

Verbal and non-verbal intelligence: dyslexic-dysgraphic students and normal students

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Abstract

Introduction: The present research aimed to compare the verbal and nonverbal intelligence of students with dyslexia-dysgraphia and normal students.

Material and methods: Thirty students with dyslexia-dysgraphia and 30 students from mainstream schools of grade 3 boy school in Tehran were selected. All subjects were matched by age and IQ. In addition, students of two groups did not show any background in either emotional-behavioral difficulties or visual/audio weakness. The instruments which were used in the research consisted of Dyslexia-Dysgraphia Inventory, Rutter Questionnaire, Raven Test, Reading-Writing Test, WISC, and a Personnel background questionnaire. The data were analyzed by the t-test.

Results: The results demonstrated that the verbal intelligence of the dyslexia-dysgraphia group was significantly lower than that of the normal student, while the nonverbal intelligence of the dyslexia-dysgraphia group was significantly higher than that of the other group. In addition, the verbal intelligence was significantly lower than the nonverbal intelligence for the students with dyslexia-dysgraphia. However, this difference was not found for the normal group.

Conclusions: This research suggesting that the nonverbal skills of students with dyslexia-dysgraphia may compensate the shortage of students' verbal intelligence, if this can be well handled by appropriate educational methods.

Key words: dyslexia, dysgraphia, student, verbal and non-verbal intelligence.

Introduction

Dyslexia is perhaps the most common neurobehavioral disorder affecting children, with prevalence rates ranging from 5 to 17.5 percent [1]. Dyslexia is both familial and heritable [2]. Family history is one of the most important risk factors, with 23 percent to as much as 65 percent of children who have a parent with dyslexia reported to have the disorder [3].

A rate among siblings of affected persons of approximately 40 percent and among parents ranging from 27 to 49 percent [2] provides opportunities for early identification of affected siblings and often for delayed but helpful identification of affected adults. Replicated linkage studies of dyslexia implicate loci on chromosomes 2, 3, 6, 15 and 18 [4]. Whether the differences in the genetic loci represent polygenic inheritance, different cognitive paths to the same phenotype or different types of dyslexia is not clear.

Reading and spelling are the prime problems for children with dyslexia. However, a growing body of research shows that their academic problems are related to a wide range of psychosocial problems, such as

inattentiveness, low motivation for schoolwork, dropping out of school, fear of failure, depression, anxiety, loneliness, low self-esteem, and poor peer relations [5-7]. Children with dyslexia, like all children with learning disabilities (LD), are also at greater risk of being bullied by their peers [8, 9].

More than a decade ago, Siegel [10] wrote an influential article questioning the relevance of IQ-achievement discrepancy in defining learning disability (LD). Since then, increasing research evidence has pointed to the irrelevance of IQ-achievement discrepancy in identifying at-risk children who will benefit from early intervention in reading [11] and to the lack of validity of discrepancy-based definitions of reading disabilities (RD) in qualifying students for special education services [12, 13].

Material and methods

The study population included all male 3rd grade elementary students in the 10th precinct of Tehran Education and Training Organization. Of 47 elementary schools for boys in this precinct, 10 were randomly selected. Then, 30 students with dyslexia-dysgraphia and 30 normal students were randomly selected from all 3rd grade students and studied. The following measures were performed in order to choose dyslexic-dysgraphic students:

- Explaining the research project and its objectives to the school administration, especially teachers, and familiarizing them with the characteristics of dyslexic-dysgraphic students in written and oral formats;
- Listing all 3rd grade students in 10 selected educational centers, as well as their scores in reading and writing;
- Completing the data sheets regarding personal information and the signs and symptoms of dyslexia-dysgraphia by the teachers;
- Evaluation of affective-behavioral features of these students by their teachers using Rutter Questionnaire, and thus, excluding students with moderate-high problems according to this scale;
- Performing a visual and auditory examination in order to distinguish students with visual-auditory disabilities from dyslexic-dysgraphic students and to exclude the former group of students; and
- Performing Raven Intelligence Test (colored matrices) by the researchers in order to select students with a moderate intelligence level and exclude those who were at a lower level.

Instruments

The following instruments were used for data collection:

- Personal information sheet, including the students' demographic and educational data, completed by their teachers using the students' files;

- A sheet for 15 signs and symptoms of dyslexia-dysgraphia, completed by the teachers according to instructions given to them. This sheet was developed based on the diagnostic criteria of dyslexia-dysgraphia in DSM-IV [14].
- Rutter Questionnaire: the questionnaire developed by Michael Rutter [15] was used to evaluate the students' affective-behavioral problems. The questionnaire has 30 items, each expressing a sign or symptom of a specific behavioral disorder. This questionnaire focusing on five factors including hyperactivity-aggression, anxiety-depression, antisocial behavior, maladaptive behavior, attention deficit disorder.
- Visual-auditory examination: Using the students' health files, their visual-auditory status was examined with the cooperation of the school health counselor in order to determine the students' visual-auditory health and to exclude examinees with related disabilities. Where files were incomplete, the examinees were assessed by audiometrists and optometrists.
- Raven's Colored Matrices Test: This test consists of 36 pictures, most of them colored. The test, which is designed for children of 5-11 years of age, has a considerably high validity in determining the overall intelligence.
- Reading-writing test: The researchers had developed test series for different age groups including elementary students of the 1st to the 5th grade. Reading tests for the first and second grade students has a 60-100 word passage along with 4-6 questions, whereas there is a 100-150 word passage with 7-10 questions for the 3rd-5th grade students. The passages and the questions are all based on the content of the students' educational textbooks. The students have to read the passage and answer the questions personally in a 20-minute limit. Writing tests have 60 words for the 1st and 2nd grade students and 80 words for 3rd-5th grades, arranged in an order of increasing difficulty.
- Modified Wechsler Intelligence Scale for Children (WISC): Developed by Wechsler in 1969, this scale was designed to assess children intelligence. The test includes 12 sub-tests (6 verbal and 6 non-verbal). The main characteristic of Wechsler Scale is that it can determine the IQ in both verbal and non-verbal domains. Internal consistency estimates of reliability for WISC-III subtests range from 0.68 (Object Assembly) to 0.89 (Vocabulary) for 12-year-olds [16].

Considering the quality of study variables, the current research has been designed as a retrospective analytical study; i.e. the researchers did not intervene in the variations of variables. T-test was used to analyze the dependent and independent groups of data.

To evaluate the reading-writing status, the first reading-writing test was performed based on 50%

Table I. Comparing the rate of mistakes made by the study groups in the first reading-writing test

Tests	Indices Groups	Rate of mistakes		df	t	p-Value
		Mean	SD			
Reading	Normal	0.97	0.99	58	15.88	0.0001
	Dyslexic-dysgraphic	18.83	6.08			
Writing	Normal	2	0.87	58	23.7	0.0001
	Dyslexic-dysgraphic	32.8	7.06			

Table II. Comparing the normal students' scores in the first reading-writing test with the mean score of dyslexic-dysgraphic students in the first and second reading-writing tests

Tests	Indices Groups	Rate of mistakes		df	t	p-Value
		Mean	SD			
Reading	Normal	0.97	0.99	58	18.12	0.0001
	Dyslexic-dysgraphic	14.66	4.02			
Writing	Normal	2	0.87	58	24.95	0.0001
	Dyslexic-dysgraphic	27.3	5.48			

Table III. A comparison of the study groups according to their verbal and non-verbal IQ scores

Groups	Indices IQ	Mean	SD	df	t	p-Value
Non-verbal	106.5	4.8				
Dyslexic-dysgraphic	Verbal	99.47	8.08	29	5.73	0.0001
	Non-verbal	108.8	4.06			

content of the 3rd grade textbook. If a student failed to pass the test, the second test was given based on the whole content of the 2nd grade textbook. Since having reading-writing disabilities in two levels lower than the student's current educational grade was determined as the criteria for diagnosis of dyslexia-dysgraphia, the student who had failed in both tests was diagnosed as one having reading-writing disabilities; those who passed the first test were considered as normal students. Thus, 30 students with dyslexia-dysgraphia and 30 normal students were selected. The Modified Wechsler Intelligence Test was finally performed individually on the examinees of two groups to determine and compare their verbal and non-verbal IQ.

Results

Demographic data show that the average age of all examinees was 8.9 ± 0.4 years (8.8 ± 0.49 years in the dyslexic-dysgraphic group and 8.9 ± 0.29 years among normal students). These data indicate that there was no significant difference between the two groups in view of the age variable. Familial situation assessment shows that the parents of all examinees are alive and healthy. In addition, their educational level is not significantly different. The examinees' overall IQ was

in the range of 95-110, with no statistically significant difference between the two groups.

T-test was used to compare the rate of mistakes in reading and writing between dyslexic-dysgraphic and normal students in the first reading-writing test (50% content of the 3rd grade textbook), demonstrating a meaningful difference ($p < 0.0001$), as shown in Table I. In addition, the normal students' scores in the first reading-writing test were compared with the mean score of the first and second tests (the whole content of the 2nd grade textbook) in the dyslexic-dysgraphic group, using t-test. As shown in Table II, the mean number of mistakes made in reading and writing by normal students was significantly smaller than those made by dyslexic-dysgraphic students ($p < 0.0001$).

The results of the comparison of verbal and non-verbal IQ scores between normal and dyslexic-dysgraphic students are shown in Tables III and IV. The T-test for correlated groups, revealed no significant difference in the verbal and non-verbal IQ scores among normal students. Moreover, the same test performed on dyslexic-dysgraphic students showed a meaningful difference ($p < 0.0001$), so that non-verbal IQ was higher than verbal IQ in these students (Table III).

Table IV. A comparison of verbal and non-verbal IQ scores of the study groups

Indices		Mean	SD	df	t	p-Value
Groups	IQ					
Verbal	Normal	105.93	4.19	58	3.89	0.0001
	Dyslexic-dysgraphic	99.47	8.08			
Non-verbal	Normal	106.5	4.8	58	2	0.05
	Dyslexic-dysgraphic	108.8	4.06			

A significant difference was found between the case and control groups when verbal IQ scores of the normal and dyslexic-dysgraphic students were compared using independent sample t-test ($p < 0.001$); i.e. verbal IQ of normal students was higher than that of the dyslexic-dysgraphic students. A difference was also discovered between the non-verbal IQ scores of the two groups using the same test ($p < 0.05$). In this case, however, non-verbal IQ of dyslexic-dysgraphic students was higher than that of normal students (Table IV).

Discussion

The present study was aimed at measuring and comparing verbal and non-verbal IQ of dyslexic-dysgraphic students with those of normal 3rd grade students. Based on the results – and as was expected – the average number of reading-writing mistakes made by dyslexic-dysgraphic students was significantly higher compared to that of normal students. This is in accordance with the results achieved by other researchers [14, 17]. This difference is not only evident in the same educational grade, but also in lower levels. These children have, thus, serious disabilities in reading and writing, even if they have normal IQs.

In addition, our research showed that normal students' verbal IQ was higher than that of dyslexic-dysgraphic students; with results in accordance with Clark [18], Ackerman et al. [19], Titmor [20], and also confirm these results. It can be argued that since verbal test questions must be answered orally, it is considerably dependent on the individual's word treasure and their correct compilation. However, it seems that dyslexic-dysgraphic students have both a limited word treasure and a lack of accurate and timely compilation of received information. Their verbal IQ is, therefore, lower than is usually expected. The study also revealed that dyslexic-dysgraphic students' non-verbal IQ is higher than that of normal students. As mentioned by other researchers, the ability to answer non-verbal questions is typically less affected by educational background than answering verbal questions. In fact, non-verbal tests are indicators of the individual's practical capabilities and have the least dependency on educational opportunities.

Moreover, it was shown that dyslexic-dysgraphic students' non-verbal IQ was higher than their verbal

IQ, whereas there was no difference in verbal and non-verbal IQ scores of normal students. This is in accordance with Swanson [21], Schultz [22], Ackerman et al [19] and Titmor [20]. This confirms the previous result that dyslexic-dysgraphic students have problems in their verbal expressions, which is especially more significant when the individual's capabilities are measured using abstract symbols, verbal memory and verbal fluency.

Conclusions

The current study showed that training these children requires a special educational program to be designed and implemented. In other words, we are facing a group of students who do not show any significant difference with normal students in their overall IQ, who have no visual or auditory impairments and display no serious affective-behavioral problems, yet their educational achievements – especially in reading and writing skills – are at a level considerably lower than expected from their peer students. In addition, the prevalence of this problem is so high that any teacher can identify and locate a number of these students in each class. The most important result of this study seems to be that dyslexic-dysgraphic students have a higher non-verbal IQ than normal students. It implies that our educational system must accurately diagnose these students in the first grade and apply a special educational program, instead of referring them to exceptional schools, which, unfortunately, will lead to school dropout. This special program must be designed according to the students' specific abilities and talents, and must focus on what they can do, not what they can not. Such a program will not only realize the potential talents of a great deal of children, but will also calm down their parents and teachers who are concerned about their educational failure and learning problems. We would thus have reasonable expectations from these students, based on their capabilities and talents.

Unfortunately, no intermediate level(s) has been defined in our educational system between the standard education and exceptional education. All students are obliged to educate in either this or that system; while the results of the present and other studies show that dyslexic-dysgraphic students are not capable enough to study in the standard schools

and, on the other hand, are not too retarded to be sent to exceptional schools. If we are concerned about these children and plan to make their future more fruitful and if we believe that education and training is the key to social development and progress, there is no other logical and realistic way than establishing special schools with specialized teachers and curriculum for these students. Since the non-verbal and practical skills of dyslexic-dysgraphic students are more advanced than their verbal skills, we have to use these advantages to compensate for their disabilities.

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