

THE IMPACT OF STUTTERING ON THE ABILITY TO ACQUIRE ACADEMIC KNOWLEDGE IN CHILDREN OF SCHOOL AGE

Nada Dobrota-Davidović¹
Jadranka Otašević
Ljiljana Radević

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*University of Belgrade, Faculty of Special Education and Rehabilitation, Republic of Serbia
Institute of Psychophysiological Disorders and Speech Pathology "Prof. Dr. Cvetko Brajović", Belgrade, Republic of Serbia*

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ABSTRACT

The aim of this research was to establish the level of abilities that is a prerequisite for acquiring academic knowledge of children who stutter. The sample consisted of 102 subjects, of whom 42 children were experimental, and 60 children constituted a control group. We used following instruments: Riley test - a test for stuttering estimation, for quantitative speech analysis and ACADIA - a capacity assessment test that is a prerequisite for the acquisition of academic knowledge. The obtained results showed that there are differences in perceptual, visuo-motor, non-verbal and speech-language abilities of children stuttering in relation to children who do not stutter. There is a significant connection between the stuttering and the success of the Serbian language and the stutter and education of the parents. These differences should be used as the starting point in a therapeutic program for working with children who stutter.

Key words: *stuttering, academic knowledge, children of school age*

INTRODUCTION

The speech is aware intentional dynamism of the continuous harmonic and rhythmic wave of sounds of various frequencies and intensity that maintains the psychophysical unity of the human being during the adaptation (Brajović, 1981). Observing such a wide process of listening and speaking, we can con-

clude that the speech function, as well as the listening function, is extremely complex (Dobrota, 2011). Listening is the auditory process of higher nervous activity and conditioned by the maturation and experience factor. Outbursts in the early developmental period of the child can impair all levels of speech-language development and so that in the field of fluency of speech.

¹Correspondence to:

Nada Dobrota – Davidović, University of Belgrade, Faculty of Special Education and Rehabilitation, Republic of Serbia
Visokog Stevana 2, Belgrade, Republic of Serbia
Phone: +38163280267
E-mail: nadadd@sbb.rs

Stuttering is the most common fluency disorder and is defined as disfluency in speech. Disfluency can also occur in other pathological conditions - Tourette's syndrome, spastic dysphonia, Parkinsonism, palilalia, apraxia, tachifemia...

This is a non-fluent voice behavior that results from the existence of differences between: psycholinguistic factors (phonology, prose, syntax, semantics, cognition, pragmatics), psychosocial factors (parents and others that significantly influence the development and upbringing of children, fear, social burden of discourse) and physiological factors (beginning of voice and limited time, laryngeal and sublingual tension, sensomotor coordination, articulation, anatomy of the nervous system, respiration and genetics) (De Nil, 1999).

Stuttering affects the entire personality of the child and should be viewed as a multidimensional problem, ie it should be observed through motor, linguistic, cognitive and emotional development and should be treated as such (Adams, 1990; Smith et al., 1996).

Basic academic skills include reading, writing and mathematical skills and their acquisition depends on personal and environmental factors. Personal factors are cognitive abilities and non-cognitive factors (child motivation, personality characteristics) that enable acquiring knowledge and skills (Gligorović 2013). The environmental factors include: school, family and sociocultural milestones in which the child lives. The influence of environmental factors is reflected on the quality of perceptual and motor functions that are an important link between emotional and cognitive development for the acquisition of academic knowledge and skills (Gligorović et al., 2011).

Intelligence is an important prerequisite for outcomes of education (Rhode & Thompson, 2007) because there is a high correlation between intelligence and academic achievement (Nikolasević et al., 2014). Other research has confirmed the importance of specific cognitive functions and environmental factors (Gligorović & Buha 2010, 2012; Spinath et al 2006).

The aim of the research was to determine the level of abilities that are the prerequisite for acquiring knowledge in stuttering children and compare them with the abilities of children who do not stutter.

The specific objectives were:

1. Assess perceptual abilities in children who

stutTt2. Assess the perceptual abilities of non-stuttered children;

3. Assess viso-motor abilities in children of who stutter;

4. Assess visually-motor skills in non-stuttered children;

METHODS

In this paper the methods of research used are described in detail. The sample consisted of an experimental and control group. The experimental group consisted of 42 patients (33 boys and 9 girls) of the Institute for Psychophysiological Disorders and Speech Pathology "Prof. Dr CvetkoBrajovic "in Belgrade. During 2010/2011, they were treated for speech disorder by type of stutter, while the control group consisted of 60 students (40 boys and 20 girls) of elementary school age who did not stutter. The criteria for inclusion in the experimental group were: age (from 7 to 13 years), duration of speech therapy (6-12 months), level of intelligence (average and above average), weight of stuttering (light, medium and heavy), success at school ,grade in Serbian language, grade in mathematics and education of parents.

Groups were harmonized with each other according to gender, age, school success, intelligence, success in mathematics and the Serbian language, and the education of father and mother.

In this research, the following instruments were used:

1. Riley test - This test evaluates quantitative speech analysis by following three parameters: frequency, physical concomitants, and duration of the longest block. The use of this test defines the degree of stinging difficulty (light, medium, heavy).

2. AKADIA - The test allows for registration of children that could have difficulty in mastering school materials due to some abilities that have not yet developed sufficiently. It is a test of developmental capabilities and consists of 13 subtests and each subtest evaluates cognitive functions. It is intended for children aged from 6.3 to 12.3 years.

In the framework of data processing and analysis, adequate statistical methods have been applied which examined the significance of the variables tested: the measures of central tendency, variation measures, variance analysis, t - test, Hi - square test and graphical and tabular presentation.

RESULTS

Table 1. Connection between intelligence and stuttering

		Stuttering		
		YES	NO	TOTAL
	total	26	46	72
	average	61.9%	76.7%	70.6%
Intelligence	total	16	14	30
	extraordinary	38.1%	23.3%	29.4%
Total		42	60	102
		100.0%	100.0%	100.0%

The χ^2 test of independence showed no significant relationship between stuttering and intelligence, $\chi^2(1, n = 102) = 1.931, p = .165 > .05$. Amongst those who stutter, 38.1% are super-intelligent, and among

those who do not stutter, 23.3%. Perhaps the difference is significant, but due to the smaller sample of the respondents, this difference is not large enough to determine that it was due to the presence of stuttering.

Table 2. Results of testing effects of stuttering and intelligence on AKADIA test

AKADIA test/subtests	factor		
	stuttering	intelligence	stuttering*intelligence
Auditory discrimination (1)	.002	.297	.684
Visomotor discrimination and the possibility of herding (2)	.000	.001	.459
Visual discrimination (3)	.541	.001	.419
Drawing shapes (4)	.001	.098	.954
Visual memory (5)	.002	.221	.091
Audio-visual association (6)	.753	.001	.181
Trace and encryption (7)	.305	.000	.727
Auditory memory (8)	.213	.003	.171
The skill of creating concepts (9)	.007	.000	.200
Acquired language goods (10)	.945	.006	.770
Automatic language goods (11)	.024	.000	.232
Visual association (12)	.575	.000	.905
Drawing (13)	.064	.032	.433

This table shows the slight influence of stuttering on the subtests Auditory discrimination, Visuomotor coordination and the possibility of herding, Drawing shapes, Visual memory, Skill of creation of concepts and Automatic linguistic goods while on subtests Visuomotor

coordination and traceability, Visual discrimination, Audio-visual association, Tracking and Encryption, Auditory Memory, Creation Skills, Acquired Language Goods, Automated Lingual Treasures, Visual Association, Drawing there is an influence of Intelligence.

Table 3. Connection between success in Serbian language and stuttering

		Stuttering		
		YES	NO	TOTAL
Serbian	4	total 12 29.3%	6 10.2%	18 18.0%
	5	total 29 70.7%	53 89.8%	82 82.0%
Total		Total 41 100.0%	59 100.0%	100 100.0%

The χ^2 test of independence showed a significant link between stuttering and success in Serbian language, $\chi^2(1, n = 100) = 4.754, p = .029$. A large number of

children who do not stutter achieve great success from the Serbian language in relation to stuttering students.

Table 4. Medium values on subtests for all combinations of success in Serbian language and stuttering

AKADIA test/subtests	grade	stuttering		p		grade	stuttering		p
		yes	no				yes	no	
Auditory discrimination (1)	4	59.58Ba	57.00Aa	.003	Auditory memory (8)	4	43.83Aa	43.33Aa	.721
	5	59.45Ba	58.04Aa			5	44.90Aa	47.72Aa	
Visomotor coordination and possibility of herding (2)	4	45.08Aa	50.33Ba	.007	The skill of creation concepts (9)	4	54.83Aa	58.00Aa	.195
	5	48.93Ab	54.62Bb			5	57.38Aa	58.74Aa	
Visual discrimination (3)	4	51.58Aa	51.33Aa	.962	Aquired language goods (10)	4	58.92Aa	60.50Aa	.888
	5	54.48Ab	54.60Ab			5	61.31Aa	60.13Aa	
Drawing shapes (4)	4	56.92Aa	60.17Ba	.038	Automatic language goods (11)	4	55.67Aa	59.33Aa	.141
	5	57.69Aa	62.34Ba			5	59.00Aa	60.57Aa	
Visual memory (5)	4	47.58Aa	44.00Aa	.676	Visual association (12)	4	54.17Aa	53.50Aa	.777
	5	47.76Aa	53.53Aa			5	57.83Aa	57.36Aa	
Audio-visual association (6)	4	48.92Ba	37.17Aa	.001	Drawing (13)	4	44.33Aa	39.00Aa	.066
	5	52.97Aa	51.34Ab			5	49.86Aa	40.92Aa	
Trace and encryption (7)	4	58.08Aa	57.00Aa	.786					
	5	58.38Aa	58.57Aa						

On the Subtest of Auditory Discrimination and Audio-Visual Association better results are achieved by students who stutter, while on the subtests Visuomotor Coordination and the Potential of Tracing and Drawing Forms better results are achieved by the children who do not stutter. On the subtest, the Audio-Visual Association there is an interaction between stuttering

and success in Serbian language. If we called for a p value ($p = .001$), we can conclude that stuttering affects the subtest Audio-Visual Association Standard and this would apply to both groups of respondents (and with grade 4 and grade 5), while it does not affect the respondent with a score of 5.

Table 5. Connection between father's education and stuttering

		Stuttering		
		YES	NO	TOTAL
Father - level of education	medium	total 29 69.0%	23 38.3%	59 51.0%
	high	total 13 31.0%	37 61.7%	50 49.0%
Total		Total 42 100.0%	60 100.0%	102 100.0%

The χ^2 independence test showed a significant relationship between stuttering and father education, $\chi^2(1, n = 102) = 8.138, p = .004$. The majority of stuttering children have parents with secondary education.

Table 6. Meduim results on subtests for all combinations of level of father's education and stuttering

AKADIA test/subtests	Level of father's education	stuttering		p value		Level of father's education	stuttering		p value
		yes	no				yes	no	
Auditory discrimination (1)	srednji	59.00Aa	58.39Aa	.000	Auditory memory (8)	srednji	41.90Aa	45.61Aa	.500
	visoki	60.69Bb	57.57Aa			visoki	48.85Aa	48.51Aa	
Visomotor coordination and possibility of herding (2)	srednji	46.69Aa	52.09Ba	.000	The skill of creation concepts (9)	srednji	56.38Aa	58.17Aa	.131
	visoki	49.38Aa	55.38Ba			visoki	56.62Aa	58.92Aa	
Visual discrimination (3)	srednji	52.83Aa	53.78Aa	.949	Aquired language goods (10)	srednji	60.66Aa	59.74Aa	.705
	visoki	55.23Aa	54.14Aa			visoki	60.31Aa	60.38Aa	
Drawing shapes (4)	srednji	56.38Aa	63.78Aa	.003	Automatic language goods (11)	srednji	56.62Aa	60.39Aa	.149
	visoki	59.92Aa	60.97Aa			visoki	60.31Aa	60.51Aa	
Visual memory (5)	srednji	46.62Aa	55.48Ba	.020	Visual association (12)	srednji	54.93Aa	57.65Aa	.597
	visoki	50.23Aa	50.92Aa			visoki	60.62Bb	56.27Aa	
Audio-visual association (6)	srednji	50.72Aa	48.65Aa	.069	Drawing (13)	srednji	48.41Ba	39.48Aa	.012
	visoki	54.38Aa	50.35Aa			visoki	47.92Ba	41,65	
Trace and encryption (7)	srednji	55.93Aa	57.26Aa	.739					
	visoki	61.15Ab	58.89Ab						

From the table it can be seen that on the subtest Auditory Discrimination Stuttering statistically significantly increases the achievement values in children with highly educated fathers. On the Subtest Drawing, better results are achieved by children who stutter.

Non-stuttering children are more successful on the test Visuomotor coordination and possibility of herding. On subtests, Drawing Shapes and Visual memorystutter affects by reducing achievement value, and only in children whose fathers have secondary education.

Table 7. Connection between mother's education and stuttering

Mother - level of education			Stuttering		TOTAL
			YES	NO	
medium	total		25	18	43
	%		59.5%	30.0%	42.2%
	total		17	42	59
	%		40.5%	70.0%	57.8%
Total	Total		42	60	102
	%		100.0%	100.0%	100.0%

The χ^2 independence test showed a significant relationship between stuttering and father education, $\chi^2(1, n = 102) = 7.662, p = .006$. The majority of stuttering children have parents with secondary education.

Table 8. Results of testing effects of stuttering and mother's education on AKADIA test

AKADIA test/subtests	factor		
	stuttering	mother's education	stuttering*mother's education
Auditory discrimination (1)	.001	.340	.415
Visomotor discrimination and the possibility of herding (2)	.000	.038	.977
Visual discrimination (3)	.844	.030	.620
Drawing shapes (4)	.003	.840	.729
Visual memory (5)	.010	.635	.619
Audio-visual association (6)	.233	.874	.632
Trace and encryption (7)	.738	.600	.896
Auditory memory (8)	.257	.452	.784
The skill of creating concepts (9)	.284	.088	.431
Acquired language goods (10)	.333	.249	.023
Automatic language goods (11)	.080	.556	.765
Visual association (12)	.602	.020	.329
Drawing (13)	.003	.160	.565

Table 8 – Results of testing effects of stuttering and mother's education on AKADIA test

From this table we can see the effect of stuttering on the subtests Auditory discrimination, Visuomotor coordination and possibility of herding, Drawing shapes, Visual memory and Drawing. The maternal education factor has a significant impact on

the subtests of Visuomotor Coordination and the possibility of herding, Visual Discrimination and the Visual Association. The interaction of these two factors can be seen on the subtest Acquired linguistic treasure.

Table 9. Average of achievement on AKADIA test for experimental and control group

AKADIA test/subtests	Stuttering	AS	SD	t	p value
Auditory discrimination (1)	yes	59.520	2.051	3.410	0.001
	no	57.880	2.598		
Visomotor coordination and possibility of herding(2)	yes	47.520	8.211	-4.440	0.000
	no	54.120	6.732		
Visual discrimination (3)	yes	53.570	5.939	-0.410	0.681
	no	54.000	4.540		
Drawing shapes (4)	yes	57.480	8.164	-3.390	0.001
	no	62.050	5.485		
Visual memory (5)	yes	47.740	9.284	-2.560	0.012
	no	52.670	9.771		
Audio-visual association (6)	yes	51.860	6.167	1.370	0.173
	no	49.700	8.778		
Trace and encryption (7)	yes	57.550	7.510	-0.530	0.594
	no	58.270	6.056		
Auditory memory (8)	yes	44.050	13.870	-1.410	0.162
	no	47.400	10.150		
The skill of creation concepts (9)	yes	56.450	5.288	-1.730	0.086
	no	58.630	6.847		
Aquired language goods (10)	yes	60.550	6.209	0.400	0.691
	no	60.130	4.304		
Automatic language goods (11)	yes	57.760	8.153	-2.080	0.040
	no	60.470	4.928		
Visual association (12)	yes	56.690	7.788	-0.070	0.941
	no	56.800	6.976		
Drawing (13)	yes	48.260	11.565	2.690	0.008
	no	40.820	15.102		

This table shows the mean values for all 13 subtests for stuttering. Using the t test of independent samples, it is examined whether these differences are significant. In the tests Auditory discrimination, Visuomotor coordination and the possibility of herding, Drawing forms, Visual memory, Automatic linguistic goods and Drawing, there is a statistically significant difference in mean values that was created due to the influence of stuttering. For example, in the subtype Auditory discrimination, the difference is significant ($p = .001$), and as the average for the group who stutter (59.52) is higher than for a group that does not stutter (57.88), this means that the presence of stutter increases the values on this subtest, as well as on the subtest Drawing, while on the tests the Visuomotor Coordination and possibility of herding, Drawing Forms, Visual Memory, and Automatic Language goods presence of stuttering reduces mean values. For other variables, statistically significant association was not established.

DISCUSSION

By analyzing the results of the study of the connection of intelligence and stuttering, we have come to the conclusion that there is no statistically significant link between stuttering and intelligence, $p = .165 > .05$. According to all parameters of descriptive statistics, students with superior intelligence achieve better results on all 13 subtests. This influence is statistically significant on subtests: Visuomotor coordination and possibility of herding, Visual discrimination, Audio-visual association, Trace and encryption, Auditory memory, Creation of concepts, Acquired linguistic goods, Automatic linguistic goods, Visual association and Drawing. On the subtype of Auditory discrimination, better results are achieved by the children who stutter.

χ^2 test of independence showed a significant connection between stuttering and success in Serbian language $\chi^2 (1, n = 100) = 4.754, p = .029$. A large number of children who do not stutter achieve great success in Serbian language in relation to stuttering students. This difference is statistically significant. According to the results of the AKADIA test, it can be concluded that on the subtests Auditory Discrimination and Audio-Visual Association better results are achieved by the children who stutter, while on the subtests The visuomotor coordination and the possibility of herding and Drawing shapes are better those who do not stutter.

The results of the χ^2 independence test showed a sig-

nificant relationship between the level of education of the father and stutter ($p = .004$). More children are stuttering from the fathers with secondary education. Interpretation of achievements on the AKADIA test shows that on the subtests Auditory Discrimination and Drawing stuttering statistically significantly increases the achievement values of children with highly educated fathers. Non-stuttering children are more successful on subtests Visuomotor coordination and possibility of herding, Drawing Forms and Visual Memory. Stuttering reduces achievement values only in fathers with secondary education.

There was a conclusion that there is a significant link between level of education of mothers and stuttering ($p = .006$), where more children stutter in the group with secondary educated mothers. On subtests Auditory discrimination and Drawing better results are achieved by children who stutter, without significant influence of mother's education. On subtests, Visuomotor coordination and possibility of tracing, Drawing Shapes and Visual Memory better achievement have children who do not stutter. On the subtest, Visuomotor coordination and possibility of herding there is a statistically significant influence on mother's education, since those with highly educated mothers are more successful in both categories of children.

Observed through the achievements of the control and experimental group on the AKADIA test, the following conclusions are: that by using the t test of independent samples on the test Auditory Discrimination there is a statistically significant difference in median values that resulted by impact of stuttering ($p = .001$). Average for group who stutter (59.52) is higher than for a non-stuttering group (57.88). This means that the presence of stutter increases the values on this subtest as well as on the subtest Drawing ($p = .008$). On the subtests, Visuomotor Coordination and possibility of herding, Drawing Forms, Visual Memory and Automatic Language goods, presence of stuttering reduces medium values (better results have non-stuttering children).

CONCLUSION

Based on the results of the research that pointed out the deviations and differences in the developmental abilities of children stuttering in relation to the children who are not stuttering, in the therapeutic work with this group of children, it is necessary to introduce a special approach and a procedure that takes into account their limitations and potentials.

This work was concerned with the analysis of those skills that are necessary for school skills (reading, writing, mathematical skills, wider success and socialization).

According to some studies, the achievements on the AKADIA test are a statistically significant factor in the success in the Serbian language. Such data confirmed the significance of this test and the justification of its application in assessing the preparedness of children of the younger school age to acquire academic knowledge and skills. Some other studies have shown that success in language teaching depends on linguistic competence, which is conditioned by cognitive potential as well as the quality of auditory information processing / auditory attention, phonological awareness, auditive discrimination, short-term and long-term verbal memory.

Difficulties in stuttering children are present in perceptual, linguistic, non-verbal and viso-motor skills. They should be the initiation of the development of a preventive and stimulating program that is part of the therapeutic process.

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