order to evaluate sociality.

In a study conducted by Begeer et al. (2011), the Theory of Mind Skill Trial (TMT) was administered to a cohort of children over a period of 16 weeks. Each session was intended to last for one hour and a half. In order to foster social connections, it is advisable to actively engage in the process of establishing friendships, attentively monitor social interactions, and emulate the behaviors and mannerisms of others. Children acquired the ability to differentiate between fictional and real situations, evaluate social contexts, and comprehend the emotions of others. The statements and illustrations made by children were subjected to evaluation. The theory of mind encompasses several cognitive abilities, such as perception, imitation, emotion recognition, pretense, and differentiation of physical reality. The study incorporated ideas of complex humor, elementary false belief understanding, and advanced second-order belief understanding. The identified factors include the social context, inquisitiveness, issues related to orientation, comprehension of social difficulties, and the manifestation of stereotyped conduct. The study revealed no significant alteration in social skills. The utilization of theory of mind abilities also contributed to the outcome.

Soorya et al. employed weekly sessions of NETT lasting between 12 and 90 minutes. The findings of the study were assessed after a period of three months. The NETT training program encompassed several components aimed at enhancing individuals' abilities, such as skills streaming, social skills education, relationship building, and the utilization of thought bubbles. The prioritization of nonverbal communication, emotional awareness, and Theory of Mind was emphasized. Furthermore, the study conducted by Chung et al. (2016) aimed to assess the enhancement of social cognition in children with ASD by their engagement in prosocial offline and online gaming activities. Over a duration of six weeks, the children actively engaged in the research by observing a game from a concealed vantage point. The children actively participated in the game and partook in many social activities, such as engaging in casual conversations, exchanging presents, acquiring social and emotional expressions, and honing their offline social language skills. The results of this study indicate that offline CBT has a positive impact on the development of social skills. Conversely, online CBT has been found to have an effect on children's blood flow and heightens their sensitivity to facial and vocal manifestations of emotion.

The efficacy of an emotional training program was investigated in a RCT by Williams et al. (2012). The program aimed to enhance children's ability to detect emotions, and it utilized DVD transporters as a teaching tool. The control group was exposed to a DVD containing an animated and narrated television programme titled "Thomas the Tank Engine". The Transporter is a concise episode lasting fifteen minutes, which aims to elucidate fifteen significant emotions. These emotions encompass six fundamental states, including basic, complicated, and meta states, which include but are not limited to excitement, hatred, pride, and jealousy. Nevertheless, the research revealed that Thomas the Tank Engine failed to impart the capacity to comprehend these emotional states. The evaluation of children was place both prior to and after to the implementation of the intervention, with further assessments conducted at three-month intervals for the purpose of follow-up.

The findings of the study indicate that the intervention exhibited a restricted level of efficacy in facilitating the acquisition of emotion identification skills. However, notable enhancements were noticed specifically in children who shown proficiency in identifying anger as an emotion.

The research employed a FaceSay survey, which was administered over a duration of six weeks, comprising a total of 12 sessions. Each session had a duration ranging from ten to twenty-five minutes. The study's results prompted the researchers to assert that there was a notable rise in facial recognition abilities, interpersonal interactions, and the significance attributed to emotional experiences. Hopkins et al. (2011) conducted a study that revealed an augmentation in the awareness of essential emotions, including happiness, sadness, neutrality, rage, disgust, fear, and mentalization. Additionally, the research findings indicated an increase in the recognition of other significant emotions.

The study encompassed a diverse range of geographical locations, including the Netherlands, Australia, California, the United States, Korea, and New York. The existing body of research on the topic mostly consists of studies conducted in wealthy nations. This aligns with the prevailing comprehension of diverse levels of awareness of ASD among healthcare systems worldwide.

Proposed Framework for ER training program:

Creating a comprehensive framework that standardizes the many parts of interventions, such as intervention types, components, levels of delivery (individual vs group), delivery method (online versus offline), and pattern of supervision (supervised versus self-guided), is a challenge due to their extensive diversity. Moreover, the inclusion of several crucial factors, such as the size of the group, the duration of each session, and the length of the treatment session, further complicates the matter.

In addition, there was considerable diversity in the selection of outcome assessment instruments utilized. Upon doing a comprehensive evaluation of the aforementioned elements, it becomes apparent that there exists a diverse array of ASD, individuals impacted by ASD, and varying degrees of functional impairment. Hence, it is imperative to acknowledge that a singular intervention aimed at offering a universally applicable answer may not be appropriate. Hence, we present a comprehensive framework that outlines the structure for designing and documenting ERT therapies aimed at children diagnosed with ASD. The implementation of a structured strategy can contribute to the promotion of uniformity in ERT therapies, as seen in Table 1.

Strengths:

This study aims to serve as a foundational resource for conducting a systematic evaluation on the aggregation of sensitivity and specificity measures for both computer-based and non-computer-based training programs designed to enhance emotion detection skills in children with ASD. The ultimate goal of such programs is to improve social cognition and interaction abilities in this population. This review presents findings from research that utilized data from the clinical domain, focusing specifically on the emotion recognition training program and its impact on social changes for children with ASD. One notable aspect of our review was the meticulousness of our literature search. This passage offers a concise overview of the primary focus of the study.

LIMITATIONS

The review presented a few concerns. To begin with, it would be beneficial to examine other papers in order to have a comprehensive understanding of the review's conclusions. Furthermore, the comparative analysis did not include a direct

comparison between the intervention program and the control group, thus introducing bias into the findings of the study. Furthermore, it is important to note that the measuring scales or instruments employed in each study varied, resulting in diverse assessments of sociality. Consequently, the measurements conducted in each study examined distinct facets of sociality, deviating from the anticipated uniformity. The examination of the intervention's efficacy in forthcoming research endeavors is also a viable avenue of exploration. Finally, there is a paucity of research conducted on emotional training programs, therefore warranting a need to enhance the quality of research studies across many facets of the training program.

CONCLUSION

The available research indicates that emotion recognition training has a positive impact on the social cognition and interaction abilities of children diagnosed with ASD. While the underlying reasoning presented appears to be consistent throughout the research, there were variations in the specific therapies employed. The treatments in question exhibited considerable variation in terms of their manner of delivery, duration, and the techniques employed to assess their outcomes. This heterogeneity poses challenges when attempting to compare or synthesize the results. In order to enhance comprehension of their therapeutic efficacy, it is imperative to establish a standardized framework for intervention components, duration, frequency of administration, and assessment of outcomes. Future study should focus on the development and examination of the emotion recognition memory training program to enhance social skills among individuals with ASD.

Authorship Criteria:

Author **Smily Jesu Priya Victor Paulraj, Supaporn Chinchai** were the brains behind the study and did all the hard work. They complied, analyzed, and interpreted the data, and all the drafts were reviewed and approved by Smily. Authors **Smily Jesu Priya Victor Paulraj, Supaporn Chinchai, Peeraya Munkhetvit, and Sarinya Sriphetcharawut** also helped fine tune the proposal and collected and entered data. They reviewed the results and helped prepare and review the drafts. Finally, the final version was read and approved by all the authors. They take full responsibility for the manuscript.

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