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Difficulty in Learning to Count or Effect of Short-term Memory Deficiency in Mathematical Abilities

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Abstract: **Many researchers have highlighted the fact that students with Down's syndrome face great difficulty in counting. Rynders et alreport that not only the misinformation but also the lack of information about the educational potential of children with Down's syndrome have led school teachers, psychologists and other school personnel to have low educational expectations of these children. One of the main objectives, set in the context of this study, is to investigate the effect of deficiency of short-term memory in acquisition of enumeration skills and discuss the results in terms of their implications for educational placement and curriculum.**

Keywords: **Down Syndrome, Utrecht Early Numeracy Test, Counting Skills, Short-Term Memory.**

I. Introduction

Short-term memory is associated with a person's ability to retain information for short periods (few seconds). As reported by Broadley and MacDonald (1993), the low storage capacity of short-term memory is associated, however, not only with development dyslexia (Jorm, 1983), but also with language disorders (Gathercole & Baddeley, 1990).Marcell and Armstrong reported that the performance of verbal short-term memory in children with Down syndrome is reduced in relation to their performance of visuo-spatial short-term memory. They also emphasized the fact that the limited capacity of short-term memory in this population is more serious than in populations of children with learning difficulties.

In fact many studies have shown that individuals with Down syndrome have lower verbal short-term memory spans than would be predicted by their level of verbal ability or their general level of intellectual function. Educational research has found that the verbal short term memory of children and adults with Down syndrome is more impaired than visual spatial memory. A consequence is that processing verbal information can be more difficult than processing visual information. In other words, learning from listening is a challenge.

II. Objective of the Study

The wide spread failure of students with Down syndrome in enumeration, is the fact that promptedus to investigate possible causes. The special profile of students with Downs yndromeposes some limitations. Part of this research, has to do with the investigation of the role that short-termmemory, poses in this phenomenon.

III. Method

Research Design

Primarily, we contacted parents by epistle to share the nature of our research and to ask for their assistance. As they agreed that their children participate, were used Utrecht Early Numeracy Test to screen their mathematical competence; the descriptive study shares the results of those surveys.

Participants

The children in this study (N=40) were those with Down syndrome between seven and fourteen years old (M=10.07, SD=2.06) and enrolled in special school programs. The group comprised the entire number of children with Down syndrome in Attica's special primary education. As we can see in Table 1, the sample consisted of 17 girls and 23 boys.

Table 1: Distribution of gender within the sample

Gender	Frequency	Percent
Girls	17	42,5
Boys	23	57,5
Total	40	100,0

IV. Research Tools

Length of Number String

The length of number string was determined by the 21st task of the standardized psychometric criterion for early mathematical competence of Utrecht (Utrecht Early Mathematical Competence Test). In the section of Data Analysis it is mentioned as Length of Number String Task A. It is a tool that is both reliable and valid in terms of its content and conceptual structure.

We also used an alternation of the above task. In the second task, they were askedto enumerate up to 20, whileallowing them either to write down the numerical string, or, if asked, the examiner wrote down the numerical string that they produced. In the section of Data Analysis it is mentioned as Length of Number String Task B.

V. Data analysis - Results

For the quantitative description of the variables involved in the statistical analysis, we present the descriptive statistics between all examined variables. Specifically, in

Table 2, we can see the average (M), the standard deviation (SD), maximum and minimum value, the skewness and kurtosis of the distribution. It is obvious that students' performance is better in Length of Number String Task B *(M=8.925 , SD=5.872),* than in Length of Number String Task *(M=9.900 , SD=5.583)*. The children comprising the sample have been diagnosed with moderate intellectual disability, having a mean mental age of *M=4.863 (years),* while their mean chronological age is *M=9.704 (years).*

Table 2: Descriptive statistics of examined variables

	M	SD	Minimum	Maximum
ChronologicalAge	116.455	27.813	74.400	176.400
Mental Age	4.863	0.974	4	7.010
Length of Number String Task A	8.925	5.872	2	20
Length of Number String Task B	9.900	5.583	2	20

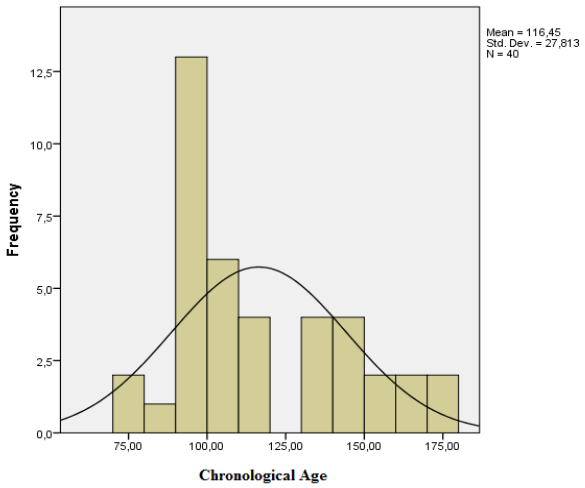

Fig.1. Distribution of scores on Chronological Age (N=40).

In Figure 1, we can see the distribution of children's chronological age, while in Figure 2 is depicted the distribution of children's mental age. It is also presented, the distribution of children's scores on Length of Number String Task A (Figure 3) and Length of Number String Task B (Figure 4).

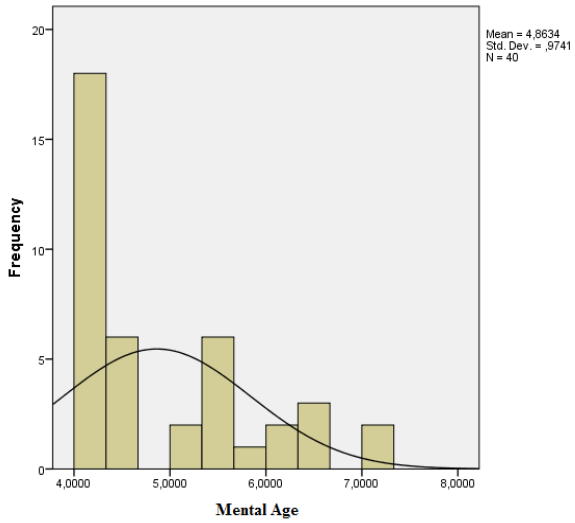

Fig.2. Distribution of scores on Mental Age (N=40).

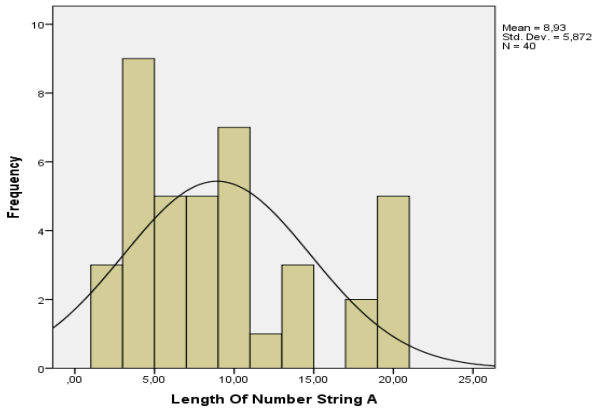

Fig.3. Distribution of scores on Length of Number String Task A (N=40).

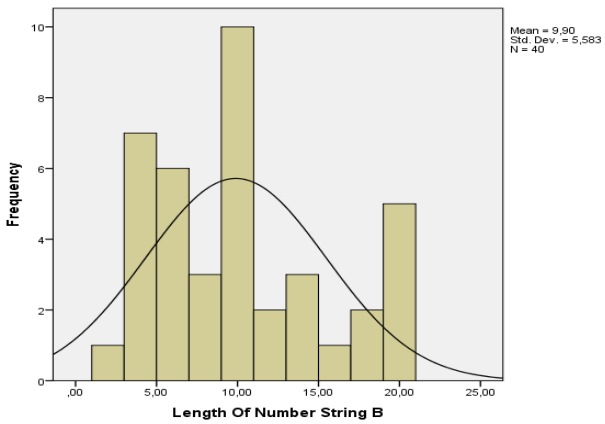

Fig.4. Distribution of scores on Length of Number String Task B (N=40).

For the check of the existence correlation between the scores on Length of Number String Task A with Scores on Length of Number String Task B, was used Paired Samples t-Test. These two variables were highly correlated *(t=-3.994,df=39,p=.000).* Furthermore, there was no statistically significant correlation of the above two variables with gender.

VI. Discussion

The results show directly that there is a differentiation in children's with Down's syndrome attainments in enumeration, while they visualize what they orally produce. This phenomenon, partly, explains their generalized failure in

counting. Their Short-term memory impairment seems to have an effect on their counting abilities. Recycling parts during enumeration is a type of error that the majority of children with Down's syndrome make (Porter,1999) and can directly be correlated to this impairment, since there was a decrease in the frequency of emergence of this error in Length of Number String Task B.

Many researchers have highlighted the fact that the impairment in Short-term memory in children with Down's syndrome is associated with their enumeration skills. They also impose in the focal point of the speculation, the differentiation of instruction. According to Abdelahmeed (2007) further linked explanation of this difficulty in learning number strings is that spoken instruction rather than visual presentations are used. The students' Short-term memory deficit is underestimated and also not taken into account for the intervention design. Other researchers as Bird and Buckley (1994) emphasize the fact that children are benefited by the use of visual representation of number sequences.

In contrast to the above findings, there are conflicting views which claim that there is no differentiation in childrens' with Down's syndrome performance on a memory task (Marcell and Weeks,1988). They found that typically developing individuals show better short-term memory for brief sequences of auditory than visual information (the modality effect). In this study, they attempted to determine whether the failure of Down's syndrome individuals to show the modality effect is due to the verbal-expressive demands of oral responding in memory tasks. Through statistical analysis they concluded that manual responding failed to enhance auditory recall in either children with Down's syndrome or any other participants and difficulty in recalling auditory stimuli was greatest for children with Down's syndrome.

Finally it should be mentioned that children with Down syndrome's have difficulty in acquiring number strings may be due to deficit in their expressive language, deficit in their auditory short-term memory, and difficulty in using rehearsal strategy and the limitation in their short-term memory span (Abdelahmeed, 2007). However, using both modes seems to be important in suppressing any difficulties which children with Down's syndrome face with enumeration tasks.

VII. Conclusion

As a conclusion, it should be mentioned the necessity of differentiated interventions, firstly, by using strengths to teach. As soon as the verbal short term memory difficulty was reported, practitioners adapted teaching by using visual supports such as signs, pictures, symbols, print and computer screen wherever possible. They are 'going around' the deficit and using the children's visual learning strengths to help children learn and remember.

Moreover, improving the weak function would be beneficiary for children with Down's syndrome. Some researchers have investigated memory training, with some limited evidence for benefits, but they concluded that it may be easier to train visual spatial than verbal short term memory.

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