

Characteristics of Cognitive Functions among Polish Adolescence with Spelling Disorders

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Abstract—The level of visual abilities, language, memory processes and intellectual functioning development affects the quality of a written text. The following analysis will present the results of diagnostic tests indicating the most common criterion for a group and stating whether a person has been diagnosed with having cognitive developmental level below the group's average or not. The study's aim is to determine whether there are specific patterns of cognitive deficits, which can be distinguished among the group of young people with spelling disorders.

Keywords—cognitive deficits, cognitive functions, spelling disorders

I. INTRODUCTION

SPECIFIC LEARNING DIFFICULTIES (SLD) are differentiated and classified based on the occurrence of a specific deficit (such as medical classification of ICD or DSM).

Problems concerning writing skills are classified in ICD - 10 as specific spelling disorders (F.81.1) and the above-mentioned DSM - IV as a written expression disorder (code 315.2). Both of these classifications are the criterion of intellectual development as one of the exclusion criteria.

This indicates the importance of assessing cognitive functioning in people with learning difficulties. This is confirmed by the analysis carried out by Fletcher, Morris and Lyon [20]. However, they do not take into account the specificity of cognitive functioning among people with spelling difficulties. It therefore seems reasonable to make an attempt to characterize people's cognitive spelling disorders within most relevant writing skills.

II. METHOD

A. Participants

The survey was conducted among adolescents aged 13 to 16. In total, 83 people were tested, including 57 boys and 26 girls.

B. Measures

The diagnosis was made with the usage of standard diagnostic tests used in psychological and pedagogical practice in Poland [15]:

1. Intelligence Scale WISC-R (PL);
2. Tests that examine visual functions:
 - a. Rey - Osterrieth complex figure test – copy
3. Tests that examine visual memory:
 - a. Rey - Osterrieth complex figure test - reproduction from memory,
 - b. Test A.L. Benton (version C);
4. auditory memory:
 - a. Zetotest - G. Krasowicz- auditory phonological memory;
5. The language's functions :
 - a. Unknown Language - M. Bogdanowicz.

C. Results

The primary diagnostic criterion for the diagnosis of specific learning difficulties, including spelling disorders, is the level of intellectual development measured with the D. Wechsler's *Intelligence Scale* [29]. Considering the respondents' age, the children-WISC-R (PL) scale was used.

The results of the survey were analyzed according to general results, profile's properties and factor analysis. Table 1 presents the summary descriptive statistics for the criterion group. As shown in table I the distribution of IQ in the group of students with spelling disabilities did not deviate from normal. The profile of the scale was relatively consistent (range 2.20).

Subjects scored relatively low in the following subtests: Repeating Numbers, Arithmetic, Adding Images and Coding. It is noteworthy that three of these scales form a so-called ACID profile: Arithmetic, Coding, Information, Digit Span, what is considered typical for learning disabilities and developmental dyslexia. It should be noted that this reduction was not significant from a statistical point of view, and no result in the subtest was lower than the average. The factor analysis was based on the three-way concept [22] and Bannatyne's model used to diagnose children with special learning difficulties [1].

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TABLE I
CHARACTERISTICS OF WECHSLER INTELLIGENCE SCALE RESULTS

Results	Mean	SD	Min	Mediana	Max
FSIQ	102.00	11.81	73.00	103.00	143.00
VIQ	102.57	11.62	74.00	102.00	138.00
PIQ	101.37	13.47	71.00	100.00	140.00
I.	10.00	2.50	4.00	10.00	17.00
S.	10.41	2.16	5.00	10.00	16.00
A.	9.56	3.08	2.00	10.00	16.00
V.	10.78	2.13	5.00	11.00	15.00
C.	11.46	2.50	6.00	11.50	17.00
D.S.	9..32	2.47	4.00	10.00	14.00
P.C.	9..53	2.76	5.00	10.00	17.00
P.A.	11.52	2.97	5.00	11.00	18.00
B.D.	9..96	2.82	2.00	10.00	18.00
O.A.	10.47	2.95	4.00	11.00	19.00
Cod.	9.42	2.82	2.00	9.00	16.00
SqA	9,39	1,86	5,00	9,67	13,33
SpA	9,97	2,30	3,67	10,00	16,67
AqK	10,13	2,07	5,00	10,33	16,00
VCA	10,90	1,86	7,00	10,83	15,67

NOTE: FSIQ = full scale IQ, VIQ = verbal scale IQ, PIQ = Perceptual IQ, I. =Information, S.= Similarities, A= Arithmetic, V. = Vocabulary, C.= Comprehension, D.S.= Digit Span., P.C.= Picture Completion, P.A.= Picture Arrangement,B.D. = Block Design, O.A.= Object Assembly, Cod.= Coding, SqA= sequence abilities, SpA= spatial abilities, AqK= acquired knowledge, VCA= Verbal Conceptual Abilities

Another group of diagnostic tests are tests that measure language functions e.g. Unknown Language used by M. Bogdanowicz [4] and Zetotest Krasowicz[25]. The first test is used to assess phonological awareness and syllable and phoneme analysis and synthesis. The second one is conducted to assess phonological memory, and therefore includes assessment of phonological language functions.

TABLE II
CHARACTERISTICS OF LANGUAGE ABILITIES TESTS' RESULTS

	Ph.D	Ph.S.D	Ph.A	Ph.S.	S.A.	S.S.	Z.
M	21.87	8.81	7.01	6.10	4.33	2.88	24.5
SD	3.17	1.93	1.28	1.41	1.01	1.06	3.52
Min.	8.00	3.00	2.00	2.00	.00	.00	4.0
Med.	23.00	10.00	8.00	6.00	5.00	3.00	25.0
Max.	25.00	10.00	8.00	9.00	5.00	5.00	28.0

NOTE: Ph.D.= phoneme differentiation, Ph. S.D.= phoneme structure of words diversification, Ph.A.= phonemes analysis, Ph. S.= phoneme synthesis, S.A. = syllabic analysis, S.S. = syllabic synthesis, Z.=Zetotest

After analyzing the test results and points scored by adolescents in tests which measure functions of language, it should be noted that the criterion group coped well with the tasks and analysis of syllabic analysis phonemes and phoneme

structure of words diversification. The comparison of the median distribution result and the maximum result indicates the so-called maximum points (ceiling effect). This subtest proved to be too easy for the surveyed group and should not be included in the evaluation of language pathomechanism among adolescence with spelling difficulties. The differentiation of phonemes subtest, which is used to measure phonological awareness, differentiates the studied group slightly, similarly to the phonological memory test.

Memory factor is present in the Wechsler *Intelligence Scale* in Arithmetic, Information and Picture Completion subtests. Visual memory factor is noticeable only in the latter subtest. Repeating digits and Zetotest subtests examine short-term memory. Moreover, in order to characterise visual memory among people with writing difficulties Rey Osterrieth's *Complex Figure Test* [30] and *Benton Visual Retention Test* [3] were used.

TABLE III
CHARACTERISTIC OF MEMORY TESTS' RESULTS

	R-O copy	R-O rep.	Benton
Mean	33.94	23.71	6.75
SD	2.97	7.35	1.95
Min.	21.50	2.00	2.00
Med.	35.00	25.00	7.00
Max.	36.00	35.00	10.00

NOTE: R-O = task of Rey – Osterrieth's Complex Figure Test – copy, R-O rep.= task of Rey – Osterrieth's Complex Figure Test – reproduction, Benton= The Benton Visual Memory Tes

The Benton Visual Memory Test and Rey- Osterrieth's Complex Figure Test results are similar to the normal distribution. The large scatter of results is mostly noticeable around the average in the Reproduction from Memory task.

III. CONCLUSION

The statistical analysis attempt was made to answer the question whether adolescents with spelling disorders have any specific deficits in cognitive function. Results of cognitive function diagnosing tests do not indicate too great differentiation within a group of people with spelling difficulties. This may result from imperfect research instruments. The tools applied in clinical trials and tests are commonly used to diagnose learning disabilities [3-13] and are recommended for psychological and pedagogic purpose.

Analysis of the results achieved by the test group in the individual tests of cognitive function indicate the ceiling effect. This means that the most recommended method used for diagnosing specific writing difficulties is too easy for a group of young people aged 13 to 16. Furthermore, these methods allow us only to identify people with special difficulties, but do not determine individual differences.

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