

## Study Protocol

# DEVELOPMENTAL COORDINATION DISORDER, IMPACT OF FINE MOTOR SKILLS ON HANDWRITING AND ACADEMIC PERFORMANCE IN SCHOOL GOING CHILDREN: A RESEARCH PROTOCOL

## ABSTRACT

**Introduction**– Developmental Coordination Disorder (DCD) is a neurodevelopmental disease that inhibits muscle coordination that affects everyday life tasks and academic achievement. Children's with DCD are often characterized as "clumsy" and "uncoordinated" and often lead to performance problems that more often create (TD) children can easily execute. Generally, treatments for DCD are not expected to succeed and the disease has no treatment. Therapies, on the other hand, will include skills, solutions, and accommodations that make it simpler for children with DCD to execute the motor activities required in everyday life and school settings. . Some studies emphasize that child's developmental status plays an important role in academic performance but there is limited evidence which focuses on fine motor performance in children suspected with DCD, and its effect on their handwriting and academic performance.

**Methodology** – This observational cross-sectional study will be conducted at several schools around Wardha, with 1511 school-aged children of both genders ranging in age from 8 to 14 years participating.

**Discussion** – Some studies stress the importance of a child's developmental status in academic achievement, however, there is minimal data that focuses on fine motor skills in children suspected of having DCD and its impact on handwriting and academic performance.

**Comment [d1]:** Children's ????

**Comment [d2]:** What does TD stand for?

**Comment [d3]:** Ambiguity. Something seems to be wrong.

**Comment [d4]:** ????

**Conclusion** – This study will help us in determining the prevalence of developmental coordination disorder and the relationship between handwriting and academic performance in these children.

**Keywords** – Developmental coordination disorder, fine motor skills, DCDQ'07, Handwriting, Academic Performance.

## **INTRODUCTION**

Developmental Coordination Disorder (DCD) is a neurodevelopmental disease that inhibits muscle coordination that affects everyday life tasks and academic achievement. Children's with DCD are frequently described as "clumsy" and "uncoordinated," which frequently leads to performance issues that (TD) children can easily accomplish. It is believed that around 3.9 percent of school-age children are impacted. Boys are somewhat more influenced than girls (1.7:1), but there are no racial differences.(1)

It is unclear why Co-ordination and other abilities do not develop in children with DCD, but some risk factors can increase the likelihood. Which includes prematurity (birth before the 37th week of pregnancy), children born with low birth weight, in utero alcohol and drug exposure, and having a family history, though it is unclear which genes are involved in the condition. Two investigations revealed that the disease's genetic inheritance was 0.47 and 0.69, suggesting both genetic and environmental influences, and genomic sequence analysis revealed the presence of many previously unknown genes.(2) Difficulties or anomalies in doing "age-appropriate" tasks are characterized as DCD.

If problems are not addressed, kids may continue to have restricted social and physical activity, and there is a significant potential that this will have a negative influence on education, social engagement, mental wellness, participation in everyday life skills, and standard of living satisfaction.(3)

Comment [d5]: ????

DSM- V is a diagnostic criteria that comprises four conditions: (a) Given the opportunities for skill learning, acquiring knowledge, and performing coordinated motor skills are below the predicted age level; (b) Motor skills difficulties significantly change with day-to-day activities, influencing academic efficiency, pre-vocational and vocational activities, leisure, and play; (c) early development; and (d) Motor skills difficulties are not identified.(4) Treatments for DCD are not likely to be successful in general, as the condition has no known cure. Therapies, on the other hand, will contain skills, solutions, and accommodations that will make it easier for children with DCD to perform the motor skills necessary in everyday life and at school.(5)

There are few treatment options, but they have been found to be more effective than no treatment.(6) Kinesthetic therapy improves awareness of spatial motion, which leads to better motor skill control. The Bobath neurodevelopmental approach seeks to inhibit persisting primitive reflexes and abnormal muscle contraction cycles while encouraging the presence of maturity level reflexes and a normal pattern of muscle activation. Children who have difficulty with any specific activity, such as preparing, performing, and determining the outcome of a motor act, may benefit from cognitive motor training.(7)

Sensory integration therapy assists children in dealing with extremely sensitive stimuli while doing motor skills by modifying their surroundings to provide an adequate amount of sensory stimulation.(3) Fine-motor issues can complicate a range of other activities, such as using a fork and knife, fastening buttons and shoelaces, brushing teeth, combing hair, opening jars and boxes, and opening and closing doors.(8)

Handwriting problems are caused by difficulty with fine motor coordination, which may be related to ideomotor difficulties.(9) Some of the issues that may arise in this area are as follows:

- Developing different movement patterns.
- Developing a particular writing pace.

- Developing the proper pencil hold.(10)
- The grouping of alphabets.

## METHODOLOGY

### Study Setting and Study design

This observational cross-sectional research will be undertaken in several schools at Wardha after getting approval from the Institutional ethics committee of Datta Meghe Institute of Medical Sciences, Deemed to be University. Prior to their involvement, both participants will be educated about the purpose and method of the research. Participants who satisfy the eligibility conditions must provide written informed consent. In this study, 1511 school-aged children of both genders, ages 8 to 14, who scored in the suspected category of DCD on the DCDQ'07 Questionnaire and satisfied all four DSM-V criteria were included, whereas children who scored over the DCD cut-off range were removed (11).

Comment [d6]: ????

### STUDY SIZE

$$N = \frac{X^2 \cdot N \cdot P \cdot (1-P)}{C^2 (N-1) + X^2 \cdot P \cdot (1-P)}$$

$X^2$  = chi square value for 1 degree of freedom at some desired probability level. This is 3.84 at 5% level of significance

P = 50% proportion

C = confidence interval of one choice

= 0.05

## **PARTICIPANTS**

This research will include 1511 school-aged children who satisfy the inclusion criteria.

School-aged girls and boys between the ages of 8 and 14 who fulfill the DCDQ'07 and DSM-V suspected criteria will be included in the study, whereas those who do not reach the DCDQ'07 cutoff range or have any previously documented neurological disease or learning problem will be excluded.

### **Inclusion criteria:**

Children between age group 8 to 14

Children who will fulfill all 4 criteria of DSMV 5

Children who will qualify for the cut off score of DCD-Q 07

**Comment [d7]:** Need to be corrected.

### **Exclusion criteria:**

Who do not fulfill DSMV 5 criteria

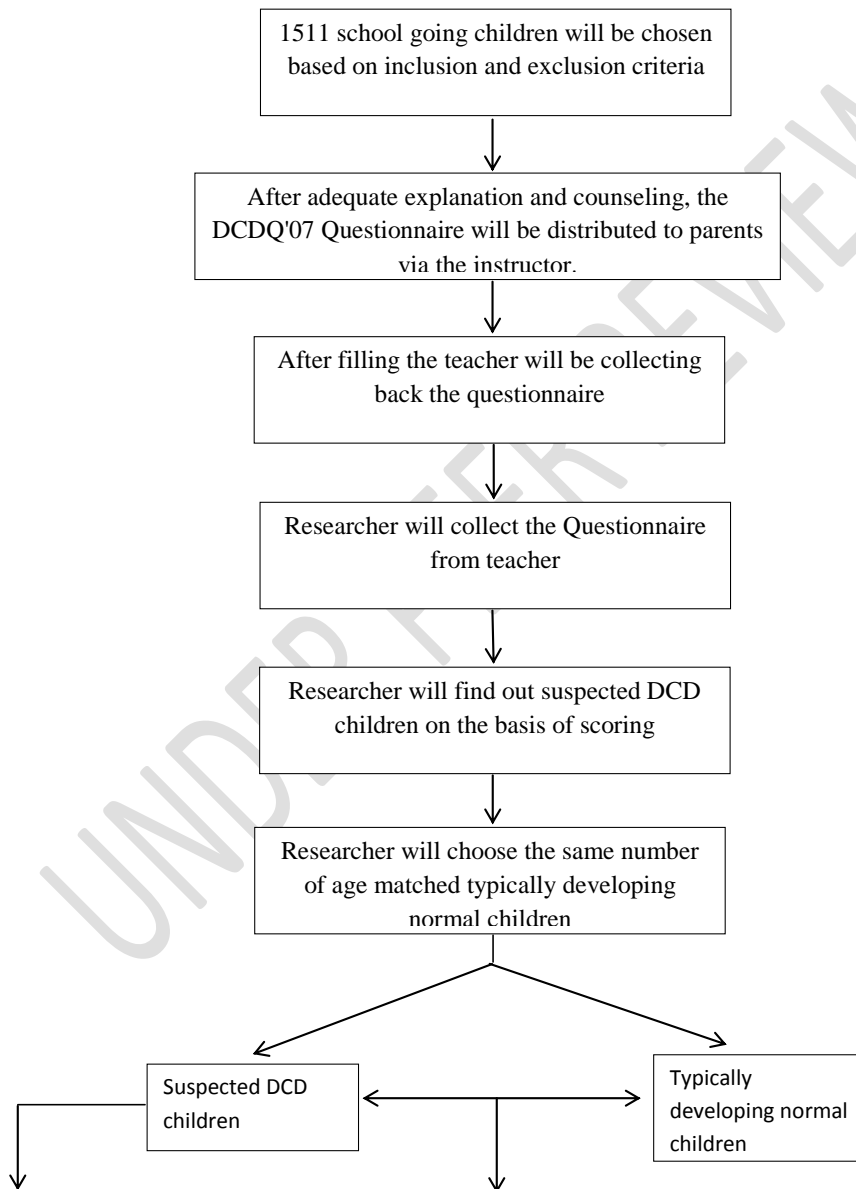
Children who score beyond the cut off range

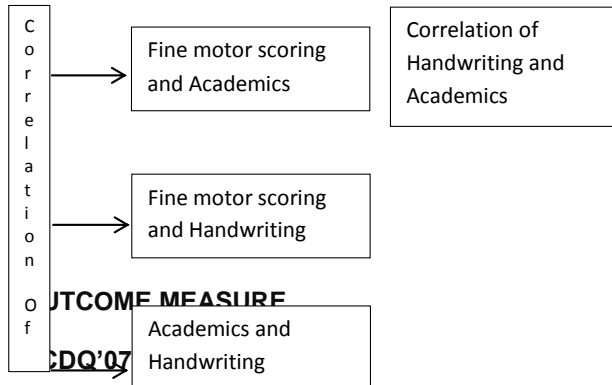
Children who are previously diagnosed with any medical condition

## **STUDY PROCEDURE**

After their parents' approval, children who meet the inclusion and exclusion criteria will be involved in the study.

The study procedure is briefly explained in the flow chart below.





The DCDQ'07 might be a reliable and accurate test for measuring motor difficulties in young children with Down syndrome. It is important to teach and reinforce motor skills in young children with DD in order to establish physical activity behaviors. A caregiver metric can be a useful tool. Early detection of motor skill deficits in children with Down syndrome. The Developmental Coordination Disorder Questionnaire 2007 (DCDQ'07) is a low-cost, simple-to-use caregiver assessment instrument for assessing motor problems and screening for developmental coordination disorder in children aged 5 to 15.(12)

#### DSM-V

The Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition (DSM-5) was produced by the American Psychiatric Association as a taxonomy and diagnostic tool (APA) The criteria are concise and straightforward, with the purpose of allowing objective evaluation of symptom presentations in a wide range of treatment settings, including inpatient, outpatient, partial hospitalization, consultation-liaison, clinical, private practice, and primary care. They are used by physicians and academics to diagnose and identify mental illnesses.(4)

#### SCALE FOR HANDWRITING EVALUATION (SHE)

This tool is developed to assess handwriting in children. This tool can have a significant contribution specifically to improve handwriting in normal school-going children and also in children who are having issues with motor execution. Content validity of this scale is in process. SHE tool has a total of 10 tasks. Each task is evaluated on a four-point Likert scale, with a minimum of 0 and a maximum of 3 for each task. This tool can be used by school teachers, health care professionals, calligraphers. No training is required to use the tool. It will take 15 minutes to complete the tool

## **DISCUSSION**

For the majority of children, the manner they write and perform in examinations is a frequent concern in school. The majority of teachers struggle to deal with these children. Some will be able to deal with it, while others will not. DCD symptoms might be mild at times, making them difficult to distinguish from those of healthy persons. While some studies indicate that a child's developmental state impacts academic achievement, there is a lack of evidence on fine motor skills in children with DCD and its impact on handwriting and academic performance.

This research will be beneficial in identifying the prevalence of DCD and the relationship between fine motor abilities, handwriting, and academic achievement in children suspected of having DCD. It will also be beneficial in establishing the prevalence of DCD as well as the relationship between fine motor skills and handwriting and academic performance in children suspected of having DCD.

## **CONCLUSION**

After the study is completed, we will know the prevalence of Developmental coordination disorder in our area and draw conclusions about the correlation between handwriting and academic performance of school-aged children with DCD by evaluating their handwriting with the help of the Scale for handwriting evaluation tool.

## **DISSEMINATION AND PROTOCOL AMENDMENTS:**

Regardless matter whether the primary results are favorable, negative, or inconclusive concerning the study hypothesis, they will be submitted for publication to a foreign peer-reviewed journal.

#### **CONFIDENTIALITY:**

Specific player data will be kept separate from the main dataset and will not be shared. To ensure confidentiality, all personal data will be securely stored prior to, during, and after the proceedings.

#### **References**

1. Sujatha B, Alagesan J, Lal DV, Rayna ABS. Prevalence of Developmental Coordination Disorder in School Children. *Indian J Pediatr.* 2020 Jun 1;87(6):454–6.
2. Fliers EA, Vasquez AA, Poelmans G, Rommelse N, Altink M, Buschgens C, et al. Genome-wide association study of motor coordination problems in ADHD identifies genes for brain and muscle function. *World J Biol Psychiatry.* 2012 Mar 1;13(3):211–22.
3. Allen S, Casey J. Developmental coordination disorders and sensory processing and integration: Incidence, associations and co-morbidities. *Br J Occup Ther.* 2017 Sep 1;80(9):549–57.
4. Association AP. *Diagnostic and Statistical Manual of Mental Disorders (DSM-5®)*. American Psychiatric Pub; 2013. 1414 p.
5. Caçola P, Lage G, Caçola P, Lage G. Developmental Coordination Disorder (DCD): An overview of the condition and research evidence. *Mot Rev Educ Física [Internet].* 2019 [cited 2021 Mar 6];25(2). Available from: [http://www.scielo.br/scielo.php?script=sci\\_abstract&pid=S1980-65742019000200201&lng=en&nrm=iso&tlng=en](http://www.scielo.br/scielo.php?script=sci_abstract&pid=S1980-65742019000200201&lng=en&nrm=iso&tlng=en)
6. Blank R, Smits-Engelsman B, Polatajko H, Wilson P. European Academy for Childhood Disability (EACD): Recommendations on the definition, diagnosis and intervention of developmental coordination disorder (long version). *Dev Med Child Neurol.* 2012 Jan 1;54:54–93.
7. Developmental Coordination Disorder DSM-5 315.4 (F82) - Therapedia [Internet]. [cited 2021 Mar 7]. Available from:

[https://www.theravive.com/therapedia/developmental-coordination-disorder-dsm--5-315.4-\(f82\)](https://www.theravive.com/therapedia/developmental-coordination-disorder-dsm--5-315.4-(f82))

8. Barnhart RC, Davenport MJ, Epps SB, Nordquist VM. Developmental Coordination Disorder. *Phys Ther.* 2003 Aug 1;83(8):722–31.
9. Rosenblum S. Handwriting measures as reflectors of executive functions among adults with Developmental Coordination Disorders (DCD). *Front Psychol.* 2013;4:357.
10. Polatajko HJ, Cantin N. Developmental coordination disorder (dyspraxia): an overview of the state of the art. *Semin Pediatr Neurol.* 2005 Dec;12(4):250–8.
11. Rosenblum S, Livneh-Zirinski M. Handwriting process and product characteristics of children diagnosed with developmental coordination disorder. *Hum Mov Sci.* 2008 Apr 1;27(2):200–14.
12. Ku B. Validity of the Developmental Coordination Disorder Questionnaire' 07 and Its Association with Physical Activity in Young Children with Developmental Disabilities. *Asian J Kinesiol.* 2021 Jan 31;23:10–9.

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