



**VISHWAKARMA
UNIVERSITY**
Maximising Human Potential

**Activity based
Project Report on
ASD Emotional Analysis
[Internship]
Project Module - III**

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Project Name : ASD Emotional Analysis

Abstract:

Autism Spectrum Disorder (ASD) is characterized by difficulties in social interaction and emotion processing. This study examines emotional processing in young children with ASD, aged 3 to 6, compared to typically developing children. While both groups exhibit differential scanning patterns for positive and negative facial expressions, children with ASD display reduced attention to facial features. Emotion regulation, a critical aspect in ASD, remains stable and strongly correlates with social and behavioral functioning, independent of IQ. Emotion dysregulation predicts increased difficulties over time, emphasizing its importance in intervention strategies. Additionally, individuals with ASD demonstrate reduced ability to differentiate between their own emotions, despite categorizing emotions similarly to typically developing individuals. This suggests that while ASD individuals assign similar meaning to emotions, they make less subtle distinctions, potentially contributing to internalizing problems. These findings underscore the importance of understanding emotional processes in ASD for developing effective educational and intervention approaches aimed at enhancing emotional development and social skills.

INTRODUCTION:-

Extensive research highlights the significant behavioral challenges faced by children with Autism Spectrum Disorders (ASD). However, limited focus has been directed towards understanding emotion regulation, particularly during the early school years, with notable exceptions. This scarcity of research underscores the importance of investigating emotion regulation, as it underpins crucial aspects of child development, enabling successful interaction with the social and physical environment.

Emotion regulation encompasses a spectrum of cognitive, physiological, and behavioral abilities facilitating the monitoring and modulation of emotional states. Central to children's developmental milestones, emotion regulation involves recognizing one's emotional states, accessing coping strategies during heightened emotions, and maintaining focus on tasks amidst emotional distractions. Deficits in emotion regulation, often characterized by heightened emotional intensity, can impede goal-directed activities and interpersonal interactions.

In the context of ASD, impairments in understanding both self and others' emotions are well-documented. While the focus has primarily been on recognizing and processing others' emotions, this study aims to delve into individuals with ASD's knowledge of their own emotions, particularly their ability to differentiate between emotional states.

ASD is commonly associated with challenges in emotional understanding, attributed in part to difficulties in theory of mind (ToM). Individuals with ASD often struggle to attribute mental states to themselves and others, affecting their comprehension of emotions. Empirical evidence suggests deficits in inferring and differentiating emotional states from facial expressions, body movements, and vocal cues in others.

The notion of "emotion differentiation" has emerged as a significant area of research, reflecting individuals' ability to distinguish between emotional states. Higher emotion differentiation is linked to adaptive emotional responding and regulation, contributing to psychological well-being. However, research directly examining emotion differentiation in ASD remains scarce.

This study aims to bridge this gap by investigating whether individuals with ASD exhibit lower emotion differentiation compared to typically developing individuals. Utilizing a multi-method approach, we assess participants' ability to differentiate between their own emotions using standardized stimuli.

Additionally, we examine semantic knowledge of emotions and its relationship with emotion differentiation.

Methods:-

Participants:

The study comprised adolescents diagnosed with Autism Spectrum Disorder (ASD) and typically developing (TD) adolescents. The ASD group, consisting of twelve males and six females, was recruited from a specialized school in Belgium catering to children with ASD and hearing disabilities. All participants had an IQ ≥ 80 and a clinical ASD diagnosis. Parent-reported assessments using the Dutch adaptation of the Social Responsiveness Scale (SRS) confirmed elevated ASD traits in the ASD group. The TD group initially comprised 26 participants matched for education level, gender, and age. However, eight non-native Dutch speakers were excluded from further analysis to maintain group comparability. The final TD group consisted of twelve males and six females, matched in age with a mean age of 16.56 years.

Measures:

Emotion differentiation was assessed through two tasks. The Photo Emotion Differentiation task (PED-task) involved rating emotional responses to standardized photographs representing various emotions using 7-point Likert scales. The intra-class correlation coefficients (ICC) measured consistency between emotion terms, with higher ICC indicating lower differentiation. The Emotional Sorting (ES) task required participants to group semantic emotion words printed on cards based on perceived similarities. A lower number of emotion groups indicated lower differentiation.

Procedure:

ASD participants completed the tasks in pairs, while TD participants participated in group testing sessions. Instructions were presented visually and orally. Participants rated their emotional responses to photographs and sorted emotion cards. The order of tasks was consistent across participants, and responses were recorded in booklets or noted by the experimenter.

Participants (N = 108) in a longitudinal study were assessed twice during the first academic year and once during the second academic year. Attrition analysis indicated a significant difference in child IQ between the included and excluded participants. Recruitment occurred through various community agencies, preschools, schools, websites, and local autism-specific events. Informed consent was obtained from primary caregivers, predominantly mothers, representing diverse racial and ethnic backgrounds. Children had a mean age of 5.7 years at the initial assessment, predominantly male, with a range of Estimated Full Scale IQ scores.

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	% of sample or mean (SD)
Child demographic variables	
Age at Year 1 assessment (years)	5.7 (1.1)
Gender (male %)	82.4 %
Child functioning	
Estimated FSIQ (WPPSI-III)	90.3 (17.1)
IQ Below 70	12.0 %
Spoken language level	
Syntax construction	81.7 (17.8)
Pragmatic language	84.8 (19.1)
Currently receiving any special education services	88.9 %
ADOS-2 module administered	
Module 1	13.0 %
Module 2	33.3 %
Module 3	53.7 %
ASD symptom severity (ADOS-2 comparison score)	7.4 (1.8)
Level of Autism symptoms (SRS total T-score)	77.7 (11.4)
Parent/family demographic variables	
Annual family income (% >\$50,000)	75.5 %
Maternal age (years)	38.4 (5.5)
Maternal race/ethnicity (% white)	66.7 %
Maternal education	
(4-year college degree or higher)	72.2 %
Marital status (% married)	85.2 %

Results:-

Participants, on average, had an intra-class correlation coefficient (ICC) of 0.65 (SD = 0.33) in the PED-task and divided the 20 emotions into 6.33 groups (SD = 2.37) in the ES-task. Kolmogorov–Smirnov tests indicated that data from the TD group were not normally distributed in either the PED-task ($D = 0.24$, $p < 0.01$) or the ES-task ($D = 0.21$, $p = 0.03$), necessitating the use of non-parametric tests for analysis.

Differences in emotion differentiation between ASD and TD groups:

A Mann–Whitney test revealed significant differences in ICCs between the ASD ($M = 0.76$, $SD = 0.15$) and TD ($M = 0.55$, $SD = 0.42$) groups in the PED-task ($U = 107.00$, $p = 0.04$, one-tailed), indicating lower emotion differentiation in the ASD group. Similarly, comparison of the number of emotion groups in the ES-task showed a marginally significant difference between ASD ($M = 5.72$, $SD = 2.32$) and TD ($M = 6.94$, $SD = 2.31$) groups ($U = 114.00$, $p = 0.06$, one-tailed), suggesting fewer emotion groups in the ASD group.

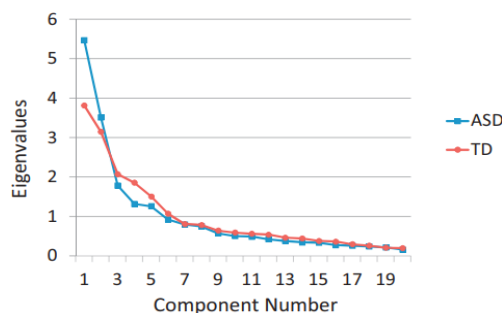
Correlations between emotion differentiation measures:

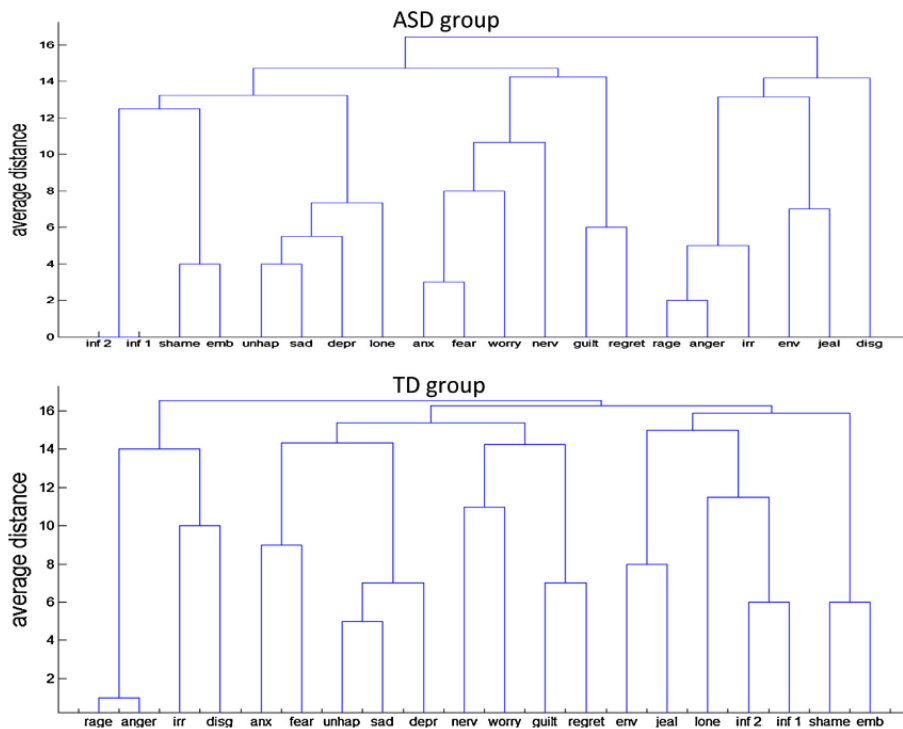
Spearman's correlations indicated non-significant associations between the PED-task ICCs and ES-task emotion groups for all participants and the ASD group alone. However, in the TD group, a negative relationship emerged ($r_s(16) = -0.432$, $p = 0.07$), suggesting that higher differentiation in the PED-task was associated with greater differentiation in the ES-task.

Qualitative differences in emotion differentiation:

Principal component analysis (PCA) revealed that the ASD group displayed a lower dimensionality in emotion ratings compared to the TD group. However, both groups applied a similar theoretical structure to emotions. Hierarchical cluster analysis showed that the TD group had more differentiated groupings of emotions compared to the ASD group, yet both groups' groupings reflected the theoretical structure proposed by Diener et al. (1995).

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Emotion Regulation Stability Across Time:

Exploratory analyses were initiated to discern the intricate relationships among diverse emotion regulation measures administered to participants. These analyses revealed significant interrelations among the various scales measuring emotion regulation, thereby providing compelling evidence for the construct's internal consistency and validity. These associations were consistently observed across both assessment years, indicating the robust and enduring nature of children's emotion regulation profiles over time. Further bolstering this notion of stability, minimal changes were detected in each emotion regulation measure

between the two assessment points, underscoring the persistent nature of these regulatory capacities. Moreover, moderate to high correlations within each measure across the two-year span lent additional support to the notion of stability in children's emotion regulation abilities.

Emotion Regulation and Child Functioning:

In probing the relationship between emotion regulation and child functioning, it became apparent that emotion regulation operates largely independently of cognitive and language competencies, as evidenced by the lack of significant correlations between these domains. However, emotion regulation exhibited substantial associations with core aspects of autism symptomatology, social skills, and behavioral functioning. These findings underscore the pivotal role of emotion regulation in shaping the socio-emotional landscape of children with autism spectrum disorder (ASD), highlighting its multifaceted impact on various facets of functioning.

Implications for Clinical Practice:

The robust stability observed in children's emotion regulation abilities underscores the importance of integrating targeted interventions aimed at bolstering these skills into early intervention programs for children with ASD. By focusing on enhancing emotion regulation capacities, clinicians can potentially mitigate the socio-emotional challenges faced by children with ASD and promote more adaptive functioning across multiple domains. Additionally, the significant associations between emotion regulation and core aspects of autism symptomatology, social skills, and behavioral functioning highlight the potential utility of emotion regulation interventions as adjunctive treatments in comprehensive treatment plans for children with ASD.

Descriptive Statistics:

In the PED-task, participants had an average ICC of .65 (SD = .33).

Participants divided the 20 emotions into an average of 6.33 groups (SD = 2.37).

Kolmogorov–Smirnov tests of normality indicated that the data of the TD group were not normally distributed in both the PED-task ($D = .24, p < .01$) and the ES-task ($D = .21, p = .03$).

Differences in Emotion Differentiation Between ASD and TD Groups:

The ASD group had significantly higher ICCs than the TD group in the PED-task (ASD: $M = .76, SD = .15$; TD: $M = .55, SD = .42$; $U = 107.00, p = .04$, one-tailed).

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In the ES-task, the ASD group categorized emotions into fewer groups compared to the TD group (ASD: $M = 5.72$, $SD = 2.32$; TD: $M = 6.94$, $SD = 2.31$; $U = 114.00$, $p = .06$, one-tailed).
Correlations Between Emotion Differentiation Measures:

Spearman's correlations showed non-significant relationships between the two emotion differentiation measures across all participants ($r_s(34) = \text{_____}$.113, ns), in the ASD group alone ($r_s(16) = .348$, $p = .16$), and in the TD group alone ($r_s(16) = \text{_____}$.432, $p = .07$).

Qualitative Difference in Emotion Differentiation:

Principal component analysis (PCA) revealed that solutions with fewer components explained a larger proportion of the variance in the ASD group compared to the TD group. Hierarchical cluster analysis indicated that the TD group exhibited a more differentiated grouping pattern compared to the ASD group, though both groups largely adhered to the theoretical structure proposed by Diener et al. (1995).

Emotion Regulation Stability Across Time:

Children's emotion regulation scores showed high stability across the two assessment years, with minimal changes observed in each measure.

Relationships Between Emotion Regulation and Child Functioning:

Emotion regulation demonstrated significant associations with autism symptomatology, social skills, and behavioral functioning, while operating largely independently of cognitive and language competencies.

These statistical details provide insights into the patterns of emotion differentiation, stability of emotion regulation, and its associations with various aspects of child functioning in the context of autism spectrum disorder.

	Emotion regulation (ERC-ER)	Lability/negativity (ERC-LN)	Emotion dysregulation (CBCL-EDI)
Emotion regulation (ERC-ER)		−0.37***	−0.46***
Lability/negativity (ERC-LN)	−0.49***		0.79***
Emotion dysregulation (CBCL-EDI)	−0.42***	0.68***	

ERC-ER emotion regulation subscale of the emotion regulation checklist, *ERC-LN* lability negative subscale of the emotion regulation checklist, *CBCL-EDI* emotion dysregulation index of the child behavior checklist, *Year 1* un-shaded (upper-right) correlations, *Year 2* shaded (bottom-left) correlations

*** $p < .001$

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Stability of emotion regulation measures across time

	Year 1 scores M(SD)	Year 2 scores M(SD)	Paired t-tests (Year 1–2)	Correlations (Year 1–2)
Emotion regulation (ERC-ER)	23.8 (4.1)	24.3 (3.8)	$p > .05$	0.78***
Lability/negativity (ERC-LN)	33.3 (6.3)	33.1 (6.8)	$p > .05$	0.71***
Emotion dysregulation (CBCL-EDI)	0.54 (0.36)	0.53 (0.37)	$p > .05$	0.61***

*** $p < .001$

Relationships among emotion regulation measures (Year 1) and child functioning

	Estimated FSIQ	CASL syntax	CASL pragmatics	Autism severity score (ADOS-2)	Autism symptoms (SRS)	Social skills (SSIS-SS)	Behavior problems (CBCL-TOT)
Emotion regulation (ERC-ER)	0.05	0.09	0.06	–0.11	–0.48***	0.73***	–0.48***
Lability/negativity (ERC-LN)	0.01	–0.07	–0.04	0.15	0.54***	–0.45***	0.75***
Emotion dysregulation (CBCL-EDI)	0.01	0.08	0.08	–0.19 ⁺	0.50***	–0.44***	–

Dashes represent correlations that were not run, due to overlap of items between measures

*** $p < .001$, ⁺ $p < .10$

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Stability of social and behavioral functioning across time

	Year 1 M(SD)	Year 2 M(SD)	Paired t-tests (Year 1 to 2)	Correlations (Year 1 to 2)
SSIS social skills	80.1 (17.3)	79.9 (17.1)	<i>N.S.</i> , $p > .05$	0.67***
CBCL total problems	61.6 (9.3)	62.0 (10.6)	<i>N.S.</i> , $p > .05$	0.74***
Externalizing composite	61.4 (8.3)	62.9 (10.0)	$t(104) = -2.45$, $p = .016$	0.78***
Internalizing	59.8 (9.5)	59.4 (11.7)	<i>N.S.</i> , $p > .05$	0.63***

*** $p < .001$

Prediction of change in child functioning by child emotion regulation on ERC-ER

Variable	Outcome: SSIS social skills (Year 2)			Outcome: CBCL externalizing behavior composite (Year 2)		
	β	R^2	ΔR^2	β	R^2	ΔR^2
Block 1		–			0.061	
Child age	–			0.247*		
Block 2		0.441			0.609	0.548***
Child age	–			–0.010		
Parent rating (Year 1)	0.664***			0.784***		
Block 3		0.460	0.019 ⁺		0.614	0.005
Child age	–			–0.009		
Parent rating (Year 1)	0.639***			0.776***		
IQ	0.140 ⁺			–0.068		
Block 4		0.506	0.046**		0.631	0.017*
Child age	–			–0.007		
Parent rating (Year 1)	0.404***			0.714***		
IQ	0.178*			–0.070		
ERC-ER (Year 1)	0.315**			–0.145*		

Dashes represents that a particular variable/block was not relevant for the outcome measure listed

Parent rating (Year 1) variable entered is social skills at Year 1 for the first column and externalizing behavior composite at Year 1 for the second column

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

ASD Emotional Analysis

Prediction of change in child functioning by child emotion dysregulation on ERC-LN

Variable	Outcome: CBCL internalizing behaviors (Year 2)		
	β	R^2	ΔR^2
Block 1		–	
Block 2		0.400	
CBCL internalizing behaviors (Year 1)	0.632***		
Block 3		0.403	0.003
CBCL internalizing behaviors (Year 1)	0.627***		
IQ	0.052		
Block 4		0.433	0.030*
CBCL internalizing behaviors (Year 1)	0.529***		
IQ	0.051		
ERC-LN (Year 1)	0.199*		

*** $p < .001$, * $p < .05$

CONCLUSION:-

The findings of this study provide valuable insights into emotion differentiation among individuals with Autism Spectrum Disorder (ASD) compared to typically developing (TD) individuals. Through a multi-method approach, it was revealed that individuals with ASD demonstrate less differentiation between negative emotions than their TD counterparts. This was evidenced by higher levels of unidimensionality in their emotional ratings in response to pictures and fewer groupings when categorizing emotion terms into distinct semantic groups. These results suggest that individuals with ASD may struggle to make subtle distinctions between different negative emotions, reflecting alterations in emotional functioning consistent with prevailing theories regarding ASD and difficulties in assessing mental states, such as Theory of Mind (ToM).

Interestingly, while the TD group exhibited an expected relationship between differentiating their own emotional experiences and semantically differentiating between emotions, this relationship was found to be independent in the ASD group. This implies that the difficulty individuals with ASD face in differentiating their emotional states is not solely due to a lack of semantic knowledge about emotions. Thus, ASD appears to be characterized by challenges in both discerning one's own emotional states and comprehensively understanding the semantic meaning of emotion words.

However, further analysis revealed that both ASD and TD participants tend to differentiate and group emotions based on established theoretical dimensions, indicating a similar understanding of emotion terms across the two groups. Despite this, individuals with ASD still exhibited less differentiated knowledge about their own emotional world and conceptually differentiated less between discrete emotions compared to TD individuals. Notably, they did not attribute radically different meanings to specific emotion terms when compared to the theoretical expectations or those given by TD individuals.

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