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The Effectiveness Of Carolina Curriculum (Infant And Toddler) Intervention To Improve Developmental Milestones Among Children With Developmental Delay

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ABSTRACT: The purpose of the study was to evaluate the effectiveness of Carolina Curriculum (Infant & Toddler) intervention to improve developmental milestones among children with developmental delay.

METHOD: A Quasi-Experimental (Single group Pretest- Posttest) design was adopted for the study. Convenience sampling was used for the study. 25 children with developmental delay ranging between the age group 2- 5 years were included in the study. Developmental milestones of the participants were assessed (pre-test) using the Carolina Curriculum for Infant and Toddler with Special Needs (CCITSN). The Carolina Curriculum intervention was given to the participants, with a duration of 1hour per session, five days a week for 12 weeks for each child. Developmental milestones of the participants were reassessed (post-test) using Carolina Curriculum for Infant and Toddler with Special Needs (CCITSN). The pre-test and post- test developmental milestones were analysed and interpreted.

RESULTS: Based on the analysis, there were significant changes observed in the developmental milestones and most of the improvements had been shown in motor skills [upright: posture & locomotion (96%), prone on stomach (84%), bilateral skills (76%)], and cognitive skills [problem solving (76%), and Attention & Memory: Visual/ Spatial skills (72%)].

CONCLUSION: The study demonstrated that Carolina Curriculum interventions are effective in improving developmental milestones among children with developmental delay.

KEYWORDS: Carolina Curriculum Intervention, Developmental Milestone, Developmental Delay, Motor skills and Cognitive skills.

I. INTRODUCTION

Child development is a dynamic process that includes physical, cognitive, social, and emotional growth [1]. Development is the maturing of functions and the acquisition of several abilities necessary for a child's optimum functioning. As they develop independently and sequentially over time, many developmental areas interact with one another [2]. It covers physical, cognitive, emotional, and social development of child. It explores how people change and grow from infancy through old age, including changes in their abilities, behaviours, and relationships. The nervous system's functional maturity is an essential requirement for development. For every child, the process in which milestones are attained is the same. A cephalocaudal direction is followed throughout the development process [3].Development is influenced by both nature (genetic inheritance) and nurture (environmental factors), and different stages of life, from prenatal to late adulthood, have their own unique developmental milestones and challenges [4].

Developmental Delay

Developmental delay is a child's slower progression through developmental phases. A developmental delay occurs when a child lags behind their peers in achieving key developmental milestones for their age. It is caused by impairment in the developmental domains such as gross motor, fine motor, speech and language development, social-emotional development, play and cognitive development. It can be classified as isolated developmental delay (involving a single domain), multiple developmental delay (involving two or more domains), or global developmental delay (affecting most developmental areas) [5].

Domains of Development:

Motor skills: Motor skills are necessary for carrying out a variety of physical activities, from simple motions to more difficult ones. They are defined as the capacity to regulate and coordinate the movements of the body's muscles and central nervous system. Motor skills are categorised into two main types: gross motor skills (GMS) and fine motor skills (FMS). Coordinating small (fine) and large (gross) muscles is one of these skills. A child with fine motor delay may have trouble holding an object in their hands. It may be difficult for a kid with a gross motor delay to walk, sit up, or roll over [6].

Speech and Language skills: One method of expressing language is through speech. Producing the unique sounds that form language requires careful coordination of muscle movements in the tongue, lips, jaw, and vocal tract. People can communicate meaningfully by using a shared set of norms called language. Language can be represented by spoken words, written words, sign language, or various gestures like blinking of the eyes or moving the mouth. These comprise the use and comprehension of language. Speaking and comprehending what others are saying might be difficult for a child who has speech and language impairment [3].

Cognitive skills: It refers to the brain's capacity to process, store, retrieve, and manage information. This involves the ability to process thoughts, acquire knowledge, and grasp information. Cognitive functions include orientation, attention, memory, learning, judgement, and reasoning, while executive functions involve the ability to plan, manipulate information, start and stop activities, identify errors, solve problems, and think abstractly. A child with a cognitive delay could struggle to follow the instruction and solve a problem. Children with cognitive delays exhibit intellectual functioning and adaptive behavior that are considerably below the average expected for their age. [(7)].

Social and Emotional skills: Abilities include mingling with others, expressing emotions, and the ability to convey needs. The terms "self-development" or temperament and "relationship development" or attachment are two key areas in social-emotional development. Social cue interpretation and communication may be difficult for a child who is socially and emotionally delayed. They may have difficulty in dealing with frustration or coping with change. Children with social and emotional delays may throw longer tantrums and require more time to calm down than other children when faced with socially or emotionally demanding situations [(8)].

Carolina Curriculum for Infant & Toddler with Special Needs (CCITSN):

The Carolina Curriculum for Infants and Toddlers with Special Needs (CCITSN) is an assessment and intervention tool specifically designed for infants and toddlers from birth to 36 months of age. It is intended to support the development of children who have disabilities or developmental delays across a wide range of impairments, from mild to severe. The curriculum offers a structured framework for caregivers and professionals to implement targeted teaching strategies and interventions. The Carolina curriculum is divided into 25 logical teaching sequences that cover five developmental domains: gross motor, fine motor, cognition, communication, and social adaptation. The Carolina Curriculum offers a thorough picture of a child's growth and offers suggestions for altering the materials to take into account of the children. It establishes a direct connection between evaluation and intervention and is also easy to use and flexible. The Carolina Curriculum helps providers track children's progress clearly [(12)].

Developmental Delay and CCITSN:

A child's failure to meet developmental milestones in comparison to peers from the same group is typically used to identify developmental delays [(5)]. CCITSN is designed to provide curricular intervention strategies for use with children with impairments who are functioning in the birth to 36-month developmental range. This intervention can be given to children with a wide range of impairments, from mild to severe [(12)]. This study evaluates and provides intervention for developmental domains using Carolina Curriculum for Infants and Toddlers with Special Needs (CCITSN). CCITSN measures the five developmental milestones that include gross motor and fine motor development, cognition, communication, and social adaptation and intervention progress log [(12)].

II.NEED OF THE STUDY

The prevalence of developmental delay has been rising globally over the past few decades, leading to various functional impairments. These delays often affect motor skills, cognitive abilities, communication, and social interactions. As a result, children with developmental delays may struggle to participate in everyday activities, impacting their independence and overall quality of life. While many studies have explored different techniques and approaches to support milestone development, fewer have focused on the Carolina Curriculum. This study specifically examines the use of the Carolina Curriculum intervention tool to improve developmental milestones in children with developmental delays.

III.METHODOLOGY

Research Design:

The Quasi- Experimental (Single Group Pretest-Posttest) Design.

Study Setting:

This study was conducted at department of Cross Disability Early Intervention Centre (CDEIC)-Occupational Therapy, NIEPMD, Muttukadu, Chennai, Tamil Nadu.

Sampling Technique:

Convenience sampling was used for this study.

Sample Population:

Children with Developmental Delay.

Sample Size:

Sample size (n) is equal to 25.

Duration Of Study:

The duration of the study was 6 months. The intervention was given for 12 weeks. Each session was for 60 minutes (10 mins for each domain with a break of 5 mins), and 5 sessions were given in a week. Total 60 sessions were given.

VARIABLES:

Independent variable – Carolina Curriculum Intervention.

Dependent variable – Developmental Milestones.

SELECTION CRITERIA:

Inclusion Criteria:

- Children with developmental delay aged 0-5 years.
- Children from both genders.

Exclusion Criteria:

- Children with seizure disorder.
- Children with orthopedic condition.
- Those children who are having physical limitations that prevent participation in intervention, such as severe muscle weakness or contractures.

TOOLS USED:

1. Trivandrum Developmental Screening Chart (TDSC)
2. Carolina Curriculum for Infants and Toddler with Special Needs (CCITSN)

PROCEDURE:

A convenient sampling was adopted for this study, which was conducted at Cross Disability Early Intervention Centre (CDEIC) Occupational Therapy, NIEPMD, Muttukadu, chennai. The parents of the children were explained about the importance of the study. Written consent was obtained from all parents of the participants prior to the study. It was assured to them that all the information would be kept confidential. Of the 30 participants who were willing to participate, 25 were selected based on the inclusion and exclusion criteria of the study. The 25 participants were administered the "Carolina Curriculum for Infants and Toddlers with Special Needs (CCITSN)" in person by the examiner, and developmental domains were collected. The Carolina Curriculum intervention was given to the participants, with a duration of 1hour per session (for every 10 minutes a break of 5 minutes was given), five days a week for 12 weeks for each child. Developmental domains were then collected using the CCITSN. The collected data was analysed and interpreted. The results were obtained.

IV.RESULTS

Statistical Analyses: All analyses were carried out using Statistical Package for Social Sciences (version 26, IBM, Chicago, USA). The number of children were expressed as n and proportion of children relative to a larger group were expressed in %. Chi-square test was used for gender comparisons. The level of significance was set at 5%.

Table 1: Demographic details of study participants

Demographic characteristics	Stratification	n (%)
Gender	Male	14 (56)
	Female	11 (44)

Table 2: The table showing the number of children attained development in each domain after intervention

Domains based on Carolina Curriculum	n	%
1.Self- Regulation & Responsibility	9	36
2.Interpersonal Skills	12	48
3.Self Concept	0	0
4-I. Self Help: Eating	16	64
4-II. Self Help: Dressing	0	0
4-III.Self Help: Grooming	0	0
4-IV. Self Help: Toileting	0	0
5.Attention & Memory: Visual/ Spatial	18	72
6-I. Visual Perception: Blocks & Puzzles	0	0
6-II. Visual Perception: Matching & Sorting	0	0
7.Functional Use of Objects & Symbolic Play	10	40
8.Problem Solving/ Reasoning	19	76
9.Number Concepts	0	0
10.Concepts: Receptive	0	0
11.concepts: expressive	0	0
12.attention & memory: auditory	12	48
13.imitation: motor	14	56
14.grasp and manipulation	14	56
15.bilateral skills	19	76

16.tool use	**0**	**0**
17.visual- motor skills	**0**	**0**
18-I. upright: posture & locomotion	**24**	**96**
18-II. upright: balance	**0**	**0**
18-III.ball play	**0**	**0**
18-IV. upright: outdoor play	**0**	**0**
19.prone (on stomach)	**21**	**84**
20.supine (on back)	**9**	**36**

Graph 1: The graph showing the number of children who attained developmental milestones after intervention

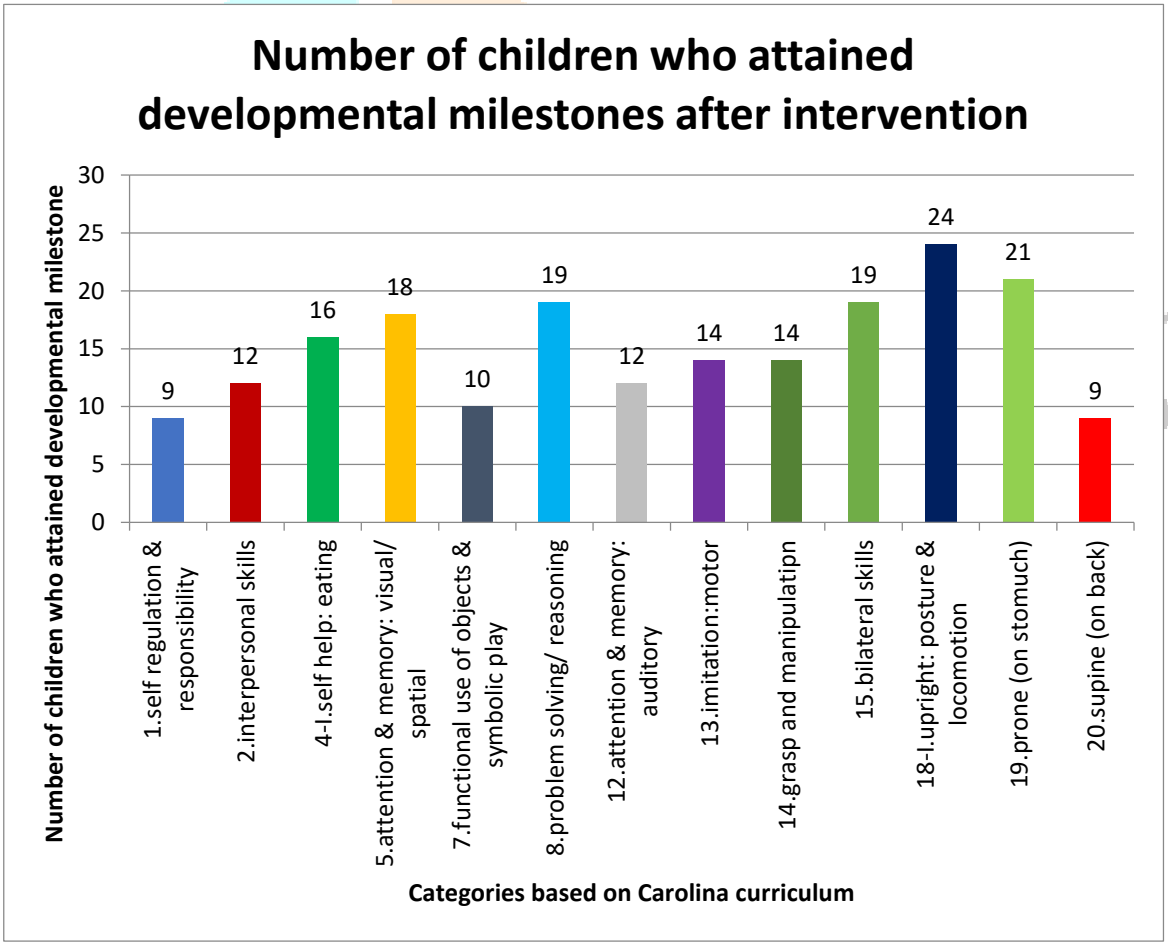
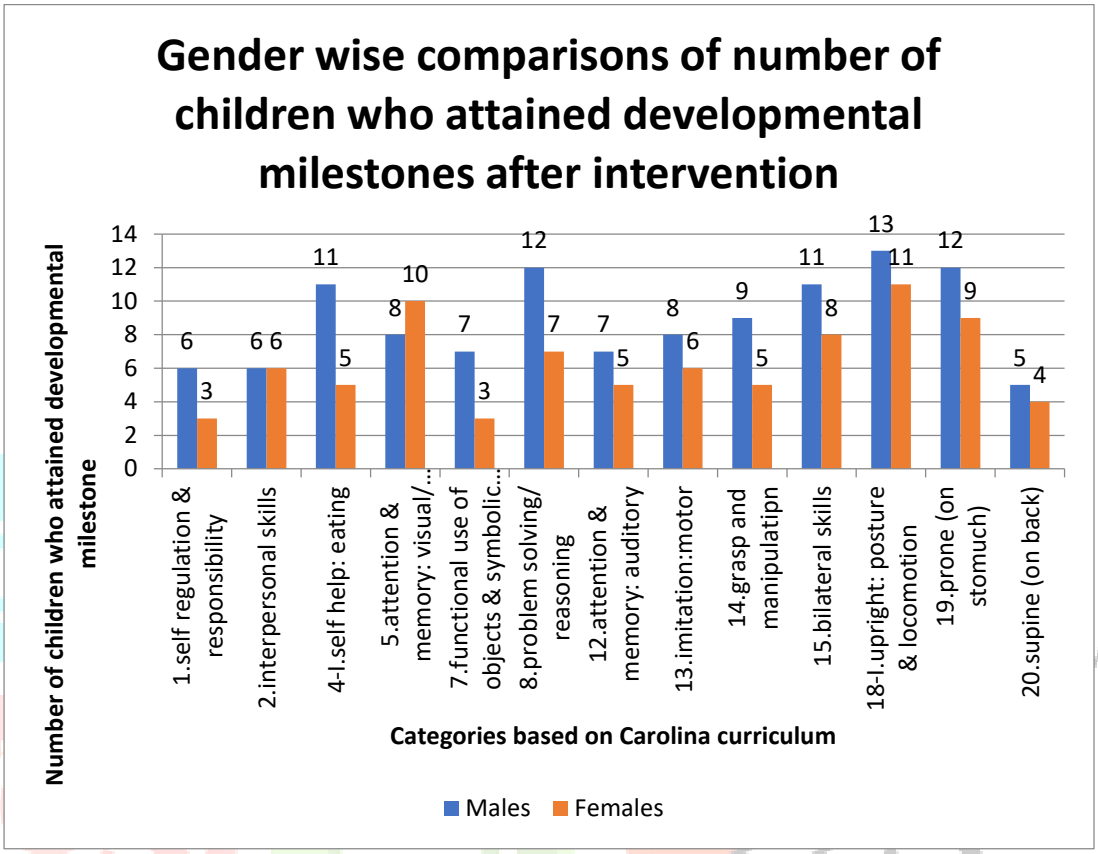


Table 3: Table showing the gender comparisons of children's improvements after intervention

Domains based on Carolina Curriculum	Male n (%)	Female n (%)	p-value
1. Self -Regulation & Responsibility	6 (42.9)	3 (27.3)	0.35
2.Interpersonal Skills	6 (42.9)	6 (54.5)	0.43
3.Self Concept	0 (0)	0 (0)	-
4-I. Self Help: Eating	11 (78.6)	5 (44.5)	0.09
4-II. Self Help: Dressing	0 (0)	0 (0)	-
4-III.Self Help: Grooming	0 (0)	0 (0)	-
4-IV. Self Help: Toileting	0 (0)	0 (0)	-
5.Attention & Memory: Visual/ Spatial	8 (57.1)	10 (90.9)	0.07
6-I. Visual Perception: Blocks & Puzzles	0 (0)	0 (0)	-
6-II. Visual Perception: Matching & Sorting	0 (0)	0 (0)	-
7.Functional Use of Objects & Symbolic Play	7 (50)	3 (27.3)	0.23
8.Problem Solving/ Reasoning	12 (85.7)	7 (63.6)	0.20
9.Number Concepts	0 (0)	0 (0)	-
10.Concepts: Receptive	0 (0)	0 (0)	-
11.concepts: expressive	0 (0)	0 (0)	-
12.attention & memory: auditory	7 (50)	5 (45.5)	0.57
13.imitation: motor	8 (57.1)	6 (54.5)	0.60
14.grasp and manipulation	9 (64.3)	5 (45.5)	0.29
15.bilateral skills	11 (78.6)	8 (72.7)	0.54
16.tool use	0 (0)	0 (0)	-
17.visual- motor skills	0 (0)	0 (0)	-
18-I. upright: posture & locomotion	13 (92.9)	11 (100)	0.56
18-II. upright: balance	0 (0)	0 (0)	-
18-III.ball play	0 (0)	0 (0)	-
18-IV. upright: outdoor play	0 (0)	0 (0)	-

19.prone (on stomach)	12 (85.7)	9 (81.8)	0.6
20.supine (on back)	5 (35.7)	4 (36.4)	0.64

Chi-square test was used to compare the gender wise development of children after the intervention.



Graph 2: The graph showing the gender wise comparisons of number of children who attained developmental milestones after intervention

V.DISCUSSION

This chapter discusses the results of the study, which was conducted to evaluate the effectiveness of the Carolina Curriculum (Infant & Toddler) Intervention in improving developmental milestones among children with developmental delay.

In Table 6.1, the demographic characteristics of the study participants are presented. Out of the 25 participants, 14 were male and 11 were female, indicating a slight male predominance in the sample.

Table 6.2, presents the developmental progress of children across various domains based on the Carolina Curriculum after intervention. Out of the 20 domains, children have shown improvement in 13, while the remaining 7 domains have not been achieved. The findings indicate a wide variation in the number of children who achieved developmental milestones across different

areas. Under the domain of Self-Regulation & Responsibility, smaller proportion of children, 9 showed developmental gains. This may be because self-regulation and responsibility skills require essential fine motor abilities, such as bilateral skills for manipulating toys, which are part of the sequence within this domain. Under the domain of Interpersonal Skills shows about 12 children demonstrated development in interpersonal skills. Under the domain Attention & Memory (Visual/Spatial), 18 children showed improvement. Under the domain of Functional Use of Objects & Symbolic Play, 10 children attained development, which may be due to the limited regular use of objects at home, apart from the time intervention is given. Under the domain of Problem-solving and reasoning skills significant improvement was there with 19 children. This could be due to the development achieved before intervention, which likely facilitated better achievement in the subsequent sequence of problem-solving and reasoning skills within the curriculum. Under the domain of Attention & Memory (Auditory), 12 children showed progress. In the domains of Imitation: Motor and Grasp & Manipulation, these two domains showed progress in 14 children. Under the domain of Bilateral Skills, 19 children exhibited progress in bilateral coordination skills. In the domain of Posture & Locomotion, 24 children showed improvement in upright posture and locomotion. Under the domain of Prone Position, 21 children showed progress in activities related to the prone position. The improvement seen in the above two domains may be due to the static balance established prior to the intervention, which likely supports the development of dynamic balance skills in subsequent postural and locomotor skills as well as prone position skills.

Table 6.3, shows gender wise comparisons of children who attained development after the intervention. From the results obtained using Chi-square test, the difference between males and females in the developmental domains was not statistically significant ($p > 0.05$), suggesting that the intervention had a similar effect on both genders.

Based on the analysis, the following conclusions were drawn regarding the proposed hypothesis: The research hypothesis, which states that “there is significant improvement in developmental milestones through the Carolina Curriculum Intervention for children with developmental delay,” is supported. Consequently, the null hypothesis, which states that “there is no significant improvement in developmental milestones through the Carolina Curriculum Intervention,” is rejected.

VI. CONCLUSION

The study aimed to assess the effectiveness of the Carolina Curriculum (Infant & Toddler) Intervention in improving developmental milestones for children with developmental delay. The results indicate noticeable improvements in the developmental progress of these children. Specifically, significant improvements were observed in the motor skills [upright: posture & locomotion, prone on stomach, bilateral skills], and cognitive skills [problem solving, and Attention & Memory: Visual/ Spatial skills]. Additionally, no statistically significant differences were found between males and

females across the developmental domains. Hence, this study concludes that there is a significant improvement in developmental milestones among children with developmental delay by providing Carolina Curriculum (Infant & Toddler) Intervention. These findings emphasize the importance of using structured programs like the Carolina Curriculum in early childhood intervention to help children develop key skills and improve their overall growth and progress.

VII. LIMITATIONS & RECOMMENDATION

LIMITATIONS

- The study was conducted only at one place – NIEPMD.
- The study population had unequal gender distribution.

RECOMMENDATION

Additional research can be conducted on the Carolina Curriculum for Preschoolers with Special Needs (CCPSN).

VIII. ACKNOWLEDGEMENT

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