


## CERTIFICATE

This is to certify that this is an authentic approved copy of the thesis titled “**Impact of Adaptive Yogāsana on Psychological Health of Children having Autism Spectrum Disorder and with Intellectual Disability (Multiple Disabilities): A Single-Case Experimental Design**” submitted by **Jyoti Maggu** in partial fulfilment of the requirement for the Doctor of Philosophy (PhD) in Yoga. She has successfully completed the required ‘course of research’ to submit this thesis to Division of Yoga and Physical Sciences under Swami Vivekananda Yoga Anusandhana Samsthana as per the regulations of the University and this is a record of the work carried out by her in National Institute of Empowerment for Persons with Multiple Disabilities (Divyangjan) [NIEPMD(D)], Chennai, India. We also declare that the subject matter of this thesis has not been previously formed the basis of the award of any degree, diploma, associate-ship, fellowship or similar titles.



Dr. Soubhagyalakshmi Mohanty

Assistant Professor, Dept. of Yoga and Humanities.

S-VYASA University, Bengaluru, India

(Guide)

Dr. Karthikeyan S.

Head of Department, Clinical Psychology.

NIEPMD(D), Chennai, India

(Co-Guide)

## DECLARATION

I, hereby declare that this study was conducted by me at the National Institute of Empowerment for Persons with Multiple Disabilities (Divyangjan) [NIEPMD(D)] in the Department of Clinical Psychology, Chennai, India; under the guidance of Dr. Soubhagya Lakshmi Mohanty, Associate Professor, Department of Yoga and Humanities, S-VYASA, Bengaluru and Dr. Karthikeyan S., Head of Department Clinical Psychology, NIEPMD(D), Chennai.

I also declare that the subject matter of my thesis entitled **“Impact of Adaptive *Yogāsana* on Psychological Health of Children having Autism Spectrum Disorder and with Intellectual Disability (Multiple Disabilities): A Single-Case Experimental Design”** has not previously formed the basis of the award of any degree, diploma, associate-ship, fellowship or similar titles.

Date: 30-Aug-2025

Place: London



Jyoti Maggu

(Candidate)

## ACKNOWLEDGEMENT

My deepest gratitude towards almighty god and my guru being the lighthouse and a constant support through my journey of life. I am sincerely grateful to all my teachers who guided and shaped me as an individual.

I thank the S-VYASA University for providing a platform to research on our ancient knowledge and its applicability in present context. This triggered a sense of pride to showcase our traditional wisdom in a contemporary scientific forum. I sincerely thank the management, teachers, staff and PhD Department for nurturing our ideas, point of views and constantly guiding and supporting throughout the PhD journey.

I acknowledge the NIEPMD(D), Chennai, India, for their continuous work in the field of empowering persons with multiple disabilities. I am much obliged for the management and the Department of Clinical Psychology to acknowledge my study, providing end to end support in identifying the subjects, assessors, dedicating space and infrastructure for intervention, timely execution of assessments and collection of data, last but not the least an environment of trust, positivity, and motivation to complete the study.

I thank all my teachers from Krishnamacharya Yoga Mandiram, Chennai, India, who helped in my learning the foundation for adaptive *yoga*, course planning and teaching methodology.

I would like to remember and thank my first research supervisor (late) Dr. Itagi Ravi Kumar, for being extremely diligent and meticulous about following the right process from the beginning in securing all the approvals from respective institutions for this study being unique by design, and having multi-institutional dependencies. This helped me to stand confident in presenting the study in all the forums.

I sincerely, appreciate contribution of Dr. Karthikeyan, Head of the Dept. of Clinical Psychology, NIEPMD(D) and my co-research supervisor, who has been the foundation of this study from defining the problem, believing in the intervention and keeping the outcome

expectations to be practical and realistic. He was very resourceful and made sure the study got executed smoothly.

My heartfelt gratitude towards my current research supervisor Dr. Soubhagyalakshmi Mohanty (Didi), S-VYASA and also being our PhD co-ordinator. She has been the biggest motivator for me in this journey to stick to my timelines, being patient throughout the study, supportive during difficult phases and truly believing in my abilities to deliver.

I am humble in acknowledging the confidence shown in me by Dr. Ramesh Mavathur, Dr. Judu Ilavarasu, and Dr. T M Srinivasan from S-VYASA, taking up this long road and believing in the potential of this study.

I appreciate the support extended by Ms. Srigothri Rajesh, Mr. Navaneethan, Ms. Jayanthi, and all the Clinical Psychologists those served as assessors from NIEPMD(D) throughout the study.

My heartfelt love, respect, and gratitude for all the mothers involved in this study with absolute commitment and hope that *yoga* could bring about positive changes in improving the condition for their children. I cannot thank enough my beloved children, the pivotal part of the study, who without any judgment were the purest souls participated with fun and enthusiasm.

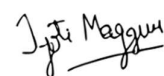
With humility, I acknowledge my family and friends who believed in my potential, having constantly motivating me to take up any challenging assignments.

Last but not the least, I acknowledge the contribution of Mr. Sumit Bose, my life partner who stand by me shoulder to shoulder in every exploration of life. He has been my technology enabler for this study and helped in developing the visual analysis tool, supporting in the data analysis and documentation.

I sincerely remember and thank everyone who helped directly or indirectly to complete this study successfully.

Date: 30-Aug-2025

Place: London



Jyoti Maggu

**STANDARD INTERNATIONAL TRANSLITERATION CODE USED TO  
TRANSLITERATE SAṂSKṚTA WORDS**

<i>a</i>	अ	<i>gha</i>	घ	<i>pa</i>	प
<i>ā</i>	आ	<i>ṛa</i>	ड	<i>pha</i>	फ
<i>i</i>	इ	<i>ca</i>	च	<i>ba</i>	ब
<i>ī</i>	ई	<i>cha</i>	छ	<i>bha</i>	भ
<i>u</i>	उ	<i>ja</i>	ज	<i>ma</i>	म
<i>ū</i>	ऊ	<i>jha</i>	झ	<i>ya</i>	य
<i>ṛ</i>	ऋ	<i>ṅa</i>	ञ	<i>ra</i>	र
<i>ṝ</i>	ॠ	<i>ṭa</i>	ट	<i>la</i>	ल
<i>e</i>	ए	<i>ṭha</i>	ठ	<i>va</i>	व
<i>ai</i>	ऐ	<i>ḍa</i>	ड	<i>śa</i>	श
<i>o</i>	ओ	<i>ḍha</i>	ढ	<i>ṣa</i>	ष
<i>au</i>	औ	<i>ṇa</i>	ण	<i>sa</i>	स
<i>aṁ</i>	अं	<i>ta</i>	त	<i>ha</i>	ह
<i>aḥ</i>	अः	<i>tha</i>	थ	<i>la</i>	ळ
<i>ka</i>	क	<i>da</i>	द	<i>kṣa</i>	क्ष
<i>kha</i>	ख	<i>dha</i>	घ	<i>jñā</i>	ज्ञ
<i>ga</i>	ग	<i>na</i>	न		

## ABSTRACT

### BACKGROUND

Children with multiple disabilities and developmental disorders face significant challenges across physiological, physical, learning, and socio-emotional domains. Psychological issues, including cognitive, emotional, and behavioural difficulties, are particularly common among children with autism spectrum disorder (ASD) and intellectual disabilities (ID). Parents and caregivers are eager for holistic interventions, such as *yoga*, which has shown promise in physical, physiological, and psychological therapies. However, limited scientific evidence exist on *yoga's* psychological benefits for children with multiple developmental disabilities.

This study addresses the need to empirically validate the impact of *yoga* through a comprehensive approach that resonates with psychologists, disability specialists, and caregivers alike. Traditional *yoga* methods are not feasible for children with special needs, requiring instead personalized, one-on-one interventions that engage caregivers, adapt to each child's abilities, and involve long-term, continuous assessment. A multiple stakeholder study involving parents (or caregiver), practicing psychologists, and *yoga* interventionist was the premise for this study.

Due to the unique and varied needs of these children, a group design like RCT may be inappropriate. Thus, a single-case experimental design (SCED) was chosen, allowing each child to serve as their own control. This rigorous approach statistically assesses the impact of *yoga* with continuous data collection, establishing a significant relationship between *yoga* intervention and psychological improvement.

## **AIMS AND OBJECTIVES**

This research work aims to prove existence of a functional relationship and efficacy of tailored made *yoga* intervention for children with ASD and with ID on improving their psychological health in cognitive, behavioural, and emotional domains by employing a rigorous scientific framework, a well-crafted adaptive course plan and teaching methodology. The purpose is also to involve caregivers that ensures continuity of the practice if there are carry forward benefits in home condition.

## **METHODS**

### **Participants**

Six children, having Autism Spectrum Disorder (ASD) and with Intellectual Disability (ID) certified as multiple disabled by NIEPMD (D) — National Institute for Empowerment of Persons with Multiple Disabilities (Divyangjan), Chennai, Tamil Nadu, India along with their caregivers recruited for this study. The chronological age of children was between 7 to 12 years having mild to moderate severity level of the disorder. The respective caregivers agreed to participate throughout the study.

### **Design**

A multiple baseline single case experimental design (AB1B2) was implemented for this study. Each participant went through three phases: (A) baseline phase without intervention for 4 months (eight assessments), (B1) intervention phase in institute setting with *yoga* teacher and caregiver for 6 months (twelve assessments), and (B2) intervention phase in home setting with only caregiver for 3 months (six assessments). Continuous assessments were planned and administered for each participant at a frequency of every two weeks.

## **Assessment**

Indian Scale for Assessment of Autism (ISAA) and Behavioural Assessment Scales for Indian Children with Mental Retardation (BASIC-MR) instruments were used to assess the desired cognitive, behavioural, and emotional parameters objectively.

## **Intervention**

The *yoga* sessions were administered for the participants as one-to-one intervention along with *yoga* teacher and caregiver. The intervention sessions started in institute setting along with *yoga* teacher and caregiver for 120 days, followed by 60 days in home setting along with only caregiver. Each intervention session duration was between 45 to 60 minutes administered every working day of the week excluding weekends and holidays. Before moving from institute setting to home setting, the ownership of intervention was handed over to the caregiver with documented course plan for continuity and smooth execution.

## **RESULT**

The internal validity of effectiveness of adaptive *yoga* intervention is established based on visual analysis, the effectiveness is supplemented by non-overlap method NAP and statistical significance using *Cohen's d*. Effect size using non overlap method shows for the 120 observable parameters across baseline vs. intervention phases (institute and home settings) having 18% as less significant, 24% as moderately significant, 44% as significant and 14% as insignificant effect. Similarly, effect size using *Cohen's d* shows 34% of data has significant effect, 8% of data shows moderately significant and 13% of data shows less significant, 32% of data shows the intervention impact is positive, however, insignificant and 13% of data shows opposite effect. The impact of intervention shows effectiveness across all cognitive, behavioural, and emotional domains; and across participant replications. This establishes external validity of the impact.

## **CONCLUSION**

The long term, consistent one-to-one adaptive *yoga* intervention can effectively improve the cognitive, behavioural, and emotional conditions of children having ASD and with ID. This study establishes the potential of *yoga* interventions in the field of multiple disabilities and psychology. This gives confidence to the caregivers in assessing the feasibility and acceptability of *yoga* practices in the context of their daily routines and overall care strategies.

## TABLE OF CONTENT

<b>1. Introduction.....</b>	<b>1</b>
<b>2. The Classical and Contemporary Āgamā-s for Adaptive Yoga, Design and Methodology .....</b>	<b>5</b>
2.1 <i>Introdcution.....</i>	5
2.1.1 <i>Heyam – Recognizing the Problem.....</i>	5
2.1.2 <i>Hetu – Cause of the Problem .....</i>	5
2.1.3 <i>Hānam – The Goal.....</i>	6
2.1.4 <i>Upāyam - The Means.....</i>	6
2.2 <i>Āsana and Benefits.....</i>	7
2.3 <i>Āsana, Breath and Mind .....</i>	8
2.4 <i>Design and planning Āsana Practice .....</i>	11
2.4.1 <i>Pūrvāṅga.....</i>	14
2.4.2 <i>Pradhānaṅga.....</i>	15
2.4.3 <i>Uttaraṅga.....</i>	15
2.5 <i>Ancient Literature Summary.....</i>	16
<b>3 Literature Review of Scientific Research.....</b>	<b>17</b>
3.1 <i>Scientific Literature on challenges with children with ASD and ID.....</i>	18
3.2 <i>Summary Table of Scientific Literature on Yoga and its Impact.....</i>	21
3.3 <i>Summary Table of Scientific Literature on Single Case Experimental Design.....</i>	26
<b>4 Aims and Objectives .....</b>	<b>29</b>
4.1 <i>Aims of the Study.....</i>	29
4.2 <i>Objectives of the Study.....</i>	29
4.3 <i>Justification of the Study.....</i>	30
4.4 <i>Hypothesis and Null Hypothesis .....</i>	30
<b>5 Methods.....</b>	<b>32</b>
5.1 <i>Desigen .....</i>	32

5.2	<i>Participants</i> .....	33
5.2.1	Sample Size and Demographics.....	33
5.2.2	Inclusion and Exclusion Criteria.....	34
5.2.3	Ethical Consideration.....	34
5.3	<i>Measures and Materials</i> .....	34
5.4	<i>Intervention Procedure</i> .....	37
5.5	<i>Course Plan</i> .....	38
5.5.1	Personalized .....	38
5.5.2	Function over form .....	39
5.5.3	Transition of planes.....	40
5.5.4	Counterposes.....	40
5.5.5	Rests.....	40
5.6	<i>Teaching Methodology</i> .....	40
5.6.1	Movement .....	40
5.6.2	Breath.....	41
5.6.3	Awareness .....	41
5.7	<i>Data Extraction</i> .....	41
5.8	<i>Data Analysis</i> .....	42
5.8.1	Visual and Quantitative Analysis .....	43
5.8.2	Magnitude of Effect .....	46
5.8.3	Statistical Significance of Effect.....	49
5.8.4	Overall Analysis.....	49
5.8.5	Qualitative Analysis .....	50
<b>6</b>	<b>Results</b> .....	<b>57</b>
6.1	<i>Preliminary Analysis</i> .....	57
6.2	<i>Primary Outcome</i> .....	57
6.3	<i>Cognitive outcome</i> .....	58
6.4	<i>Behavioural Outcome</i> .....	60
6.5	<i>Emotional Outcome</i> .....	61

6.6	<i>Overall Outcome</i> .....	63
6.7	<i>Observable Changes of Clinical Significance</i> .....	65
<b>7</b>	<b>Discussions</b> .....	<b>66</b>
<b>8</b>	<b>Appraisal</b> .....	<b>69</b>
8.1	<i>Summary of the Findings</i> .....	69
8.2	<i>Conclusion</i> .....	69
8.3	<i>Implications of the Study</i> .....	69
8.4	<i>Application of the Study</i> .....	70
8.5	<i>Strength of the Study</i> .....	70
8.6	<i>Limitations of the Study</i> .....	71
8.7	<i>Suggestions for Future Studies</i> .....	71
<b>9</b>	<b>References</b> .....	<b>73</b>
	<b>Appendix – 1: Sample Course Plan</b> .....	<b>77</b>
	<b>Appendix – 2: Sample Session Plan</b> .....	<b>78</b>
	<b>Appendix – 3: Sample Intervention &amp; Assessment Plan</b> .....	<b>79</b>
	<b>Appendix – 4: Informed Consent Form</b> .....	<b>80</b>
	<b>Appendix – 5: Institutional Ethics Committee Letter</b> .....	<b>87</b>
	<b>Appendix – 6: Cognitive Parameters</b> .....	<b>92</b>
	<b>Appendix – 7: Behavioural Parameters</b> .....	<b>96</b>
	<b>Appendix – 8: Emotional Parameters</b> .....	<b>99</b>

## LIST OF TABLES

Table 1: Scientific Literature On ASD And ID .....	20
Table 2: Scientific Literature On Yoga And Its Impact.....	26

Table 3: Scientific Literature On SCED .....	28
Table 4: Participant Demographics .....	34
Table 5: Variables Of Interest.....	36
Table 6: Unification Of Scales Across Visual, NAP And <i>Cohen's D</i> .....	49
Table 7: Cognitive Metrics Supporting Visual Analysis Within Phase: Level (Mean), Trend (Slope), Stability (% Of Data Between 15% Range Of Median). .....	51
Table 8: Behavioural Metrics Supporting Visual Analysis Within Phase: Level (Mean), Trend (Slope), Stability (% Of Data Between 15% Range Of Median). .....	52
Table 9: Emotional Metrics Supporting Visual Analysis Within Phase: Level (Mean), Trend (Slope), Stability (% Of Data Between 15% Range Of Median). .....	53
Table 10: Visual Analysis Across Phase BL Vs II And BL Vs IH: Non-Overlap Indices Using Percentage Of Non-Overlap Data (PND) And Percentage Of Data Exceeding Median (PEM).....	54
Table 11: Visual Analysis Across Phase BL Vs II And BL Vs IH: Non-Overlap Metric Using Non-Overlap Of All Pairs (NAP).....	55
Table 12: Effect Size Across Phase - <i>Cohen's D</i> .....	56
Table 13: Visual Analysis Consolidated Interpretation Summary .....	64
Table 14: Non-Overlap Analysis Consolidated Interpretation Summary .....	64
Table 15: <i>Cohen's D</i> Analysis Consolidated Interpretation Summary.....	64

## LIST OF FIGURES

Figure 1: IBM Model.....	11
Figure 2: Stages of course planning.....	14
Figure 3: Recruitment Flow and Intervention Procedure .....	39
Figure 4: Data Analysis Flow .....	43
Figure 5: P#1 Odd Behaviour: Level (Mean) .....	44
Figure 6: P#1 Odd Behaviour: Level (Median) .....	44
Figure 7: P#1 Odd Behaviour: Trend.....	45
Figure 8: P#1 Odd Behaviour: Stability % (Median) .....	45
Figure 9: P#1 Odd Behaviour: IoE for Level and Trend between Baseline & Intervention Institute Settings.....	46
Figure 10: P#1 Odd Behaviour: PND between Baseline vs Intervention Institute and Intervention Home Settings .....	47

Figure 11: P#1 Reading-Writing: PND between Baseline vs Intervention Institute and Intervention Home Settings .....	47
Figure 12: P#1 Odd Behaviour: PEM between Baseline vs Intervention Institute and Intervention Home Settings .....	48
Figure 13: Cognitive - Overall consolidation of analysis outcome of effect across visual, NAP and Cohen's d. ....	59
Figure 14: Behavioural - Overall consolidation of analysis outcome of effect across visual, NAP and Cohen's d. ....	61
Figure 15: Emotional - Overall consolidation of analysis outcome of effect across visual, NAP and Cohen's d. ....	63
Figure 16: Overall consolidation of analysis outcome of effect across visual, NAP and Cohen's d. ....	64

### **LIST OF GRAPHS**

Graphs 1: Cognitive Component .....	92
Graphs 2: Language .....	93
Graphs 3: Reding-Writing.....	94
Graphs 4: Number-Time .....	95
Graphs 5: Behaviour Patterns .....	96
Graphs 6: Hyperactivity and Inattention.....	97
Graphs 7: Repetitive Behaviour.....	98
Graphs 8: Emotional Responsiveness.....	99
Graphs 9: Violent and Destructive Behaviours.....	100
Graphs 10: Temper Tantrums.....	101
Graphs 11: Self-Injurious Behaviours.....	102
Graphs 12: Odd Behaviours.....	103