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## THE RATE OF READING OF VISUALLY IMPAIRED STUDENTS FRONT AND BACK EYE SEGMENT

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### Abstract

The aim of this work was to examine existence of influence of visually impairment type on the rate of reading of visually impairment students, primary school's age, from the Centre for blind and partially sighted children and youth in Sarajevo. One minute test of laud reading is used for reading rate examination (Furlan, 1965), which makes the list of 120 words arranged from easier and shorter, to heavier and longer. We used the form C, and the result of examinees represents number of correctly read words in one minute. Results demonstrated that there is statistically evident difference within the group of visually impaired students with a different type of visual impairment. The work points out to the importance of individual approach, adaptation of working environment as well as enabling aids during education of students with a different type of visual impairment.

**Keywords:** Visual Impairment, Rate of Reading.

### Introduction

Acquiring reading skill is strenuous, complicated and long-term process. Reading is very complex cognitive skill, which demands coordination of wide range of oculomotorius and perceptive processes, as well as processes of understanding (Rončević, 2005). By reading, you establish realization between written content and its importance (Teskeredžić, 2009). One of the methods of readability measuring is measuring of reading rate. The text is readable if you read it quickly. The other method is defining regressive eye movements. If number of regressive movements is higher, the text is less readable. The third method is tahytoscopyc (quick introduce of impression); The fourth method is reading from the distance, the text is readable from longer distance; The fifth method is reading by means of intermediary or indirect seeing. Examinee is required to fix marked point in the field of sight. On the distance from this point, letters and words are written which subject should read. The text is more readable if it could be read by indirect seeing. The sixth method is examination by decreasing light during reading. Large print, oily letters and short lines are less important for readability than expected. Good contrast between paper and letter is very important (Wudvort, 1964). Readability of text also depends on letters size. Smaller letters are easier read than bigger. Italic pretty tires eyes. Reading small letters results by tire. Oily letters don't affect to reading rate. It is identified that eyes are not tire during reading, so it could be neglected (Džorđević, 1976). Visually impaired children could lag in skills of visual perception and discrimination, so practicing is included in order to increase their readiness for learning to read. Visual tire is important problem in these children, so it is very important to insure good conditions for reading (Stančić, 1991). For many visually impaired children, reading could be tiresome and slow. So, it is necessary to motivate and encourage them to read their literature (Mason, and McCall, 1997). Visually impaired children

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have problem to achieve satisfactory reading rate (Best, 1997) Despite of the fact that eyes movement during reading are well known, there are a certain controversies which should be solved, before developing model which could explain relation between eye movement and understanding during reading. One of controversies concerns (according to Starr and Rayner, 2001), are eye movement controlled by oculomotorius strategies, which are mechanical, which depend on characteristics of text and vision acuity, or under influence of the processes at higher level, with respect to current cognitive processes. Eye movements are defined by characteristics of text and cognitive processes.

Oculomotorius factors affects to eye movements, primary on the place where we will stop our look (For example, our eyes are the most often stopped between beginning and middle of word, but it depends on the length of word). Lexical factors and current cognitive processes have decisive role, particularly in determining when move eyes, with respect to how long to stay to certain word (Reichle and Sar., 1998). the following question, which is not completely clear is, which type of information we get from parafoveal vision. Although the most authors agree with the fact that the reader of certain information of word which follows gets from parafoveal vision, dilemma exists are these information exclusively on sublexic level, or a certain aspects of meaning are processed (Roncovic, 2005). It is not completely clear how much ability of perception of information by parafoveal vision can influence to effectness of reading skill. The third controversy mentioned by (Starr and Rayner, 2001) reefer to the way of word processing during reading, actually are the words processed serial or parallel. The most of the models (Reichle and Sur., 1998), supposes that processing is serial, but a certain researches offer challenge for such apprehension, because they prove possibility of parallel processing of two words, under certain conditions (Kennedy, 2000). It means that eye moves fixing only few points in line, jumping from one to the other fixation point, so quickly that clear vision is not possible during jumping, which means that all letters could not be seen. Readability depends on greatness' and form of the letter, lighting of outlines, general eye situation and physiological factors: tire, strain and stress (Zovko, 1998). Results of research (Teskeredžić and all2012), confirmed that visual perception is in positive correlation with greatness of grapheme and their mutual distance. They recommend that texts adapted for visually impaired students should be provided within regular textbooks. Along with visual acuity, other visual skills are needed for clear vision included: maintenance of fixation, focus change, subject tracing, as well as perceptive skills (depth perception, visual memory, discrimination of figure and forms). All this factors affect in combination and researched through functional assessment (Best, 1997). The sense of vision include synergism of accommodation and convergence, which affects to vision acuity, as well as oculomotorous abilities, oculomotorous coordination, which is important for fixation, perception and discrimination. Series of vision deficiency results by reducing of image acuity and reading disorder. The most of vision deficiency can be corrected by glasses, contact lenses, exercises, operations, etc. It is important to detect deficiencies in time how it could be corrected or treated. In other case, visual impairment can last for all your life. (Zovko, 1991), states that the needs of visually impaired students in reading and writing are so specific, that this problem could be solved only through individual approach. The aim of this work was to examine reading rate of visually impaired students, front and back eye segment, primary school age, from the Centre for blind and visually impaired children and youth in Sarajevo.

### **Subjects and methods**

The sample included 50 subjects (pupils) with visual impairment that attend „Center for blind and visually impaired children and youth“ in Sarajevo. The sample was received from a total of 60 subjects, from which 50 subjects were set apart. Subjects were selected by the following criteria:

youth“ in Sarajevo. The sample was received from a total of 60 subjects, from which 50 subjects were set apart. Subjects were selected by the following criteria:

- That the subjects are with different types and degrees of visual impairment with correction;

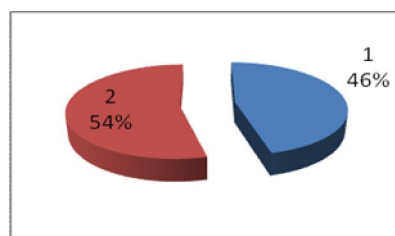
- that besides of visual impairment they do not have other developmental delays (preserved EQ).

By using these criteria and reviewing of medical documentation, we got sample of 50 subjects (22 male and 28 female), from 6 to 15 years old, with different level of visual impairment.

Taking care that students have different types of visual impairments, we divided them according to place of impairment, with respect to students who along with visual impairment as refraction errors have changes in front segment of visual apparatus (27 students or 46%) and on students who as refraction errors have changes in the back segment of visual apparatus (23 students, 54%). Examination was made individually. In examination, we used day light when students were relentless, from 8 to 11 h in the morning. Instrument for examination was applied in the same conditions, with avoiding of sun light glare on working surfaces, on the distance of 30 cm, during text reading. We examined reading rate by one minute test (Furlan, 1965), which makes the list of 120 words arranged from easier and shorter to harder and longer. We used the form C, because form A and B are used in lower classes. The results of examinee represent a number of right read words in one minute. The rate of laud reading is limited to rate of laud, understandable speech and theoretic range is from 0 to 120 words in a minute. Used information are processed by using software program for statistics SPSS 16.00. The frequencies of amblyopic were calculated with additional impairments in the front and back segment of the eye. For establishing significant differences of subject in analyzed variables, we analyzed variances.

### Results and Discussion

Having in mind above mentioned problem, we divided examinees with respect to diagnoses on examinees who along with visual impairment as refractive errors have changes in the front segment of visual apparatus (27 examinees or 46%) and on examinees who along with visual impairment as refractive errors have changes in the back segment of visual apparatus (23 students or 54%) chart 1.



Legend: 1- front; 2- back

Chart 1. According to place of visual impairment

How the difference within the group could be determined, in dependant variable, arithmetic means were calculated. As you can see from table 1. arithmetic means for variable "Furlan", with respect to variable of reading rate and place of impairment, differentiate for 30,16. Having in mind that the distance of arithmetic means is large, we could expect significant difference. How we could determine the statements more precisely, with respect to dependent variable, it is obvious that arithmetic means of examinees with front and back impairment of vision apparatus differ for 8,16.

Table 1: Arithmetic means and standard deviations within the group of visually impaired examinees in front and back eye segment

Lesion site	Variable	Mean	Std. Deviation
1	Furlan	26,41	10,735
2	Furlan	34,57	9,643
Total	Furlan	30,16	10,944

Legend: Furlan- reading rate; 1- the front eye segment; dg 2- the back eye segment

Graphical overview (chart 1), clearly demonstrates reading rate difference, within one minute test of laud reading Furlan, with regard to visually impaired examinees in the front and back eye segment. It is visible that visually impaired examinees in front eye segment read maximum 55 words in the text in one minute from totally 120 words, while examinees with visual impairment in back eye segment read maximum 60 words in one minute.

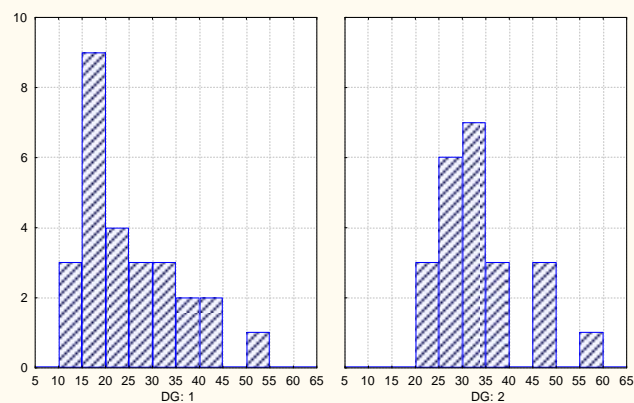


Figure 1. Overview of reading rate with respect to the place of impairment

Legend: DG1- Visually impairment examinees in the front eye segment; DG2- Visually impaired examinees of the back eye segment

From value p it is obvious that there is statistically significant difference within the group of visually impaired examinees with regards to the type of visual impairment ( $p=0,007$ ). analyses demonstrated that there is statistically significant difference within the group at the level of 95% of reliability (table 2).

Table 2: The results of variance analyses of different places of visual impairment examinees

Variable	Source of variation	Sum of Squares (SS)	Degree of freedom (df)	Mean Square (MS)	Empical proportion (F)	p-value
Furlan	Between Groups	826,5493	1	826,5493	7,8685	0,0072
	Within the Groups	5042,1707	48	105,0452		
	Total	5868,7200	49			

Legend: Furlan- Reading rate

Rubin and sar conducted similar research. (2006), on totally 43 examinees, in the most cases, with the medium cataract or glaucoma, with vision acuity 6/30 on better eye (arithmetic mean 72; from 24-88 age old), they examined laud reading with selective texts of different chart size (10, 12, 14, and 16 points), for all from four types of charts: Foundry Form Sans (FFS), Helvetica (HV), Tiresias PC font (TPC), Times New Roman. The standard text from 70 charts is used during reading from the distance of 40 cm. As a subgroup are charts of different dimensions and form koji su ispitani with spaces from totally 35 and 90 charts. According to expectations, reading rate enhanced with increasing of medium charts from 144 words in minute, for charts of 10 points of magnitude, they read 163 words in one minute for charts of 16 points (ANOVA,  $p<0,0001$ ). The authors got statistically significant difference in charts the type of TPC with repeated reading from 8 words in one minute quicker from other magnitudes (159 words /min for TPC 151 word/min for the other magnitudes of chart,  $p<0,0001$ ). However, offered magnitude of chart is not equivalent with standard magnitude of charts. Accommodation of horizontal and vertical space is also eliminated, as well as giving priority to TPC chart tipe because statistical importance of line space is not demonstrated ( $p>0,3$ ). Researchers pointed out that presented data could be applied kao procjena on population over 65 years oldi. This assesment reffers to growing of minimal magnitude of chart from 10 to 16 points, how reading of mentioned population could be fluent ( $>85$  words /min for 88%-94,4%). Examination demonstrated that spaces between charts and type of chart have a small effect on reading rate in persons with medium visual impairment. The final result and recommendation of researchers is

that with growth of chart from 10,14 and 16 points, will increase significantly as well as ability of mentioned population during reading (Rubin, and sar. 2006).

On the bases of tests of the groups (table 3) It can be concluded that Wilks lambda is statistical important, on variable of reading rate with regards to visual impairment type, and visual impairment degree , so it is recommended to conduct canonical discriminative analyses, with the aim of udetermination of differences factors.

Table 3: Tests of Equality of the Group Means

Varijabla	Wilks' Lambda	F	df1	df2	Sig.
Furlan	,859	7,869	1	48	,007

As Wilksoise's lambda is statistical important with one degree of freedom and <sup>2</sup> test= 7,21 at the level of statistical importance from 0,007, Correlation discrimination analyses was made which produced one function (table 4).

Table 4: The importance of Wilks' Lambda on variable of reading rate

Test of Function(s)	Wilks' Lambda	Hi- quadrat	df	Sig.
1	,859	7,210	1	,007

The importance of function is visible from mentioned table, and coefficient of canonical discriminative function is very high degree that explains 100% variance of analyzed groups. The matrix structure, also explains absolute correlation within the groups, between discriminative variable and standardized canonical discrimination function. Reading rate Variable is in a good correlation with sa discriminative factor which explains with 100% variance.

U table 5. Centroids of examinees groups are presented which demonstrate discrepancy of certain group of average value on discrimination factor. Examinees who makes the first group, examinees with visual impairment on the front eye segment, have more unfavorable neposition in discrimination space and they are far from starting point 0, of 366 standard deviations in negative direction of discrimination function, unlike examinees with visual impairment in the back eye segment, who are in better position.

Table 5: Functions at Group Cancroids'

	Function
	1
1	-,366
2	,430

Legend: 1- the front eye segment; 2- the back eye segment

It is supposed that additional affect made bigger problems during one minute test reading Furlan. The result of this finding could be changes in the depth of vision field of examinees, which or not taken into account in this research.

Examination has demonstrated that reading rate is different in persons with different diagnosis. Students with cataract need stronger light, while for students with other impairments such as albinism, level of light should be reduced (Orlansky and Rhyne, 1981).

Sandberg and Gaudio (2006), conducted examination with 33 patients with retinal pigmentosis and 12 examinees without visual impairment, they examined possibility of increasing reading rate with decreased visual perception. Patients had vision acuity of 20/200 on better eye, the central visual feeling < of 20 degrees. Reading rate was measured by reading sentences rate, different magnitude of chart and font Times and Courier, with standard black text on white background as well as white text on black background. Results showd that arithmetic mean of reading rate for standard text type of Times chart with optimal magnitude of chart 43%, with regards to normal reading rate is (p<0,001). Reading rate in patients is in relation with visual acuity (r=,044; p<0,001) and in contrast without central vision (r=,068; p<0,001). Multiple regresion analysis showd that contrast text gave strong dependance on reading rate in patients, including visual acuity and combination of visual feelings from environment. It is assessed that reading rate is higher when using type Times with regards to

Couirer grafeme ( $P < 0,001$ ). Researchers concluded that patients with disease of retinitis, have less central vision and they assess that reading rate, its reduction, and that only small contrast can give more important results.

Dikic, 1991 (From) points out that it is possible to prove that impaired optical ability in visual impaired person represents important cause of small success in reading. During reading large print, success of visually impaired children approach to success of sighted children. According to mentioned author, visually impaired children recognize one alphabet, when greatness and thickness of letters are different from alphabet. It is necessary to range to smaller charts during learning of visually impaired students, when process of reading and writing is over. It means that, the following research could be concentrated to specific types and degree of visual impairment with regards to magnitude of charts and their mutual distance.

Dikic (1982), examined development of visual perception in 50 partially sighted students age from 7,5 to 15 years in the area of Old S town Belgrade, as well as control groups of 50 students of primary school's age without developmental delays. Examination showed backset in visual perception development in persons with atrophies of retina, impairment of nerves' and amblyopic with regards to students without developmental delays (Dikic, 1991).

Teskeredzic and sar. (2003), examining characteristics of visual discrimination symbols and reading in 30 visually impaired children in regular school, and the same sample of students without visual impairment, by the test of quickness of visual perception of letter range VPB-1, they identified correlation between reading rate and visual discrimination, as well as that discrimination and recognition are difficult in conditions of reduced vision, which makes students serious problems.

Rubin and Turano (1994) examined series of presentations in 14 examinees with central scotoms and 9 examinees without scotom, the rate of perception during presentation, reading words in a minute. The same concluded that potential factor is very important and limitation of visual perception due to disease, on reading rate.

Technic of reading rate is used in few studies for examination of time and reading rate as well as effect of time which reader used for reading. On sample of 59 examinees the method Ober2 is used with infrared monitoring of eye movements. Method Ober2 noted reading rate, number of fixations of 100 words, number of seen words in each fixation. group of examinees (students  $n=25$ ) utook part in reading rate, while the second group ( $n=34$ ) is not. After examination of all 59 examinees, reading rate increased in 4 of 6 areas. Calef and sar. (1999), point out that adequate changes are accompanied by high reading rate, after training.

Reading acuity is better if reading rate is better, which is a good precondition for daily visual functioning (Radner and sar.,1998). On sample of 160 examinees with visual impairment age 21 and 16 examinees without visual impairment, reading rate was measured (number of read words in one minute). Greatness of chart, of offered text is from less to bigger chart, increased progresively ( $F=1,25$ ), and reading rate is determined with logoritm of reading rate. Results demonstrated that arithmetic means of reading rate between mentioned examinees deffer for  $+0,104 \pm 0,066$  and korrelation between groups ( $r=0,59$ ). Authors showd through examination that magnitude of chart is one of the reasons of reading rate.

Bucci and Kapoula (2006) Bynocular coordination and stability of fixations could be the reason of longer fixation in younger students, authors point out.

In the favour of this talk research conducted by Nutmann and sar. (2007), who tried to explain effects based on errors during reading because of the lack of fixation (by model of research Nutmann, Engbert and Kliegl, 2005). The same concluded that oculomotoros changes caused by insufficient fixation are main reason of the lack of perception, and that way insufficient reading rate.

Research conducted on 40 children, age of 11, 6, with different monocular and binocular impairments, using standard text as precondition for reading rate and its acuity, Stiffer and all. (2005). 20 children were included in test, after unilateral amblyopic treatment microstrabism,

(vision acuity of the eye with amblyopic: log MAR 0,19 (0,15); leading eye 20,1 (0,07)); as well as examinees without visual impairment, with normal vision acuity, as a control group (vision acuity of right eye -0,04 (0,15); left eye - 0,08 (0,07). Results showed that relation of maximum reading rate of binocular vision is statistically important with regards to children who have amblyopic with microstrabism and control group ( $p= 0,03$ ); where control group achieved binocular maximum reading rate of 200,4 words in one minute, children with unilateral amblyopic achieved only binocular maximum reading rate of 172,9 (43,9) words in one minute. But, statistically important difference between two groups is achieved in binocular vision acuity and reading rate ( $p>0,05$ ). Authors got importance on the bases of examinees with amblyopic, where difference between leading eye of children with amblyopic and control group did not exist. It means that binocular maximum reading rate can exist between microstrabismic amblyopic and control group. Results refer to presence of functional reading disorder, even in binocular vision acuity and reading rate in both groups (Stiffer and all, 2005a).

### CONCLUSION

In final considerations on results of this research is very important to remind to contemporary endeavours in the direction of providing maximum possibility for development of all students. Within these endeavours we can monitor visually impaired students and their specific needs in the area of reading and broader. Without considering their specific needs, which could be described as ophthalmological, psychological, social, pedagogic, etc., Only their specific needs were considered in this research in the area of reading rate and methods of their meeting. Reading rate in one minute test showed that examinees with visual impairment in front eye segment quickly read.

It is also necessary to pay attention on early detection and monitoring of visual impairment in children of regular schools. Difficulties in this area, in many cases, are cause of children's uncertainty and learning difficulties advancement in education. So it is very important to start working through information education population, educators in kindergarten and teachers in regular schools, in order to improve conditions for visually impaired students.

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