

# PHONOLOGICAL WORKING MEMORY IN CHILDREN WITH NORMAL NON-FLUENCY

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# PHONOLOGICAL WORKING MEMORY IN CHILDREN WITH NORMAL NON-FLUENCY

## **Abstract**

Clinically, it is very important to predict the development of stuttering at an early age of life because stuttering has an impact on academic, social, emotional and vocational achievements in life. Many studies have reported that children with stuttering show poorer in their phonological working memory. It has been proven to be an important predicting factor for the development of stuttering. There is dearth of studies in Indian scenario regarding the relationship between phonological short term memory and NNF. Identifying its relationship may help speech language pathologist for the identification of development of stuttering in its early stage. Hence the purpose of the study was to explore the possible relationship between phonological short term memory and NNF by comparing the performance on non-word repetition task between children with more NNF and less NNF. A total of 16 subjects in the age range of 2.5 to 3.5 years were taken up for the study. Based on percentage of disfluency the subject were grouped into two i.e. Group 1 consisted subjects with percentage of disfluency more than 5 and Group 2 will consisted subjects with percentage of disfluency less than 5. Non word repetition task was used to assess the phonological short term memory. The result indicated that children in Group 1 performed significantly poorer than that of children in Group 2.

Keywords: Normal Non-Fluency, Stuttering, Phonological Working Memory

## **Background**

Linguistic issues are reported as one of the most important factors in the etiology of stuttering in the past few decades (Vahab, Zandiyan , Falahi & Howell, 2013) . Recently

various studies have been carried out in working memory and has contributed <sup>25</sup> the role of working memory in the development of stuttering (Aboul , Hossam , Dessouky, Shohdi & Aisha,2010). <sup>2</sup> Working memory is recognized as a neurocognitive system which gives temporary storage and processing of incoming information. Working memory is critical to phonological encoding (Gathercole & Baddley, 1990). Numerous <sup>1</sup> researchers (Smith, 1999; Van Riper,1992) have suggested that the components that add to the onset and advancement of stammering shift crosswise over people, and hence, <sup>1</sup> a given language skill may be a solid factor in child's etiological history. Recently, a language -related area that has claimed attention from researches of stuttering is <sup>24</sup> phonological working memory.

Many studies have reported that children with stuttering show poorer in their phonological working memory. Prior, <sup>1</sup> it has been accounted that youngsters who stammer have a higher rate of phonological issue relative to general population (Paden, Yairi & Ambrose, 1999;Yaruss, Lasalle & Conture, 1998) suggesting an existence of relation between phonological skills and stuttering. Anderson and Wagovich (2010) reported <sup>11</sup> that children with stuttering performed significantly poorer than children without stuttering on non- word repetition and focused attention skill.

Few researchers like Bakhtiyar , Soleymani and Mahmoud (2006) in Persian language examined phonological encoding in twelve <sup>13</sup> children who stutter and twelve children who do not stutter through non word repetition task. Their results indicated that children with stuttering showed slightly poorer performance than non stuttering children but the difference was not significant. Anderson, Wagovich and Hall (2006) compared <sup>2</sup> non word repetition in children who do and do not stutter and found that children with stuttering produced fewer two, three syllable word repetition and made significantly more phonemic errors compared to that of children who do not stutter. <sup>23</sup> Spencer and Fox (2014) reported that phonological and

articulation abilities in preschool children are important predictor for the development of chronic stuttering

Phonological short term memory in Normal Non-Fluency (NNF) is one of the aspects of cognition. It has been proven to be an important predicting factor for the development of stuttering. Phonological working memory can be assessed using various tasks. One such task is non- word repetition task. In children non-word repetition tasks have been broadly used to explore the phonological working memory skills (e.g., Dollaghan, Biber, & Campbell, 1993, 1995; Dollaghan & Campbell, 1998). These tasks basically depend on retrieval and the response gives information about storage capacity and rehearsal abilities. That is, a person who can retrieve a non-word stimulus precisely have depended upon sufficient rehearsal and storage capacity to achieve that point. According to Anderson, Wagovich & Hall (2006) Non-word repetition is appropriate for measuring phonological working memory in people with typical and atypical speech and language disorders. Hence, non-word repetition task would appear to be an appropriate assessment tool for investigating phonological working memory capacities of children with stuttering. Magimairaj and O'Malley(2008) have utilized non word repetition task to check phonological short term memory and reported it to be a useful measure to assess phonological short term memory in typically developing children. It is hypothesized that non word repetition tasks remarkably evaluate phonological working memory by making the listener to store the phonemes listened, recover them from memory, and deliver the nonsense word (Gathercole & Baddeley, 1990). Not just does non-word repetition evaluates phonological memory abilities, yet it additionally provides information on phonological representation speech motor planning and execution (Gathercole,2006; Rispens& Bakers,2012.)

Clinically, it is very important to predict the development of stuttering at an early age of life because stuttering has an impact on academic, social, emotional and vocational

achievements in life. <sup>5</sup> It is not monetarily or practically feasible to treat each child who starts to stammer, yet early intervention has reliably been shown to profit the youngster, both by enhancing fluency strategies and giving passionate support (Subramanian, Yairi, & Amir, 2003). Normal dysfluency commonly happens in kids between ages two and seven, with an uplifted event between 2.5-4 years. During this period the dysfluencies are episodic and cyclic in nature without any typical pattern. According to Guitar (2007), frequency of dysfluencies are less than ten per hundred words in children with normal non-fluency and most of the repetitions are simple with no significant features of tension or struggle. The commonly seen normal disfluencies are interjections, revisions and whole word repetitions. As age increases, they will show a decline in these disfluencies. Most of the time they are unaware of the disfluencies and they keep talking without interferences.

Identifying <sup>17</sup> the relationship between phonological short term memory and NNF may help <sup>21</sup> speech language pathologist for the identification of development of stuttering in its early stage. It is clear from the literature that many researchers have attempted to find the relationship between <sup>21</sup> phonological working memory and stuttering. However studies <sup>16</sup> focusing on phonological working memory in children with NNF are scanty. Hence <sup>16</sup> the present study was aimed to explore the possible relationship between <sup>7</sup> phonological short term memory and NNF by comparing the performance on <sup>7</sup> non word repetition task between children with more NNF and less NNF.

### **Method**

A total of 16 subjects in the age range of 2.5 to 3.5 years were taken up for the study. All the subjects were native speaker of Kannada language. <sup>6</sup> None of the subjects had any history of speech, language, hearing and other medical related problems. Speech samples

were taken from each of the subject by using general conversation and story narration. Speech sample consisted of minimum of 250 syllables. None of the subjects exhibited stuttering like dysfluencies. Percentage of disfluency was calculated from each of the subject. Based on percentage of disfluency the subjects were further grouped into two. Group 1 consisted of 8 subjects (M=6, F=2) with percentage of disfluency more than 5 and group two consisted of 8 subjects (M=5, F=3) with percentage of disfluency less than 5.

### **Stimuli used**

The stimuli consisted of 15 <sup>20</sup> non-words with varying syllable length from two syllables to four syllables. The non-words had various combinations of consonants and vowels like CVCV, CVCCV, and CVCVCCV that followed the Kannada phonotactic rules.

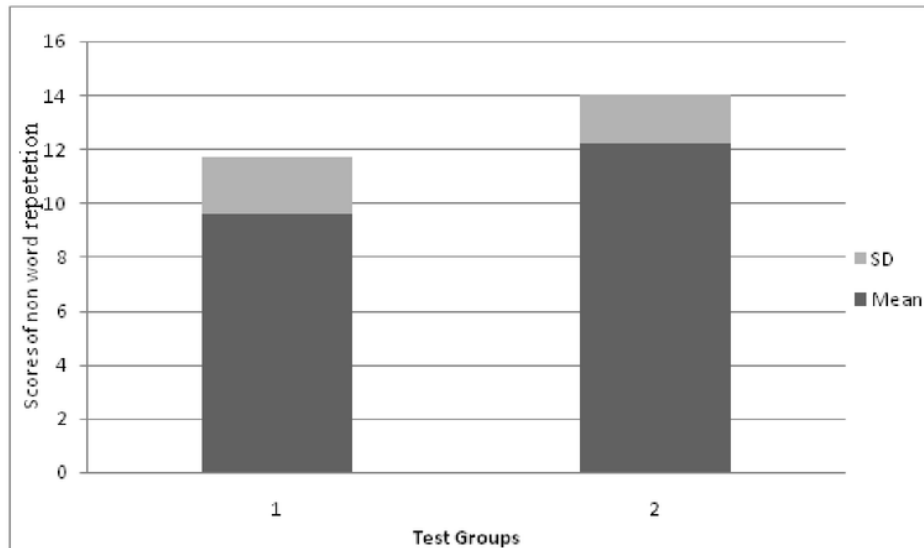
### **Procedure**

Each subject was seated comfortably on a chair facing the investigator across the table in a quiet and distraction free room. In order to get the co-operation from the subject for testing, rapport was built by talking about the daily activities of the child and games played by the child etc. After that the subject was instructed as follows “now i will read out to you certain meaningless words. You will have to immediately repeat each one as you hear it”. <sup>10</sup> The non-words were presented in a random order, and the subject had to repeat the non-words. Online scoring was adopted. For every correct answer a score of 1 was awarded.

### **Results**

The scores obtained by children in group one and group two on non word repetition task were subjected to statistical analysis using SPSS version 17 software. The mean scores obtained by children in group one was 9.63 (SD=2.13) and for children in group 2 was 12.25

(SD=1.83). The Figure 1 represents the mean scores obtained by children with more and less normal non fluency.



<sup>9</sup> **Figure 1: Mean scores obtained by children in Group one and two**

The mean scores obtained by children in group 1 and 2 were compared using independent sample t test and <sup>15</sup> results revealed significant differences between the groups [ $p<0.05$ ] i.e. children who were more fluent performed significantly better than that of children who were less fluent.

### **Discussions**

Studies have reported that children having delay <sup>4</sup> in the development of phonological working memory can have stuttering in their later period of life (Vehab, Shojaei, Ahmadi & Nasiri; 2014). Anderson and Wagovich (2010) investigated the conceivable connections <sup>4</sup> between measures of linguistic processing speed and two aspects of cognition: phonological



working memory and attention in children who stutter. The results indicated the children with stuttering were less proficient in consonant production and repetition of novel phonological sequences. They also concluded that, along with other predictive factors, the phonological and speech articulation abilities also should be considered in pre-school children as a part of comprehensive risk assessment for the development of chronic stuttering.

According to Kolk, Conture, E., Postmark, and Louk (1991) stuttering occurs as a result of inefficient or slow phonological encoding that may be leading to an increase in covert repairs to the phonological plan, particularly when the individual is endeavouring to talk at a faster rate that may be exceeding the capacity of the phonological encoding mechanism. By comparing phonological working memory using non word repetition task between children with stuttering and typically developing school age children, Krishnan, Alcock, Mercure., Leech, Barker, and Smith, (2013) indicated a significant portion of variance (24%) in performance of a standard non word repetition task for children with stuttering.

In the present study children with more number of disfluencies performed poorer in non word repetition task which may be because of the developmental delay in phonological working memory. The findings of the present study is similar to the findings of Vehab, Shojaei, Ahmadi & Nasiri (2014) who compared phonological working memory in 4-8 Year-Old Persian Children with stuttering and found that, mean percentage of error was higher in children who stutter than normal children, but the difference was not statistically significant. They also support the view that children with stuttering may have some degree of delay and slow in phonological working memory abilities when compared to normal children. Spencer and Fox (2014) reported that children with stuttering who performed better in non word



repetition had recovered eventually better than that of children who had a poorer performance.

### **Conclusion**

Studies have proven that children from mild to severe stuttering also exhibit poorer performance on non word repetition task. Hence it can be concluded that probability of occurrence of stuttering is high in children who performed poorer on phonological short term memory task compared to that of children who performed better. The non-word repetition task can be used with children who have mild and severe NNF to trace the involvement of developmental stuttering in them.

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