

Cognitive communication skills in children with Intellectual Developmental Disorder

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ABSTRACT

The need of the study was to evaluate cognitive communication skills in children with Intellectual Developmental Disorder (IDD). One such Indian tool used to determine the cognitive communicative ability is Children's Communicative Cognition Assessment Battery (3CAB) in Tamil. The present research was aimed at exploring the cognitive communicative aspects in children with Intellectual Development Disorder using 3-CAB. Method: Children with IDD across different severities of Intellectual Disabilities were identified (20 participants in each group) and included in the current study between the language age of 3 -9 years. Children's Communicative Cognition Assessment Battery (3CAB) in Tamil were administered for children with IDD and age matched Typical Developing Children (TDC). Results: The Overall mean scores across all domains such as attention, discrimination, memory, executive functioning and social cognition were documented for TDC and Children with IDD. Due to intelligence factor and lack of cognitive ability children with IDD displayed significant difference in mean score across all domains as compared with TDC. Cognitive skills include planning, problem solving, learning which has greater influences on communication and communicative competence. Thus, children with IDD demonstrated poor scores in cognitive domains hence affecting the child's communicative performance. Henceforth professionals can use the current instrument in predicting the child's communicative performance effectively.

Keywords: *Intellectual Developmental Disorder, Typical Developing Children, Intellectual Disability, 3CAB -Children's Communicative Cognition Assessment Battery in Tamil*

Intellectual Developmental Disorder (IDD) are neurodevelopment disorders that begin in childhood and are characterized by intellectual difficulties as well as difficulties in conceptual, social and practical areas of living (APA, 2013). Children with Intellectual disability show characteristic features such as deficit in intellectual abilities, cognition and adaptive functioning. Primarily, children with IDD exhibit deficits in cognitive functions. Cognition is a mental action or the process which helps in acquiring knowledge,

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understanding through thoughts and senses. Cognitive skills include planning, problem solving, learning which has greater influences on communication.

Cognition and Communicative competence

Communicative competence (CC) is defined as the ability to use language, or to communicate, in a culturally- appropriate manner in order to make meaning and accomplish social tasks with efficacy and fluency through extended interactions. The term CC is synonymous called as 'Communicative Competence', 'Cognitive- communication skills' or 'Psycholinguistic skills'. The effectiveness of use of language depends on the person's CC ability along with other cognitive skills which are the key factors for effective communication in social situations Cognitive communicative disorder is defined as that compass difficulty in any aspect of communication that is affected by disruption of cognition. communication may be verbal or nonverbal and includes listening, speaking, gesturing, reading and writing all components of language American Speech -Language-Hearing Association (ASHA, 2005). Cognitive Communicative Disorder show difficulty in attending to conversation, sustaining a topic, remembering information, responding accurately.

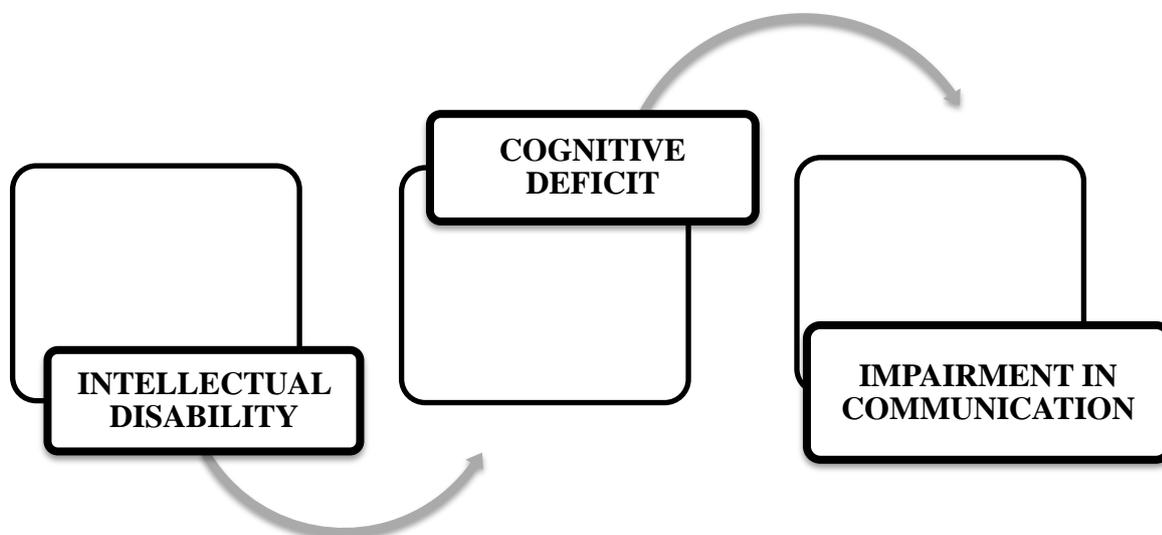


Figure 1. Effect of IDD on Cognition and Communication

To identify and describe the underlying strengths and weakness related to cognitive, executive function/self-regulatory and linguistic factors, including social skills that affect communication performance. It is also important to explore the effect of cognitive communication impairments on individual's capacity, performance and participation in every day communication contexts.

Primary components involved in assessment of Communicative cognition are attention and discrimination, memory, executive functioning and social cognition. Few assessment tools are commonly used to assess Cognitive abilities for individuals with intellectual disability are, Balthazar Scales of Adaptive Behavior (Balthazar, 1973), Adaptive Behaviour Scales (Nihira, Foster, Shellhaass and Leland, 1974), Behaviour Disturbance Scale (Leudar, Fraser and Jeeves, 1987)

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In Indian context, there is limited test available to assess cognitive aspects of communication in pediatric population. These tests are “the Cognitive Linguistics Assessment Protocol for Children (CLAP-C) in Kannada and Children’s Communicative Cognition Assessment Battery (3CAB) in Tamil (Felix& Selvaraj, 2018). One such test devised in assessing Communicative cognition abilities in Tamil speaking children is 3CAB. It primarily focuses on cognitive abilities such as Attention and Discrimination, Memory, Executive functioning, Social cognition.

Domains of Children’s Communicative Cognition Assessment Battery (3CAB) in Tamil

- **Attention and Discrimination**
Attention and discrimination ability primarily measure the discrimination ability of the child to pair the difference of words, distinguishing between same or different words and it also assess the selective attention.
- **Memory**
Memory predicts the child’s phonological working memory, Verbal working memory and memory for sentences. It also assesses the higher cognitive skills because the sentences are semantically incorrect without providing any contextual cues.
- **Executive Functioning**
Executive functioning focusses on the child’s ability of planning, problem solving, reasoning, categorization, organization, cognitive flexibility and inhibitory control that is faced by a child day-day.
- **Social cognition**
Social cognition attributes to child’s theory of mind especially understanding emotions of others and false beliefs.

Aim

The study aimed at exploring cognitive communicative aspects in children with Intellectual Development Disorder using 3-CAB (Children’s Communicative Cognition Assessment Battery in Tamil).

METHODOLOGY

The specific objectives of the study were to profile the cognitive communicative aspects of children with Intellectual Developmental Disorder (IDD) using 3-CAB (Children’s Communicative Cognition Assessment Battery in Tamil). The study also explored the effect of gender and cognitive communicative skills across various severities of children with IDD.

Table 1 Demographic details of the participant

	Group B 1	Group B 2	Group B 3
N	20	20	20
Age range	3-15 years	3-15 years	3-15 years
Mean age	12.90	13.30	12.60
Language age	3-7 years	3-7 years	3-7 years
Degree of severity	Mild	Moderate	Severe

Inclusion criteria

The participants included in the study were - Children with IDD across different severities of Intellectual Developmental Disorder were identified (20 participants in each group) and included in the current study between the language age of 3 -9 years. Children who have Tamil as their native language were included. Children with normal or corrected

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vision/hearing without any other behavioural disorders as well children who were attending special education, speech therapy and occupational therapy were also included in the present study.

Exclusion criteria

Children with behavioral disorders and other associated conditions were excluded from the study.

Procedure

The participants were seated in comfortable position in quiet room the total time taken each participant ranged between 30 min – 45 min the test were conducted solely by the examiner. A good rapport was established with each subject prior to test administration. Written consent was taken from the parents, caregivers for the participation of the child in the study. Participants in Group A (Typically Developing Children) with language age of 4-7 years were included in the study by administering a language assessment tool Extended- Receptive and Expressive Emergent Language Scale (E-REELS).

DSM – V was used to diagnose Intellectual Developmental Disorder (Group B) and various severities of children with IDD were identified; 60 participants (Group B) were divided into 3 groups. Group B1 include 20 children with Mild severity of IDD, Group B2 include 20 children with Moderate degree of IDD and Group B 3 include 20 children with severe degree of IDD. By administering a Language assessment tool Extended- Receptive and Expressive Emergent Language Scale (E-REELS), Children who has 4-7 years of language age were only included in Group B.

Testing is carried out using Children's Communicative Cognition Assessment battery (3-CAB) in Tamil. There are four domains in 3CAB which are depicted in Table

Table 2 Domains, tests, presentation mode and maximum scores of the 3CAB

Domain	Test	Presentation mode	Maximum score
I Attention discrimination	a) Auditory word discrimination	Auditory	6
	b) sound count test	Auditory	9
II Memory	a) Phonological working memory	Auditory	16
	b) Word recall	Auditory	13
	C) Sentence recall	Auditory	6
III Executive control	a) Deductive reasoning	Auditory	6
	b) Causal reasoning	Auditory	6
	c) Identifying by attributes	Auditory	9
	d) Semantic fluency	Auditory	15
	e) Letter fluency	Auditory	9
	f) Inhibitory control	Auditory +Visual	26
IV Social cognition	Theory of mind	Auditory +Visual	10

RESULTS AND DISCUSSION

The present study aimed to profile cognitive communicative aspects in children with Intellectual Development Disorder (IDD). Total of 60 participants (Group B) with language age of 4-7 years were included in the study. The findings from Group B were compared with

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Group A (Typically Developing Children). After the administration of 3-CAB, the raw scores were subjected to descriptive and statistical analysis. One way ANOVA and 't test' were carried out using Statistical Package for Social Sciences (SPSS) (version22.0)

Table 3 Cognitive Communicative abilities in Typically Developing children (TDC) (Group A) and Children with IDD (Group B)

Domain	Subtest	TDC (n = 126)		IDD (n = 60)		p value
		Mean	SD	Mean	SD	
Attention Discrimination	AWD	5.69	0.65	2.58	1.66	0.00*
	SCT	6.66	3.28	3.36	2.53	0.00*
	Total	12.35	3.54	5.95	3.93	0.00*

Cognitive Communicative abilities are the thought process that allow human to function successfully and interact meaning fully with each other. It reflects the mental ability of an individual to actively take part in social situation, use language and carry out an effective communication. The children with Intellectual Developmental Disorder lack in cognitive functions making it necessary to identify communicative cognitive abilities. The cognitive communicative aspects of children with Intellectual Developmental Disorder (IDD) were assessed using 3-CAB (Children's Communicative Cognition Assessment Battery in Tamil) and the mean score of cognitive communicative abilities of group A and Group B were profiled.

Over all mean scores in TDC across all domains such as attention discrimination (12.35), memory (29.41), executive functioning (50.67) and social cognition (8.51). Mean score of children with IDD (Group B) are attention discrimination (5.95), memory (22), executive functioning (28.3) and social cognition (5). Due to intelligence factor and lack of cognitive ability children with IDD displayed significant difference in mean score across all domains.

Since cognition is a prerequisite for development of communication in young children. Assessing Communicative cognition function is important. A tool which is designed to profile cognitive communicative ability is 3CAB (Communicative Cognition Assessment battery) Communicative Cognition Assessment battery (3CAB) consists of four main domains such as attention discrimination, memory, executive functioning and social cognition.

Domain- I Attention Discrimination

Attention discrimination

Attention is central mechanism for cognitive and linguistic processing. To process the language, attention skills such as sustained attention and selective attention. The basis of the cognizance function in children with mild intellectual disability is significantly determined by the attention functions. Neuropsychological research shows that disturbances in attention represent a significant factor of cognitive development, which hinders learning, perceptive and motor functions in children with intellectual disabilities (Bigby, Fyffe, Ozanne, 2007; Delfos, 2004; Kurtz, 2006; Kurtz, 2007).

Control group vs Study group

Attention discrimination is a process in which the attention promotes child to focus on completion of any activities that is required. This domain incorporates subtask of phoneme

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sequencing and word discrimination task. Sensory, motor, intelligence and cognitive functions are the primary factors required for better attention discrimination (Spearman, 1904). Any decline in one of the above factors could result in reduced performance of the attention discrimination task. Similarly, in the present study using 3- CAB, children with IDD showed statistically significant score (0.00) in attention discrimination domain as compared to TDC.

Intellectual Deficit express difficulty in combining and sequencing of phoneme. Attention abilities significantly influence learning and behavior in children and adults with IDD.

Across various severities of Intellectual Developmental Disorder, children with Mild degree of IDD showed significant differences of (0.00) for auditory word discrimination whereas for sound count test children with IDD showed no significant difference (0.46) when compared with TDC. On comparing TDC with moderate and severe degree, which showed a higher significant value of (0.00) due to which children with IDD had relative less attention span than that of typical developing children.

Table 4 Attention discrimination abilities in TDC and different severities of IDD

Domain	Sub test	TDC (GA) N=126		Mild (GB1) N=20		Moderate (GB2) N=20		Severe (GB3) N=20	
		Mean	SD	Mean	SD	Mean	SD	Mean	SD
Attention discrimination	AWD	5.69	0.65	4.4	1.23	1.80	0.61	1.35	1.19
	SCT	6.66	3.28	6.10	2.61	2.20	0.89	1.80	0.69
	TOTAL	9.02	3.54	7.45	1.61	2.9	0.60	2.25	0.81

Effect of gender on cognitive communicative aspects in IDD

Gender difference in Attention Discrimination task in children with IDD was profiled. There was no significant change in performance between male and female this Could be attributed to the fact that cognitive performances among male and female as similar hence forth there was no gender differences in the present study which is supported by (Stewart & Einfeld, 2010) the results revealed that there was no significant differences between gender.

Comparing TDC across various severities of IDD

Across various severities of Intellectual Developmental Disorder, children with Mild degree of IDD showed significant differences of (0.00) for auditory word discrimination whereas for sound count test children with IDD showed no significant difference (0.46) when compared with TDC.

On comparing TDC with moderate and severe degree, which showed a higher significant value of (0.00) due to which children with IDD had relative less attention span than that of typical developing children. Based on the present study findings and which had also been supported by author Saunders (2001) Children with IDD have difficulty in attending to relevant questions in both learning and social situations (Saunders, 2001)

Table 5 Comparison of TDC and severities of IDD

Domain	Sub test	TDC vs IDD		
		Mild p value	Moderate p value	Severe p value
Attention	AWD	0.00*	0.00*	0.00*
Discrimination	SCT	0.46	0.00*	0.00*
	Total	0.03	0.00*	0.00*

(Note: * $p < 0.05$ is significant)

Comparison between Groups in Attention Discrimination Domain various across severity This can be due severity of IDD and lack of language ability which was also supported by the author (Moore-Brown & Montgomery, 2006).

Memory

To acquire or learn a new skills, adequate attention and memory is required. Since memory is a mental process of encoding, storing and retrieval of information through past experiences. These processes showed deficit in children with IDD. Hence assessing memory domain in children with IDD is important. Current study showed children with IDD have difficulty in phonological processing ability that would attribute to delay in the memory processes when compared to TDC. Hence children showed reduced mean score (3.11) as compared to control group. Correspondingly, Baddeley and Swanson (2012) suggested that children with IDD have deficits in phonological storage system which is a primary requirement for working memory and shortterm memory.

Table 6 Comparison of memory abilities in TDC and Children with IDD

Memory	TDC		IDD		p value
	Mean	S.D	Mean	S.D	
PM	19.12	2.60	13.73	2.86	0.00*
WR	7.72	3.61	5.15	2.13	0.00*
SR	2.57	0.75	3.11	1.32	0.00*
Total	29.41	5.32	22	5.28	0.00*

(Note. * $p < 0.05$ taken as significant)

Table 7 memory abilities in TDC and different severities of IDD

Domain	Sub test	TDC		Mild Degree		Moderate Degree		Severe	
		n=126		n= 20		n= 20		n =20	
		Mean	SD	Mean	SD	Mean	SD	Mean	SD
Memory	PWM	19.12	2.60	15.30	1.34	14.75	1.65	11.15	3.21
	WR	7.72	3.61	7.20	1.23	5.0	1.91	3.25	0.85
	SR	2.57	0.75	4.20	0.99	2.95	0.94	2.00	0.72
	Total	29.41	5.32	26.8	2.26	22.75	3.02	16.4	3.57

Gender differences in memory task in children with IDD were profiled. There was no significant change in performance between male and female. This could be attributed to the fact that cognitive performances among male and female were similar hence forth there was no gender differences in the present study which is supported by Stewart. Einfeld (2010). The results revealed that there was no significant differences between gender.

The Significant differences was compared with TDC and among degrees of IDD. Cognitive Communicative abilities for TDC across various severities of Intellectual Developmental

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Disorder were profiled. Children with IDD showed significant score (0.00) across all the groups in phonological working memory, whereas in word recall, children with IDD showed no significant differences in mild degree. Children with moderate and severe degree of IDD showed higher significant differences (0.00) when compared with TDC which indicated as deficits in storage capacity process reported by Gathercole Schuchardt et al (1993).

In typically developing children, the storage component emerges in the first years of life and it is crucial in processing acoustic information where as children with IDD showed deficits in storage. Sentences recall domain showed a greater significant value of (0.00) across all the severity due to which children with IDD had relative less memory span than that of typical developing children. Based on the present study findings which had also been supported by author (Tahir 2016) suggested that children with IDD showed impairment on all the measure of working memory / short term memory. This attributes to the delay in intellectual functioning compared to typically developing children.

Domain III -Executive Functioning

Executive functions (EFs) are processes that control and regulate thought and action in to different degrees, be related to mental age and experience. Deficits in executive functioning are frequently described in developmental disorder. This domain assesses the child's executive function like planning and problem solving. children with IDD showed deficits on switching, verbal executive -loaded working memory inhibition, planning and nonverbal executive -loaded working memory (DanielssonH, et al 2012)

Children with IDD also display lower performance in executive functioning tasks that involve inhibition, updating, shifting, planning, decision making, problem solving, fluency and working memory-related dual task. Executive functions (EFs) also control and regulate thought and action in TDC. Deficits in executive functioning are frequently described in developmental disorder, similarly children with IDD showed statistically significance (p value of 0.00) in performing executive functioning task as compared to TDC. This suggests that children with may have deficits in planning, cognitive flexibility and inhibitory control. The present study findings also supported by the evidence of Floriana Costanzoetal 2013.

Adults with ID had a selective impairment in some areas of EFs such as verbal fluency and executive loaded word recall. Thus, selective impairment on EFs was found for individuals with ID compared to the controls (Danielsson, Henryd, Ronnberg & Nilssone, 2010).

Table 8 Comparison of executive functioning in TDC and children with IDD

Executive functioning	TDC		IDD		Significance
	Mean	S.D	Mean	S.D	
DR	5.12	1.25	3.63	1.61	0.00*
CR	5.06	1.43	2.98	1.66	0.00*
I	5.71	2.28	3.31	2.86	0.00*
SF	10.39	3.91	5.86	3.94	0.00*
LF	4.55	3.51	2.71	2.63	0.00*
IC	19.85	4.96	10.3	5.46	0.00*
Total	50.67	14.33	28.3	50.69	0.00*

Table 9 Executive functioning in TDC and different severity of IDD

Domain	Sub test	TDC		Mild Degree		Moderate Degree		Severe	
		n=126 Mean	SD	n= 20 Mean	SD	n= 20 Mean	SD	n =20 Mean	SD
Executive Functioning	DR	5.12	1.25	5.35	0.93	3.40	1.09	2.15	0.74
	CR	5.06	1.43	4.80	1.05	2.40	1.35	1.75	0.44
	IA	5.71	2.28	6.10	2.91	2.70	1.62	1.15	0.93
	SF	10.39	3.91	11.95	2.06	5.85	2.60	1.85	2.05
	LF	4.55	3.51	5.20	2.85	1.95	1.50	1.00	0.97
	IC	19.85	4.96	16.65	2.1	9.20	3.57	5.25	2.19
	Total	50.67	14.33	50.55	7.93	26.45	6.72	13.15	4.33

Gender differences in executive functioning in children with IDD were profiled. There was no significant change in performance between male and female. This could be attributed to the fact that executive functioning among male and female were similar hence forth there was no gender differences in the present study which is supported by (Memisevic H, Sinanovic O.2014) The results revealed that there was no significant differences between gender.

Comparison between Executive functioning of TDC and IDD children with mild degree showed a significant value in IC (0.00) whereas in moderate and severe group showed greater significant value of (0.00) across sub test. This reflects lack of executive functioning abilities. the present study findings had been supported by the author (Margherita Orsolini et al 2015) that attentional control and executive functions of inhibition and switching are all involved in verbal working memory (Margherita Orsolini et al 2015)

Domain IV -Social cognition

In order to achieve child’s cognitive development, understanding social cognition is very important. Social cognition predicts child’s perception, understanding and implementation of linguistics, auditory, visual and physical cues that communicate emotional and interpersonal information. Social cognition understanding is one of the most important domains predominantly assesses the child ‘s theory of mind especially in understanding emotions of others and false beliefs. Under this domain one such test is Theory of Mind (ToM). TOM is considered as a comprehensive knowledge, which predict people's behavior in terms of expectations. Some behaviors and skills such as the intentional interactions, repairing failed communications and teaching are associated with ToM in people’s behavior and relationship. Assessing TOM in children with IDD shows a significant role in children’s social and cognitive functioning. The current study findings indicated that children with IDD showed statistically significance score (p value of 0.00) in social cognition domain as compared to TDC. Children with IDD showed a deficit in understanding emotions of other false beliefs.

Table 10 Comparison of TDC and children with IDD

Social Cognition	TDC		IDD		p value
	Mean	SD	Mean	SD	
TOM	8.51	1.75	5	2.21	0.00*

On comparing social cognition of TDC with various severity showed that the children with IDD showed a poorer performance of mild (7.5) when compared with TDC similarly with moderate (4.2) , severe (1.30). Social cognition ID participants present lower abilities than

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the TD children in change of representation. The participant must take another person's perspective in order to formulate two different points of view, They have also found that children with D.S performed more poorly than children with I.D. Benson et al. (1993) report that mentally retarded children have greater difficulties in solving ToM tasks than children of the same mental age who are not retarded.

Table 11 Social cognition in TDC and different severity of IDD

Domain	Sub test	TDC		Mild Degree		Moderate Degree		Severe	
		n=126 Mean	SD	n= 20 Mean	SD	n= 20 Mean	SD	n =20 Mean	SD
Social	TOM	8.51	1.75	7.5	1.35	4.20	1.19	3.30	1.30
Cognition	Total	8.51	1.75	7.5	1.35	4.2	1.19	3.30	1.30

Comparison between male and female group showed no significant value (0.838) was observed, thus it helps to us relate there is no significant performances among gender differences which had also been supported by the author.

On comparison of TDC with across various severity children with IDD showed a greater significant value of (0.00) thus this indicates that children with IDD had false beliefs. Which had also been states weakness in the change of representation in the ID participants reflects their harder renouncement of “egocentric thought” than in the TD children.

On comparing social cognition domain across various severity in between groups showed a greater significant value of (0.000) in mild and moderate degree, mild and severe group whereas moderate and severe degree shows significant value of (0.02). As severity of IDD increases their memory, mental actions and conceptual understanding is less as compared to mild degree.

CONCLUSION

The findings of children with TDC and IDD showed a highly significant values across domain and sub domains. Children with IDD showed Statistically significant score of in Attention Discrimination domain as compared to TDC. Over all findings for both the tests of attention and discrimination revealed a steady decrease in cognitive performance in children with IDD. Memory abilities with TDC across various severities of Intellectual Developmental Disorder were profiled. Children with mild of IDD showed better mean scores for mild degree when compared to moderate and severe degree across all domains and sub domains i.e, sentence recall and word recall showed a statistically difference higher score pathological group than that of TDC. Executive functioning of TDC across severity of IDD was observed to have decreases in the mean score and standard deviation and also various based the severity across all domains and sub domains. With respective sub domain of E.F such as D.R ,I.A, L.F, S.F showed differences in the score than that of normal in mild. Social cognition of TDC with various severity showed that the children with IDD showed a poorer performance across all group based on mean and SD. In terms of gender, There was no significant change in performance between male and female this Could be attributed to the fact that cognitive performances among male and female as similar hence forth their was no gender differences in the present study. Cognitive skills include planning, problem solving, learning which has greater influences on communication and communicative competence. Thus, children with IDD demonstrated poor scores in cognitive domains hence affecting the child's communicative performance. Henceforth professionals

can use the current instrument in predicting the child's communicative performance effectively.

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Conflict of Interest

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