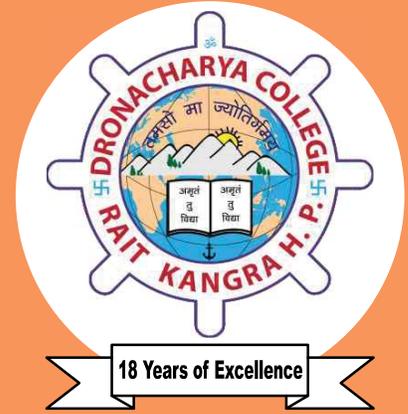


ISSN : 2347-3290



# GYANKOSH

Journal of Educational Research

*A Peer reviewed Bi-Annual National Journal*

**Published by**

School of Education  
Central University of Himachal Pradesh  
Dharamshala (H.P.)  
and  
Dronacharya College of Education  
Rait, Kangra (H.P.)

**Volume-3**

**Issue-2**

**July-December 2023**

# **GYANKOSH**

## **Journal of Educational Research**

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### PUBLISHED BY

School of Education, Central University of Himachal Pradesh, Dharamshala &  
Dronacharya College of Education, Rait, Distt. Kangra, Himachal Pradesh, PIN-176208

### PRINTED AT

Rana Arts, Gaggal

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Dharamshala-176215, Himachal Pradesh  
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## EDITORIAL



Dear Readers,

*I am extremely happy and thrilled to present the current issue of GYANKOSH Journal of Educational Research. Being the editor of the Journal, I acknowledge the contribution of Editorial Board, Advisory Board and Reviewers of the papers published in this issue of GYANKOSH. I believe that the wide range of research articles that got placed in this issue will surely contribute to the new understanding of research and it will add to the already existing corpus of knowledge on education and research. The articles in this issue also provide an effective way of making the writings discernable to the wider communities of researchers and academicians. We have accepted the articles/research papers after getting the reports from our reviewers. These articles traverse through convoluted challenges that fall upon the educational landscapes of the country which simultaneously make these articles significant and considerable. I am happy to give glimpses of select articles included in the present issue.*

*The article "Reliability Study of The EFAC-CDD: Developmental Disabilities" focuses to conduct a reliability study to standardize the EFAC-CDD. The study assesses the test-retest reliability to standardize the testing of this checklist.*

*In the article, "Collaborative Learning: An Essential Element of Modern Classroom" the author discusses the roles and activities of both teachers and students in a collaborative classroom setting, aiming to provide clarity on the significance of collaborative learning in modern education.*

*The Article "A Case Study of a Student Having Locomotor Disability (Right Hand Missing From Birth)" aims to examine the specific characteristics and abilities of special children concerning their individual disabilities or conditions, family dynamics, effective strategies and interventions, and other significant dimensions.*

*In the Article, "Exploring the Branches of Yoga: Integrating Ancient Wisdom into Modern Education for Holistic Development", the author explores how yoga can be seamlessly integrated into existing curricula, teacher training programs, and school cultures.*

*In the article, "Gandhian Peace and Non-violent Road to a Peaceful World" the authors focus on different emerging concepts in the context of peace and non-violence. They have seen these dynamics by looking through the Gandhian perspective.*

*There is an article on the theme "Digitalization of Higher Education: Technology Integration in Teaching-Learning" the author focuses on digital transformation, innovative teaching methods and administrative efficiencies, cyber security, and digital literacy.*

*In the Article "Impact of National Education Policy (NEP) in Transforming Higher Education in India" focuses on understanding the implementation of NEP-2020 and deliberated on its positive outcomes.*

*The article, "Social Network and Cognitive Well-being among Students of Jammu and Kashmir" focuses on the importance of promoting social connectivity and nurturing cognitive well-being among students in Jammu and Kashmir.*

*The wide array of articles included in this issue will surely help students, scholars, and academicians to understand the new trends in educational research. I wish that this issue of GYANKOSH will be advantageous for all its stakeholders.*

**Prof. Manoj Kumar Saxena**

Editor

GYANKOSH Journal of Educational Research

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# Reliability Study of The EFAC-CDD : Executive Functioning Assessment Checklist For Children With Developmental Disabilities

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## Abstract

**Background & Aim:** A checklist was developed to assess executive functioning on 9 different areas, i.e. Working Memory, Impulse Control, Planning Skills, Mental Flexibility, Action Monitoring, Problem Solving, Emotional Control and Time Management for children with developmental disabilities in India called the EFAC-CDD by Mr Vikas Ray, which is a 256-item checklist in English.

**Aim:** This research aims to conduct a reliability study to standardize the EFAC-CDD.

**Methodology:** The study will analyze the reliability of EFAC-CDD on sample of children with developmental disabilities (N=50) between the ages of 8 to 15 years of age on a broad range of EF areas using the EFAC-CDD using test-retest reliability.

**Results:** There is a highly significant ( $p=4.17$ ) correlation (large,  $r=0.98$ ) among the children with developmental disabilities when tested on test-retest reliability 5 months apart. The results of test-retest reliability in all 9 domains of the tool are discussed.

**Conclusion:** The findings of this research help in standardizing the EFAC-CDD and establish reliability of the tool, helping is standardization for testing executive functioning in children with developmental disabilities.

**Keywords:** Executive Functioning, Evaluation Checklist, Developmental Disabilities, Standardization, Reliability.

**To Cite :** Ray, Vikas & Singh, Yash Pal (2023). Reliability Study of The EFAC-CDD: Executive Functioning Assessment Checklist For Children With Developmental Disabilities, *Gyankosh Journal of Educational Research*, 3(2), 1-12.

## INTRODUCTION

Executive functioning (EF) refers to neuropsychological processes that regulate functions of attention, emotion, planning in behavior that are used towards completing a daily activity, a task or a goal (Barkley, 2012). "Although there is no single, universally agreed-upon definition of EF, most conceptualizations of EF include several related but separate processing domains primarily mediated by neural circuits in the prefrontal cortex" (Barkley, 2012). "These core executive functions include self-directed attention (considered the central executive because it serves a gatekeeping role for subsequent executive functions), working memory (simultaneous processing and storage of a stimulus/event), response inhibition (controlled suppression of a prepotent or automatic response to a stimulus/event), cognitive flexibility (shifting between mental

states, responses or tasks), and fluency (rapid processing under concentration demands)"; (Barkley, 2012; Friedman & Miyake, 2004). Interventions that can be applied early along with early detection and identification is of utmost importance when it comes to Executive Functioning deficits as it can lead to development of many disorders and associated risks such as cerebral palsy, traumatic brain injury, epilepsy, and the risk grows with the level of delays and deficits in EF (Parrish et al., 2007, Daly & Brown, 2007; O'Hara & Holmbeck, 2013).

Executive functions are a set of cognitive skills that are used to learn, work and manage everyday life, which, when it comes to children with developmental disabilities, are observed to be dysfunctional. Executive functioning involves a set of top-down mental skills which helps in memory, thinking, and control. Some people describe executive functioning as "the

management system of the brain” as they help set goals, plans and get things done. According to experts, all the skills can majorly be classified under three important domains of executive functioning called inhibitory control, working memory, and flexible thinking.

The professionals of this field i.e. special educators, speech therapists, occupational therapists, psychologists, educators and researchers, scholars and academics of this field have been interested in the early identification and applying interventions as early as possible to combat EF deficits, as they are seen in children with developmental disabilities. These EF deficits are synonymous with symptoms observed in individuals with Autism Spectrum Disorder (ASD), highlighting that individuals with Intellectual Disability, Autism Spectrum Disorder, Attention-Deficit/Hyperactivity Disorder commonly experience executive functioning deficits (Robinson et al., 2009; Benallie et al. 2021; Panerai et al., 2014).

Low or poor levels of executive functioning are addressed as substantial health issues clinically not only because it leads to developmental of many neurological disorders, but it also has significant impact on academic performance and daily functioning; it also can lead to memory issues and problems or failure in academic performance (Barkley, 2012). “EF delays, as well as disorders characterized by poor EF, are commonly associated with academic underachievement, learning deficits, and related problems with learning and memory” (Barkley, 2012).

Many researches have drawn a parallel between a deficiency in executive functions and developmental disabilities i.e. autism spectrum disorder, learning disability, intellectual disability, attention deficit hyperactivity disorder, downs syndrome, stating that a deficiency of executive functioning in individuals with developmental

disabilities can be targeted for intervention and treatment plans.

### **THE EXECUTIVE FUNCTIONS ASSESSMENT CHECKLIST FOR CHILDREN WITH DEVELOPMENTAL DISABILITIES (EFAC-CDD)**

The executive Functions assessment checklist for children with developmental disabilities (EFAC-CDD) is developed to assess the executive functioning level of children with developmental disabilities across different domains of executive functions. For assessment of executive functions, domains; Sub-domains and set of skills have been developed. The set of skills could be used for program planning and providing intervention in different Domains and sub-domains of executive functions. In view of non-availability of checklist or any assessment tools with an Indian standardization, for the purpose of assessing the level of executive functioning of children with developmental disabilities; the EFAC-CDD can be used by special educators, occupational therapists, psychologists, behavioral therapist and other allied professionals working for children with developmental disabilities. The checklist will be able to guide them to assess and to plan for intervention of children with developmental disabilities.

The dimensions of the checklist that are assessed by the EFAC-CDD are as follows:

- Working Memory – It involves processes holding/retaining small amounts of or temporary information that helps us is accomplishing tasks. Doing mathematical operations, translating instructions, and working with language, all require the use of working memory.
- Impulse Control – It involves the ability to hold or control own thoughts or behaviors, attentions and/or emotions that have the strength to overrule a strong internal predisposition or an impulse. Herein, the individual may resist their urges and act in a

more appropriate, relevant manner or what is needed. This is commonly known as “thinking before acting”.

- Planning – It involves the ability to come up with a plan of action that is appropriate or a roadmap that helps in attaining a goal. Completing any task has the requirement of mental planning and having it ready before approaching the task in order to do it.
- Mental Flexibility – It involves the ability to change perspectives and be flexible enough to adapt according to the situation or circumstance demands.
- Attention – It helps us to focus on tasks, ignore distractions, and resist impulsive behavior.
- Action Monitoring – It is the ability to monitor one's own behaviour involving controlling impulses and emotions, staying on task, keeping belongings organized.
- Problem Solving – It involves the capability to detect and identify a problem, then understand and describe it and further generate ideas and solutions to overcome it.
- Emotional Control – It involves how we manage and respond to emotional experiences in the environment, particularly stressful ones.
- Time Management – It is the ability to plan and organize one's time in an efficient manner which helps in achieving goals and maximizing productivity.

The EFAC-CDD is a checklist developed to assess the level of executive functioning among children with developmental disabilities across 9 domains i.e., Working Memory with 7 sub-domains; Impulse Control with 4 sub-domains; Planning Skills with 4 sub-domains; Mental Flexibility with 3 sub-domains; Attention with 5 sub-domains; Action Monitoring with 3 sub-domains; Problem Solving with 4 sub-domains; Emotional Control with 2 sub-domains; and Time Management with 1 sub-domain. Each sub-

domain consists of 8 skills that will be assessed, hereby resulting in a total of 256 items.

The domains of the checklist are described below with the aspects of the concept that are included in the checklist to assess that function.

**Working Memory** -The working memory domain assesses short-term recall (auditory digit spell, letter spell), visuospatial memory (odd one out,), symbolic memory (card matching game) as well as delayed recall and recognition (find the pair, summarizing the story and add-on words to category). Herein these specific items give an accurate representation of whether the child is able to perform said task or needs assistance in further development of the skill.

**Impulse Control** - The Impulse Control domain measures the child's ability to control an impulse, interference control and inhibition through a folk game called “Chidiya ud”, also known as “Does it fly?”, jump in jump out game, and random letter cancellation which increase in level of complexity with each item.

**Planning Skills** - The Planning skills domain assess concentration, perception, memory, reasoning and coordination through Jenga, find the key, block building and net the ball.

**Mental Flexibility** - The Mental Flexibility domain assesses attention, detection, inhibition, working memory and switch process through read and clap, follow and underline the pattern, and watch the color and tap.

**Attention** - The Attention domain assesses executive, selective, divided and sustained attention through follow the line pattern, imitate physical action, pattern walking, track the ball below the cups, and coloring game.

**Action Monitoring** - The Action Monitoring domain assesses self-monitoring through find the difference, sort the items, and color coding sub-domains.

**Problem Solving** - The Problem-Solving

domain assesses the ability to identify a problem and come up with ways to solve it, through the tasks mazes, crossword puzzles, tangrams, finding a solution to a narrated problem.

Emotional Control - The Emotional Control domain assesses the ability to recognize, understand and manage emotions in our environment through knowing one's emotions, and knowing others' emotions.

Time Management - The Time Management domain assesses understanding, performing tasks while prioritizing and postponing specific tasks according to importance, setting a routine through identification of priority of task.

### Scoring

A child will be scored on each skill item on a score of 0 – 1. The child will be given 3 attempts to perform the given skill, which is termed as a trial, and each successful attempt will receive a score of 1, and every unsuccessful attempt will receive a score of 0 subsequently. Further scoring process is described in the tool construction study wherein the domain total score, domain percentage, as well as the overall total executive functioning score and percentage of the participant is calculated to determine their level of functionality (Ray & Singh, 2023).

The raw score of each sub-domain will be calculated by summing the 8 constituent skill items, i.e., the raw score for each sub-domain is the total of all the successful or functional scores ranging from 0-8. The raw score for each domain is the summation of all sub-domain scores, the range for each specific domain varies and is given as follows. The maximum score for each domain is as follows:

Working Memory	=	56
Impulse Control	=	24
Planning Skills	=	32
Mental Flexibility	=	24

Attention	=	40
Action Monitoring	=	24
Problem Solving	=	32
Emotional Control	=	16
Time Management	=	8

Individual domain percentage calculation:

$$\text{Domain\%} = \frac{\text{Raw Score}}{\text{Max Score}} \times 100$$

Grand total percentage calculation:

$$\text{Domain\%} = \frac{\text{Raw Score}}{\text{Max Score (256)}} \times 100$$

The score obtained for different domains and total executive functioning reflect the functionality level of the child in the given area (Ray & Singh, 2023).

## METHODOLOGY

### Sampling

The sampling design was selective and purposive as for the purpose of this study a sample of children with developmental disabilities (N=50) were chosen.

The children in this group were chosen from the referrals made to a disability and therapy centre in New Delhi i.e., Learning Ladder Therapy Centre. This includes children with Intellectual Disability (n=25) and children with Autism Spectrum Disorder (n=25).

### Testing

The sample was tested on the Executive Functioning Assessment Checklist for Children with Developmental Disabilities (EFAC-CDD) five months apart for testing the reliability of the measure through test-retest reliability.

The test-retest reliability was analysed and evaluated using Pearson Correlation Analysis. "Test-retest scores at or above .70 were considered satisfactory" (Nestor & Schutt, 2015). "In line with published conventions,

## RESULTS AND INTERPRETATION

**Table-1**  
**EFAC-CDD Description**

Domain of EFAC-CDD	Test-retest reliability N=50, 1-5 months	Correlation values
Working Memory	0.97*	Large
Impulse Control	0.90*	Large
Planning Skills	0.95*	Large
Mental Flexibility	0.93*	Large
Attention	0.93*	Large
Action Monitoring	0.97*	Large
Problem Solving	0.95*	Large
Emotional Control	0.88*	Large
Time Management	0.91*	Large
Total EF	0.98*	Large

Values for test-retest reliability are pearson's correlation coefficient  $p < 0.01^*$

**Table-2**  
**Correlation and Statistics for Total Executive Functioning**

	Test	Re-test
Mean	50.94	69.94
Variance	711.8535	750.6698
Observations	50	50
Pearson Correlation	0.987817	
Hypothesized Mean Difference	0	
df	49	
t Stat	-31.3833	
P(T<=t) one-tail	2.08E-34	
t Critical one-tail	1.676551	
P(T<=t) two-tail	4.17E-34	
t Critical two-tail	2.009575	

The executive functioning has a statistically significant ( $p=4.17$ ) and large correlation ( $r=0.98$ ) among the children with developmental disabilities.

**Table-3**  
**Correlation and Statistics for Working Memory**

	Test	Re-test
Mean	14.08	18.8
Variance	38.93224	45.30612
Observations	50	50
Pearson Correlation	0.9737	
Hypothesized Difference	Mean 0	
df	49	
t Stat	-21.3201	
P(T<=t) one-tail	9.65E-27	
t Critical one-tail	1.676551	
P(T<=t) two-tail	1.93E-26	
t Critical two-tail	2.009575	

The working memory domain has a statistically significant ( $p=1.93$ ) and large correlation ( $r=0.97$ ) among the children with developmental disabilities.

**Table-4**  
**Correlation and Statistics for Impulse Control**

	Test	Re-test
Mean	6.02	7.18
Variance	7.652653	6.028163
Observations	50	50
Pearson Correlation	0.906888	
Hypothesized Mean Difference	0	
df	49	
t Stat	-7.02932	
P(T<=t) one-tail	2.99E-09	
t Critical one-tail	1.676551	
P(T<=t) two-tail	5.98E-09	
t Critical two-tail	2.009575	

The impulse control domain has a statistically significant ( $p=5.98$ ) and large correlation ( $r=0.90$ ) among the children with developmental disabilities.

**Table-5**  
**Correlation and Statistics for Planning Skills**

	Test	Re-test
Mean	5.42	7.42
Variance	10.41184	8.942449
Observations	50	50
Pearson Correlation	0.954249	
Hypothesized Mean Difference	0	
df	49	
t Stat	-14.596	
P(T<=t) one-tail	9.04E-20	
t Critical one-tail	1.676551	
P(T<=t) two-tail	1.81E-19	
t Critical two-tail	2.009575	

The planning skills domain has a statistically significant ( $p=1.81$ ) and large correlation ( $r=0.95$ ) among the children with developmental disabilities.

**Table-6**  
**Correlation and Statistics for Mental Flexibility**

	Test	Re-test
Mean	5.6	7.78
Variance	12.16327	10.86898
Observations	50	50
Pearson Correlation	0.938235	
Hypothesized Mean Difference	0	
df	49	
t Stat	-12.7718	
P(T<=t) one-tail	1.65E-17	
t Critical one-tail	1.676551	
P(T<=t) two-tail	3.29E-17	
t Critical two-tail	2.009575	

The mental flexibility domain has a statistically significant ( $p=3.29$ ) and large correlation ( $r=0.93$ ) among the children with developmental disabilities.

**Table-7**  
**Correlation and Statistics for Attention**

	Test	Re-test
Mean	7.56	11.8
Variance	19.47592	22.61224
Observations	50	50
Pearson Correlation	0.93028	
Hypothesized Mean Difference	0	
df	49	
t Stat	-17.1862	
P(T<=t) one-tail	1.09E-22	
t Critical one-tail	1.676551	
P(T<=t) two-tail	2.18E-22	
t Critical two-tail	2.009575	

The attention domain has a statistically significant ( $p=2.18$ ) and large correlation ( $r=0.93$ ) among the children with developmental disabilities.

**Table-8**  
**Correlation and Statistics for Action Monitoring**

	Test	Re-test
Mean	3.8	4.48
Variance	12.20408	12.21388
Observations	50	50
Pearson Correlation	0.975863	
Hypothesized Mean Difference	0	
df	49	
t Stat	-6.26316	
P(T<=t) one-tail	4.59E-08	
t Critical one-tail	1.676551	
P(T<=t) two-tail	9.19E-08	
t Critical two-tail	2.009575	

The action monitoring domain has a statistically significant ( $p=9.19$ ) and large correlation ( $r=0.97$ ) among the children with developmental disabilities.

**Table-9**  
**Correlation and Statistics for Problem Solving**

	Test	Re-test
Mean	5.58	7.6
Variance	16.37102	15.79592
Observations	50	50
Pearson Correlation	0.951312	
Hypothesized Mean Difference	0	
df	49	
t Stat	-11.3958	
P(T<=t) one-tail	1.1E-15	
t Critical one-tail	1.676551	
P(T<=t) two-tail	2.21E-15	
t Critical two-tail	2.009575	

The problem solving domain has a statistically significant ( $p=2.21$ ) and large correlation ( $r=0.95$ ) among the children with developmental disabilities.

**Table-10**  
**Correlation and Statistics for Emotional Control**

	Test	Re-test
Mean	1.52	2.74
Variance	1.887347	2.767755
Observations	50	50
Pearson Correlation	0.881851	
Hypothesized Mean Difference	0	
df	49	
t Stat	-10.92	
P(T<=t) one-tail	5E-15	
t Critical one-tail	1.676551	
P(T<=t) two-tail	1E-14	
t Critical two-tail	2.009575	

The emotional control domain has a statistically significant ( $p=1.0$ ) and large correlation ( $r=0.88$ ) among the children with developmental disabilities.

**Table-11**  
**Correlation and Statistics for Time Management**

	<b>Test</b>	<b>Re-test</b>
Mean	1.36	2.14
Variance	2.765714	3.42898
Observations	50	50
Pearson Correlation	0.917709	
Hypothesized Mean Difference	0	
df	49	
t Stat	-7.48859	
P(T<=t) one-tail	5.83E-10	
t Critical one-tail	1.676551	
P(T<=t) two-tail	1.17E-09	
t Critical two-tail	2.009575	

The time management domain has a statistically significant ( $p=1.17$ ) and large correlation ( $r=0.91$ ) among the children with developmental disabilities.

## DISCUSSION

The aim of this study was to test the reliability of the measure Executive Functioning Assessment Checklist for Children with Developmental Disabilities (EFAC-CDD) developed by Ray and Singh (2023). The study assesses the test-retest reliability to standardize the testing of this checklist.

Through the reliability study, it was established that there is a large correlation ( $r=0.98$ ) on the test-retest reliability which is statistically significant ( $p=4.17$ ) when a sample ( $N=50$ ) of children with developmental disabilities were assessed on the measure of the executive functioning (EFAC-CDD) 5 months apart.

Since executive functioning is a very broad concept, the specific domains that were tested with the use of EFAC-CDD help in furthering our understanding. The resulting performance of the group tested 5 months apart with the use of test-retest reliability, when analysed led to the following inferences.

In the sample group, the largest correlation was

achieved in the action monitoring and working memory domain ( $r=0.97$ ). This was followed by the correlation score obtained in problem solving and planning skills ( $r=0.95$ ). This was followed by attention and mental flexibility domains ( $r=0.93$ ); and then time management domain ( $r=0.91$ ) and then impulse control ( $r=0.90$ ). Lastly, the relatively lowest correlation was seen in emotional control ( $r=0.88$ ) which is a large coefficient score by itself.

Upon comparing the correlation scores of the domains of executive functioning in the sample group, the most statistically significant score was found in the domain of action monitoring ( $p=0.9.19$ ), followed by impulse control ( $p=5.98$ ), mental flexibility ( $p=3.29$ ), ad problem solving ( $p=2.21$ ), attention ( $p=2.18$ ), working memory ( $p=1.93$ ), planning skills ( $p=1.81$ ), time management ( $p=1.17$ ) and lastly, emotional control ( $p=1.0$ ).

Hence, all reliability scores are observed to be large correlations helping establish all the nine domains of and total executive functioning

areas of the Executive Functioning Assessment Checklist for Children with Executive Functioning (EFAC-CDD) by Ray & Singh (2023).

## CONCLUSION

The current study aimed to assess the validity of an executive functioning checklist among children with developmental disabilities in India. The EFAC-CDD was developed and a pilot study was conducted (Ray & Singh, 2023) in which the tool development is recorded along with a study on children with developmental disabilities between the age of eight and fifteen year; post which a study comparing the sample results with typical children to validate the test was conducted. It was found that there is a significant difference in executive functioning between children with developmental disabilities and their peers without it with the use of EFAC-CDD. After conducting these studies, the checklist's standardization was needed, hence, this study was conducted to further the testing and reliability of the checklist EFAC-CDD. The EFAC-CDD's reliability was found to be satisfactory with the help of this research study.

For future studies, the pre and post analysis on a case basis with a intervention plan will be tested using this checklist to help establish an effective assessment and intervention tool in working with children with developmental disabilities, with a larger sample size.

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