

**AN EXPLORATION INTO THE SOCIAL COGNITION OF CHILDREN WITH
SPECIFIC LEARNING DISORDER**

SANIYA BHUTANI



DEPARTMENT OF HUMANITIES AND SOCIAL SCIENCES

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by

SANIYA BHUTANI

Department of Humanities and Social Sciences

Submitted

In fulfilment of the requirements of the degree of Doctor of Philosophy

to the



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Dedicated to my Family and Loved ones

CERTIFICATE

This is to certify that the thesis titled “**An Exploration into the Social Cognition of Children with Specific Learning Disorder**”, being submitted by **Ms. Saniya Bhutani** to the **Indian Institute of Technology Delhi**, for the award of the degree of **Doctor of Philosophy**, is a record of original bona fide research carried out by her under my supervision. In my opinion, the thesis has reached the standards fulfilling the requirements for submission relating to the degree.

The results contained in the thesis have not been submitted, in part or full, to any other institute or university for award of any degree or diploma.

Singh

Dr. Kamlesh Singh
Professor (Psychology)
Department of Humanities and Social Sciences
Indian Institute of Technology Delhi
New Delhi- 110016, India

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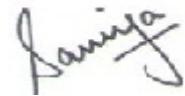
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Abstract

American Psychiatric Association (APA) in the latest edition of Diagnostic Statistical Manual (DSM-5) recognized social cognition (SC) as one of the core domains in neurocognitive functioning. With this inclusion, the research SC has immensely increased across all age groups and disorders. SC guides human relationships by facilitating humans to become members of social groups wherein multiple signals in social set-ups are absorbed. It determines our social interactions and the way we process the socially relevant information, thus facilitating interpretation of social situations, considering which, appropriate behavior is exhibited. Literature suggests that culture contributes significantly to social cognitive understanding. This points towards the need to have culturally-fair for assessing SC. Another aspect in SC development is that different social cognitive abilities are attained at different age, thus age-specific tools may be preferential. Thus, the first study aims to adapt a suitable measure of SC for Indian children. Further, on diving into the literature exploring SC in neurodevelopmental disorders, it is evident that several studies are addressing this aspect in autism spectrum disorder and few studies are exploring SC in Attention Deficit Hyperactivity Disorder (ADHD). But amongst neurodevelopmental disorder, Specific Learning Disorder (SLD) is marginally researched with respect to SC. Thus, the next study aims to compare the SC in children with Specific Learning Disorder (SLD) and typically developing (TD) children. The tool adapted in first study is taken forward for in the second study.

In the first study, with the premises that various tools are available to capture SC, but tools to assess SC for Indian children are limited, the purpose of the study was to adapt and validate Edinburgh Social Cognition Test (ESCoT) for Indian Children. Additionally, the study explored the effect of demographics on adapted version of ESCoT. For content validity, ten practicing psychologists and clinical psychologists gave their feedback about the test scenarios based on which the items were retained. The adaptation process involved 100

participants of in the age group 6 to 12 years. Informed consent from parents and verbal assent from the participant was taken. Demographics were collected. Measures were individually administered. The study was carried out online in the period January 2021 to August 2021. Data was scored and analyzed. Seven out of ten scenarios were retained in content validity. Convergent validity, internal consistency and inter-rater reliability were found to be acceptable. Regression analysis indicates that age significantly predicts performance on Adapted version ESCoT for Indian children (ESCoT_IC). Age is associated with the cognitive theory of mind, affective theory of mind, and interpersonal social norms understanding. The current study provides evidence for validation of ESCoT_IC. Results indicate acceptable psychometric properties of ESCoT_IC. Thus, it is suitable for Indian settings and amongst children. The ESCoT_IC is taken forward to the next study as a measure of SC.

In the second study, SC in children with specific learning disorder (SLD) is explored. The concept of SC is trending specifically in children with neurodevelopmental disorders. DSM-5 (2013) categorizes autism, attention deficit hyperactivity disorder (ADHD) and SLD as neurodevelopmental disorders. Amongst these neurodevelopmental disorders, it is well established that deficits in SC are predominant in autism and interventions seem to enhance SC abilities. Recent researches have emphasised SC deficits in ADHD, although the severity of deficits may vary across domains. Lately, researchers which have initiated exploration of domains of SC in SLD, have suggested the need for exploring Theory of Mind and other domains of SC extensively in SLD. Therefore, the primary aim is to compare the SC between children with SLD and TD children. While addressing this aim, more objectives that were addressed include comparison of verbal quotient and performance quotient between children with SLD and TD children, comparison of the executive function abilities between the two groups and to depict the relationship between verbal abilities, executive functioning and SC

in children. This study comprises of 60 participants from the age-group 6 to 12 years. 30 participants are children with SLD and 30 participants are TD children. For both the groups, same tools were used, which are: Malin's intelligence test for Indian children (MISIC; Malin, 1969), SOCRATIS (Mehta et al., 2011), EScoT_IC (study 1), Stroop test (Stroop, 1935), Corsi block tapping test (Corsi, 1972) and card sorting test (Heaton & Staff, 1993). The data was collected from September 2021 to December 2022 in hybrid mode over multiple sessions per child. These sessions were scheduled within a period of one month of parental consent. Data was collected and simultaneously scored. For analysis, independent t-test, and Cohen's d were computed to test the differences in the scores and effect size of various tests. Mann-Whitney test was used for non-normally distributed scores. For analyzing the relationship between the variables, Structured Equation Modeling (SEM) was opted. Multigroup bootstrapping was used for comparing the model for SLD and TD group.

On MISIC, significant differences in verbal quotient and performance quotient of the two groups were observed. On EScoT_IC, significant differences were observed for cognitive ToM ($p=.02$), affective ToM ($p=.002$), interpersonal social norms understanding ($p<.001$) and intrapersonal social norms understanding ($p=.003$). On SOCRATIS, significant differences were observed for First order ToM ($p= .001$) and faux-pas abilities ($p=.026$). In attributional styles, personalising bias is significantly different between the two groups ($p=.010$), but not externalising bias ($p=.43$). Furthermore, in the area of executive functioning, significant differences were observed in performance of Corsi block tapping test indicating weaker working memory for children with SLD. Significant differences were also observed in Stroop test with higher number of Stroop errors, lower accuracy and higher response time for incongruent stimuli was displayed by the SLD group. In the card sorting test, cognitive flexibility indicated through perseverative errors did not show any significant difference between the two groups. Although, significant differences were evident in the

number of errors exhibited and conceptual level response, with TD group outperforming the SLD group.

SEM highlighted the role of verbal abilities and executive functioning in determining SC. Executive functions of response inhibition and working memory contribute directly in determining the social norms understanding and abstract social perception. But, verbal abilities mediate between executive abilities and ToM, thus, indicating full mediation. In addition to this, for testing the generalizability of the model, multigroup bootstrapping was used to compare the model for SLD and TD group. No significant differences were observed in the models for SLD and TD group. This indicates that similar direct and mediational effects are observed in TD children as well as children with SLD.

Overall, the second study implied that children with SLD tend to perform weaker than TD children of similar age in the areas of SC and EF. The findings of the study implicate the need for developing interventions for children with SLD where their social cognitive understanding can be enhanced. And while planning the interventions, verbal abilities as well as executive abilities should be targeted.

Keywords: Social Cognition, Indian Children, Specific Learning Disorder, Theory of Mind, Social Norms Understanding, Adaptation, Executive functions

अमूर्त (Abstract)

अमेरिकन साइकिएट्रिक एसोसिएशन (एपीए) ने डायग्नोस्टिक स्टैटिस्टिकल मैनुअल (डीएसएम-5) के नवीनतम संस्करण में सामाजिक अनुभूति (SC) को तंत्रिका-संज्ञानात्मक कामकाज में मुख्य डोमेन में से एक के रूप में मान्यता दी है। इस समावेशन के साथ, सभी आयु समूहों और विकारों में अनुसंधान SC में अत्यधिक वृद्धि हुई है। एससी मनुष्यों को सामाजिक समूहों का सदस्य बनने की सुविधा प्रदान करके मानवीय संबंधों का मार्गदर्शन करता है, जिसमें सामाजिक व्यवस्था में कई संकेतों को अवशोषित किया जाता है। यह हमारी सामाजिक अंतःक्रियाओं और सामाजिक रूप से प्रासंगिक जानकारी को संसाधित करने के तरीके को निर्धारित करता है, इस प्रकार सामाजिक स्थितियों की व्याख्या की सुविधा प्रदान करता है, जिस पर विचार करते हुए, उचित व्यवहार प्रदर्शित किया जाता है। शोध से पता चलता कि संस्कृति सामाजिक संज्ञानात्मक समझ में महत्वपूर्ण योगदान देती है। यह SC के मूल्यांकन के लिए सांस्कृतिक रूप से निष्पक्ष होने की आवश्यकता की ओर इशारा करता है। SC विकास में एक और पहलू यह है कि विभिन्न सामाजिक संज्ञानात्मक क्षमताएं अलग-अलग उम्र में प्राप्त की जाती हैं, इस प्रकार आयु-विशिष्ट उपकरण अधिमान्य हो सकते हैं। इस प्रकार, पहले अध्ययन का लक्ष्य भारतीय बच्चों के लिए SC के उपयुक्त माप को अनुकूलित करना है। इसके अलावा, न्यूरोडेवलपमेंटल विकारों में SC की खोज करने वाले शोध को पढ़ कर, यह स्पष्ट है कि कई अध्ययन ऑटिज्म स्पेक्ट्रम विकार में इस पहलू को संबोधित कर रहे हैं और कुछ अटेंशन डेफिसिट हाइपरएक्टिविटी डिसऑर्डर (ADHD) में SC की खोज कर रहे हैं। लेकिन न्यूरोडेवलपमेंटल डिसऑर्डर के बीच, विशिष्ट शिक्षण विकार (SLD) पर SC के संबंध में मामूली शोध किया गया है। इसलिए दूसरे अध्ययन का उद्देश्य विशिष्ट शिक्षण विकार (SLD) वाले बच्चों और आमतौर पर विकासशील (TD) बच्चों में SC की तुलना करना है।

पहले अध्ययन में, इस आधार पर कि SC को मापने के लिए विभिन्न उपकरण उपलब्ध हैं, परंतु भारतीय बच्चों में SC का आकलन करने के उपकरण सीमित हैं, अध्ययन का उद्देश्य भारतीय बच्चों के लिए एडिनबर्ग सोशल कॉग्निशन टेस्ट (ESCoT) को अनुकूलित और मान्य करना था। इसके अतिरिक्त, अध्ययन ने ESCoT के अनुकूलित संस्करण पर जनसांख्यिकी के प्रभाव का पता लगाया। सामग्री की वैधता के लिए, दस अभ्यास मनोवैज्ञानिकों और नैदानिक मनोवैज्ञानिकों ने परीक्षण परिदृश्यों के बारे में अपनी

प्रतिक्रिया दी, जिसके आधार पर वस्तुओं को बरकरार रखा गया था। अनुकूलन प्रक्रिया में 6 से 12 वर्ष की आयु वर्ग के 100 प्रतिभागी शामिल थे। माता-पिता से सूचित सहमति और प्रतिभागी से मौखिक सहमति ली गई। जनसांख्यिकी एकत्र की गई। उपाय व्यक्तिगत रूप से प्रशासित किए गए थे। यह अध्ययन जनवरी 2021 से अगस्त 2021 की अवधि में ऑनलाइन किया गया। डेटा स्कोर किया गया और उसका विश्लेषण किया गया। दस में से सात परिदृश्यों को सामग्री वैधता में बरकरार रखा गया था। अभिसरण वैधता, आंतरिक स्थिरता और अंतर-रेटर विश्वसनीयता स्वीकार्य पाई गई। प्रतिगमन विश्लेषण इंगित करता है कि उम्र भारतीय बच्चों के लिए अनुकूलित संस्करण ESCoT (ESCoT_IC) पर प्रदर्शन की महत्वपूर्ण भविष्यवाणी करती है। आयु मन के संज्ञानात्मक सिद्धांत, मन के भावात्मक सिद्धांत और पारस्परिक सामाजिक मानदंडों की समझ से जुड़ी है। वर्तमान अध्ययन ESCoT_IC के सत्यापन के लिए साक्ष्य प्रदान करता है। परिणाम ESCoT_IC के स्वीकार्य साइकोमेट्रिक गुणों को दर्शाते हैं। इस प्रकार, यह भारतीय परिवेश और बच्चों के लिए उपयुक्त है। ESCoT_IC को SC के माप के रूप में अगले अध्ययन के लिए आगे ले जाया जाता है।

दूसरे अध्ययन में, विशिष्ट शिक्षण विकार (SLD) वाले बच्चों में SC का पता लगाया गया है। SC की अवधारणा विशेष रूप से न्यूरोडेवलपमेंटल विकारों वाले बच्चों में चलन में है। डीएसएम-5 (2013) ऑटिज्म, अटेंशन डेफिसिट हाइपरएक्टिविटी डिसऑर्डर (ADHD) और SLD को न्यूरोडेवलपमेंटल विकारों के रूप में वर्गीकृत करता है। इन न्यूरोडेवलपमेंटल विकारों के बीच, यह अच्छी तरह से स्थापित है कि SC में कमी ऑटिज्म में प्रमुख है और हस्तक्षेप SC क्षमताओं को बढ़ाते प्रतीत होते हैं। हाल के शोधों ने ADHD में SC घाटे पर जोर दिया है, हालांकि घाटे की गंभीरता अलग-अलग डोमेन में भिन्न हो सकती है। हाल ही में, जिन शोधकर्ताओं ने SLD में SC के डोमेन की खोज शुरू की है, उन्होंने SLD में थ्योरी ऑफ माइंड (ToM) और SC के अन्य डोमेन की बड़े पैमाने पर खोज करने की आवश्यकता का सुझाव दिया है।

इसलिए, प्राथमिक उद्देश्य SLD और आम तौर पर विकास हो रहे (TD) बच्चों के बीच SC की तुलना करना है। इस उद्देश्य को संबोधित करते समय, जिन अन्य उद्देश्यों को संबोधित किया गया उनमें SLD और TD वाले बच्चों के बीच मौखिक भागफल और प्रदर्शन भागफल की तुलना, दो समूहों के बीच कार्यकारी कार्य क्षमताओं की तुलना और मौखिक क्षमताओं, कार्यकारी कामकाज और SC के बीच संबंध को चित्रित करना शामिल है।

इस अध्ययन में 6 से 12 वर्ष आयु वर्ग के 60 प्रतिभागी शामिल हैं। 30 प्रतिभागी SLD वाले बच्चे हैं और 30 प्रतिभागी TD वाले बच्चे हैं। दोनों समूहों के लिए, समान उपकरणों का उपयोग किया गया, जो हैं: मलिन इंटेलिजेन्स स्केल फ़ोर इंडीयन चिल्ड्रन (MISIC), सोशल कॉग्निशन रेटिंग टूल्स इन इंडीयन सेटिंग (SOCRATIS), एसकोट_IC, स्ट्रूप टेस्ट, कोर्सी ब्लॉक टैपिंग टेस्ट और कार्ड सॉर्टिंग टेस्ट। डेटा सितंबर 2021 से दिसंबर 2022 तक प्रति बच्चे कई सत्रों में हाइब्रिड मोड में एकत्र किया गया था। ये सत्र माता-पिता की सहमति से एक महीने की अवधि के भीतर निर्धारित किए गए थे। डेटा एकत्र किया गया और साथ ही स्कोर भी किया गया।

विश्लेषण के लिए, विभिन्न परीक्षणों के स्कोर और प्रभाव आकार में अंतर का परीक्षण करने के लिए इंडिपेंडेंट टी-टेस्ट और कोहेन-डी की गणना की गई। मान-व्हीटनी परीक्षण का उपयोग गैर-सामान्य (नोन-नॉर्मल) रूप से वितरित अंकों के लिए किया गया था। चरों के बीच संबंध का विश्लेषण करने के लिए, स्ट्रक्चर्ड इक्वेज़न मॉडलिंग (SEM) को चुना गया था। SLD और TD समूह के मॉडल की तुलना करने के लिए मल्टीग्रुप बूटस्ट्रैपिंग का उपयोग किया गया था।

MISIC पर, दोनों समूहों के मौखिक भागफल और प्रदर्शन भागफल में महत्वपूर्ण अंतर देखा गया। ESCoT_IC पर, संज्ञानात्मक ToM ($p=.02$), भावात्मक ToM ($p=.002$), पारस्परिक सामाजिक मानदंडों की समझ ($p<.001$) और अंतर्व्यक्तिक सामाजिक मानदंडों की समझ ($p=.003$) के लिए महत्वपूर्ण अंतर देखा गया। SOCRATIS पर, प्रथम क्रम ToM ($p=.001$) और फॉक्स-पास क्षमताओं ($p=.026$) के लिए महत्वपूर्ण अंतर देखा गया। गुणात्मक शैलियों में, वैयक्तिकृत पूर्वाग्रह दो समूहों ($p=.010$) के बीच काफी भिन्न है, लेकिन बाहरी पूर्वाग्रह नहीं ($p=.43$)।

इसके अलावा, कार्यकारी कामकाज (इग्ज़ेक्यूटिव फ़ंक्शनिंग) के क्षेत्र में, कोर्सी ब्लॉक टैपिंग परीक्षण के प्रदर्शन में महत्वपूर्ण अंतर देखा गया, जो SLD वाले बच्चों के लिए कमजोर कामकाजी स्मृति का संकेत देता है। स्ट्रूप परीक्षण में महत्वपूर्ण अंतर भी देखा गया, जिसमें स्ट्रूप त्रुटियों की अधिक संख्या, कम सटीकता और असंगत उत्तेजनाओं के लिए उच्च प्रतिक्रिया समय एसएलडी समूह द्वारा प्रदर्शित किया गया था। कार्ड सॉर्टिंग परीक्षण में, लगातार त्रुटियों के माध्यम से संकेतित संज्ञानात्मक लचीलेपन ने दोनों समूहों के बीच कोई महत्वपूर्ण अंतर नहीं दिखाया। हालाँकि, प्रदर्शित त्रुटियों की संख्या और वैचारिक स्तर की प्रतिक्रिया में महत्वपूर्ण अंतर स्पष्ट थे, TD समूह ने SLD समूह से बेहतर प्रदर्शन किया।

SEM ने SC के निर्धारण में मौखिक क्षमताओं और कार्यकारी कामकाज की भूमिका पर प्रकाश डाला। प्रतिक्रिया निषेध और कार्यशील स्मृति के कार्यकारी कार्य सामाजिक मानदंडों की समझ और अमूर्त सामाजिक धारणा को निर्धारित करने में सीधे योगदान करते हैं। लेकिन, मौखिक क्षमताएं कार्यकारी क्षमताओं और ToM के बीच मध्यस्थता करती हैं, इस प्रकार, पूर्ण मध्यस्थता का संकेत मिलता है। इसके अलावा, मॉडल की सामान्यता का परीक्षण करने के लिए, SLD और TD समूह के मॉडल की तुलना करने के लिए मल्टीग्रुप बूटस्ट्रैपिंग का उपयोग किया गया था। SLD और TD समूह के मॉडलों में कोई महत्वपूर्ण अंतर नहीं देखा गया। यह इंगित करता है कि TD बच्चों के साथ-साथ SLD वाले बच्चों में भी समान प्रत्यक्ष और मध्यस्थ प्रभाव देखे जाते हैं।

कुल मिलाकर, दूसरे अध्ययन से पता चला कि SLD वाले बच्चे SC और कार्यकारी कामकाज के क्षेत्रों में समान उम्र के TD बच्चों की तुलना में कमजोर प्रदर्शन करते हैं। अध्ययन के निष्कर्षों से पता चलता है कि SLD वाले बच्चों के लिए ऐसे हस्तक्षेप विकसित करने की आवश्यकता है जहां उनकी सामाजिक संज्ञानात्मक समझ को बढ़ाया जा सके। और हस्तक्षेप की योजना बनाते समय मौखिक क्षमताओं के साथ-साथ कार्यकारी क्षमताओं को भी लक्षित किया जाना चाहिए।

मुख्य शब्द: सामाजिक अनुभूति, भारतीय बच्चे, स्पेसिफिक लर्निंग डिऑर्डर (SLD), थीयोरी ओफ़ माइंड , सामाजिक मानदंडों की समझ, अनुकूलन, कार्यकारी कार्य

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List of Abbreviations

ADHD	Attention Deficit Hyperactivity Disorder
APA	American Psychiatric Association
ASD	Autism Spectrum Disorder
BRIEF	Behavior Rating Inventory of Executive Function
CFT	Cognitive function tests
CLR	Conceptual Level Response
CNS	Central Nervous System
CRT	Cognitive Retraining Techniques
CSUS	Children's Social Understanding Scale
DALI	Dyslexia Assessment for languages of India
DSM	Diagnostic and Statistical Manual for Mental Disorders
DSM-5	Diagnostic and Statistical Manual for Mental Disorders- 5 th Edition
EB	Externalising Bias
EF	Executive Functioning
EI	Emotional Intelligence
EP	Emotion Perception
ESCoT	Edinburgh Social Cognition Test
ESCoT_IC	Adapted ESCoT for Indian Children
FOT	First Order Theory of Mind
FPCL	Faux Pas Composite Index
ICC	Intra-Class Correlation
ICD	International Statistical Classification of Diseases and Related Health problems
IDEA	Individuals with Disabilities Education Act
IQ	Intelligence Quotient
K-SADS-PL	Kiddie-Schedule for affective disorders and schizophrenia-Present and Lifetime Version
KTEA	Kaufman Test of Educational Achievement
LD	Learning Disorder
MATRICES	Measurement and Treatment Research to Improve Cognition in Schizophrenia

MCAR	Missing completely at random
MI	Multiple Imputation
MISIC	Malin's Intelligence Scale for Indian Children
NEP	New Education Policy
PB	Personalising Bias
PEBL	Psychology Experiment Building Language
PONS	Profile of Non-Verbal Sensitivity Measure
PQ	Performance Quotient
RCI	Rehabilitation Council of India
RMET	Reading Mind in the Eyes Test
RMET-C	Reading Mind in the Eyes Test (Child Version)
RPWD Act	Right to Persons with Disabilities Act, 2016
RT	Reaction Time
SC	Social Cognition
SEM	Structured Equation Modeling
SES	Socio-economic Status
SIP	Social Information Processing
SLD	Specific Learning Disorder
SLD-SQ	Specific Learning Disability- screening questionnaire
SNQ	Social Norms Questionnaire
SNU	Social Norms Understanding
SNU_Inter	Interpersonal Social Norms Understanding
SNU_Intra	Intrapersonal Social Norms understanding
SOCIAL	Socio-Cognitive Integration of Abilities Model
SOCRATIS	Social Cognition Rating Test for Indian Setting
SOT	Second Order Theory of Mind
SPI	Social Perception Index
SPSS	Statistical Package for Social Sciences
SRS	Social Responsiveness Scale
SSA	<i>Sarva Shiksha Abhiyan</i>
TD	Typically Developing
ToM	Theory of Mind

ToM-A	Affective Theory of Mind
ToM-C	Cognitive Theory of Mind
ToMI	Theory of Mind Inventory
TOWL	Test of Written Language-IV
VQ	Verbal Quotient
WCST	Wisconsin Card Sorting Test
WHO	World Health Organization
WM	Working Memory
WRAT	Wide Range Achievement Test