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Porovnanie dielčích funkcií žiakov 1. stupňa diagnostikovaných s parciálnymi deficitmi špecifických porúch učenia – vizuálno-stimulačný materiál

Comparison of Partial Functions in First Graders who Were Either Neurotypical, Had Been Diagnosed with Deficiencies of Partial Functions or Were Suspected of Having Such Deficiencies – Visual Stimulus Material

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Abstract

Article provides insight into the procedural and theoretical framework of a study conducted by the Palacký University Olomouc – Faculty of Education, into factors that affect the educability and scholastic successfulness of children (pupils). It focuses on the differences in basal functions measured using the established methodology of B. Sindelar diagnostic and re-educational exercises. These were measured among first-graders who were either neurotypical, had been diagnosed with deficiencies of partial functions or were suspected of having such deficiencies.

Keywords: Educability. Pupils in need of supportive measures. Deficiencies of partial functions. Failure at school. Suspicion of deficiencies of partial functions. Visual stimulus material.

Introduction

This article analyses the partial results of a multi-year study carried out by the Palacký University Olomouc Institute of Special Education Studies which focuses on factors that affect the dynamics of educability among children and students who require special-education supportive measures – in other words, students with special educational needs. This specific analysis focuses on the differences in the dynamics of partial (basal) functions among first-grade students who had been diagnosed with deficiencies of partial functions, those suspected of having such deficiencies, with the third major study group (the normative group) comprised of neurotypical peers.

The starting point for comparing the data from these specific groups of first-graders were the findings from a smaller-scale preliminary research carried out as part of the overall project – namely that students with diagnosed disorders performed better with some of the B. Sindelar stimulus materials than neurotypical students. The premise of our research is to consider whether this could be the case because re-educated students diagnosed with deficiencies of partial functions (DPF) are more familiar with this stimulus material than neurotypical students. To test for this, we put together a group of students who were suspected of having DPF, which included students suspected of having DPF (based on the qualified judgement of their homeroom teacher) and those who had been recently diagnosed (within the last 3 months) and, as a result, have not yet undergone significant re-education.

The theoretical framework of this research is based on the theory of deficiencies of partial (basal) functions (DPF) of Félicie Affolter (1972) and Brigitte Sindelar (2000) and the additional observations of *partial performance reduction* by Jitka Scharinger & Friedrich W. Scharinger (1994). The general theoretical basis of the research is in neuropsychology, cognitive psychology and ontogenetic psychology.

The need for further insight into this issue stems from the lack of this or similar kind of research in the Czech Republic, despite the fact that – according to research conducted elsewhere (Sindelar, 2000; Affolter, 2000) – deficiencies of basal functions affect 15-20% of school-age children and significantly contribute to failures at school due to being the determiners of, among other things, specific developmental disorders of scholastic skills and of a wide range of emotional disorders in childhood and adolescence. Converting these statistics into numbers, for the Czech Republic, this would mean that roughly 200,000 children and students are affected by DPF. We do not know the actual prevalence – learning this prevalence falls under the survey part of the research project. However, studies from other countries (such as Arnbak, Elbro, 2000; Carroll, Snowling, Hulme, Stevenson, 2003; Janzen, Saklofske, Das, 2013) repeatedly point to the fact that improving partial cognitive functions – including phonemic awareness, morphological awareness, visual differentiation etc. – positively affects the acquisition of reading and writing skills. In other words, supporting development and minimizing the listed deficiencies often plays a key role in the acquisition of the trivium and thus directly affects the future successfulness of students. In addition, all the listed skills can be divided into truly partial components. For example, research by Carroll et al. shows that the development of phonemic awareness is preceded by the development of syllabification, the ability to separate the first vowel from the rest of the word and the development of articulatory skills (Carroll, Snowling, Hulme, Stevenson, 2003).

Adequate maturation and harmonious development of partial (basal) functions are a prerequisite for the development of more complex processes and acquisition of the complex skills belonging to the trivium – the ability to read, write and count. Deficiencies of partial functions (DPF) are thus one of the causes of specific learning and behavioral disorders.

Graichen (1973) defines DPF as a reduction in the performance of individual factors or elements within a larger functional system that are necessary for the acquisition certain complex adaptation processes. However, this general definition of the phenomena includes a far too wide range of disorders and as a result, the entire concept was narrowed down and specified for the purposes of counselling and practical special education.

Partial functions (as simplified for the purposes of this research project) include a cluster of ten functions – a deficiency in either one of them can affect the educability of a given student through a corresponding symptom (repeating mistakes, for example, in spelling or reading).

Sindelar (2000) clearly illustrates the individual partial functions on an example of a second-grader's dictation exam. In order for him to write the dictated sentence correctly, he needs to:

- distinguish the teacher's voice from other environmental sounds (auditory attention – auditory differentiation figure-background);
- briefly hold the spoken sentence in (auditory) memory;
- divide the word into sounds – phonemes (auditory analysis);
- differentiate the individual phonemes from similar phonemes (auditory differentiation – phonemic hearing);
- choose the correct graphemes to represent the phonemes (visual memory);
- not confuse similar-looking graphemes (visual differentiation - graphomatic vision);
- connect the correct phoneme with the correct grapheme, i.e., connect interperceptive information (intermodal functions, the partial ability to create intermodal relationships);
- coordinate the fine the motor skills of fingers during writing (visual-motor coordination);
- place the letters into the correct section of the line (spatial orientation);
- not shuffle up the correct sequence of phonemes and graphemes and not forget either one of the listed activities (perception of time, sequencing).

Diagnosing DPF employs the above-described procedural scheme. Instrumentally, it uses established means of psychological and special-educational normative diagnostics (both clinical and counseling ones), with a preference for dynamic diagnostic means (Feuerstein, Falik, Rand, Feuerstein, 2002; Haywood, Lidz, 2006; Tzuriel, 2015).

Methodological aspects and study aim

The aim of the study is to identify, describe and compare determinants of educability and its dynamics in children and students with needs for special-education support measures. The secondary goal of this analysis is to produce a comparison of the results of B. Sindelar subtests between neurotypical students, students with DPF and students suspected of having DTF which could be used to observe whether there are statistically significant differences (and if so, between which groups of respondents).

The subject of this analysis were visual stimulus materials (subtests) of the B. Sindelar battery[1].

Subtests employed – stimulus material: SINDELAR, B.: *Diagnostic method for detecting partial function deficits in school children – handbook (Diagnostická metoda k zjišťování deficitů dílčích funkcí u školních dětí – příručka)*. Bratislava-Brno, Psychodiagnostika (2007).

Participants

The research was conducted in four Moravian regions and in the capital city Prague. The selection of students from the population of first-grade elementary school students for the study sample was done through deliberate institutional selection (Pedagogical and Psychological Counseling, Special Education Centres, elementary schools, Dyscentrum), with a total of 613 first-grade elementary school pupils.

Out of these 422 were neurotypical; 119 were suspected of having deficiencies or had been recently diagnosed; 72 had DPF.

Survey instrument

As it was mentioned above, selected subtests of the author SINDELAR, B were used for this purpose: *Diagnostic method for detecting deficits of partial functions in school children – handbook.* Bratislava-Brno, Psychodiagnostics, 2007) such as:

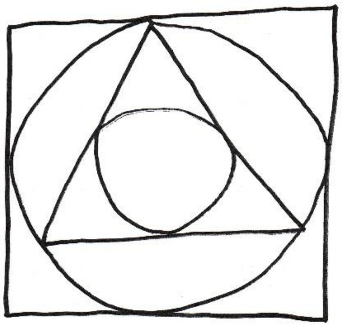
1. Stimulus material for the visual classification subtest (copying a shape), subtest B of the test battery;
2. Stimulus material for the visual differentiation of image pairs, subtest D of the test battery;
3. Stimulus material for visual memory subtest – pictures, subtest Ga of the test battery;
4. Stimulus material for visual memory subtest – shapes, subtest Gb of the test battery.

[1] Subtests employed – stimulus material: SINDELAR, B.: *Diagnostic method for detecting partial function deficits in school children – handbook (Diagnostická metoda k zjišťování deficitů dílčích funkcí u školních dětí – příručka)*. Bratislava-Brno, Psychodiagnostika.

Procedure

Ad 1: Assignment: *"Copy the shape as best you can"* (place the pattern on the left for right-handed students and on the right for left-handed ones). Template – Picture 1. Evaluation: Following the manual, the drawing is evaluated with 0, 0.5, 1 or 2 points.

Picture 1: Template – material for the visual classification subtest



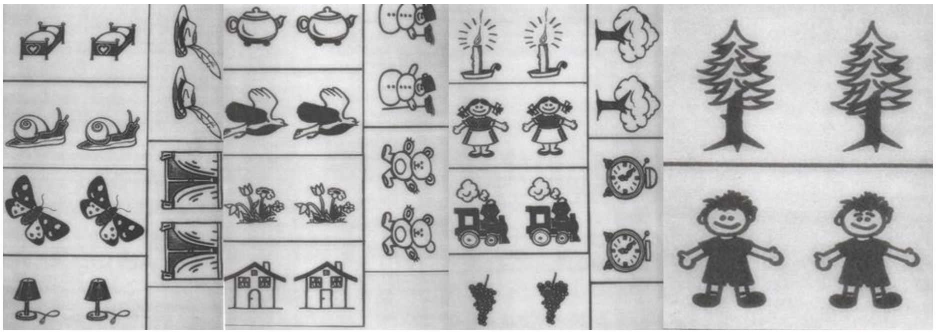
Ad 2: Assignment: "*Now, I'll show you two pictures. Please tell me if these pictures are the same or if they are different".* (First, show the two alarm clocks where the difference is most apparent and ensure that the child understands the assignment. Do not tell the child if it makes a mistake. Put the new image over the previous one to prevent it from being distracting.) Stimulus material – Picture 2.

Evaluation – if the answer is that they are the SAME, circle A; if the answer is that they are DIFFERENT, circle N. Then add all the circled letters that have a 1 next to them, which will yield the point score (Table 1).

Table 1: Record sheet – the visual differentiation

alarm clock	**candle**	**house**	**Bed**	**lamp**	**bear**	**Boy**	**snowman**	**girl**	**snail**
A–N1	A1–N	A–N1	A1–N	A1–N	A–N1	A–N1	A–N1	A1–N	A1–N
butterfly	**hat**	**grape**	**Bird**	**steam engine**	**teapot**	**flowers**	**curtain**	**firtree**	**leafy tree**
A1–N	A1–N	A–N1	A–N1	A1–N	A–N1	A–N1	A1–N	A–N1	A1–N

Picture 2: Template – material for the visual differentiation of image pairs

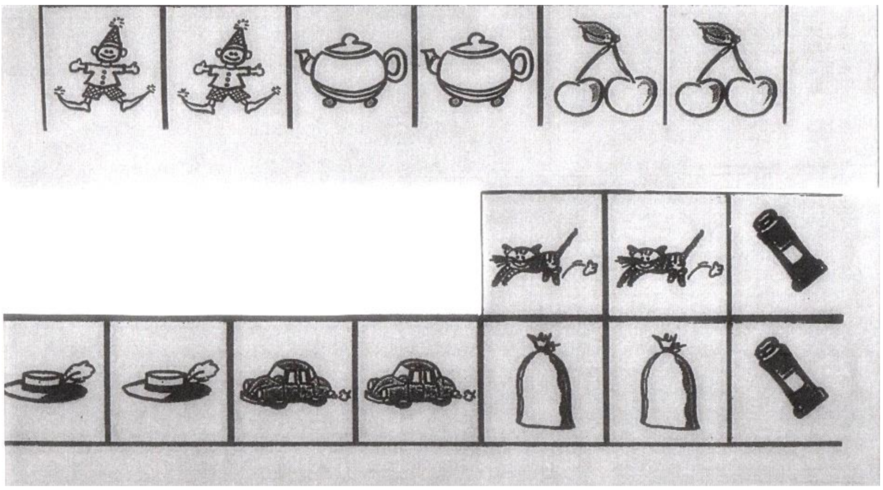


Ad 3: Assignment: *"Put your tongue between your teeth, observe me closely and try your best to memorize these pictures".* (Place the cards in front of the child from left to right at the speed of one card every two second – proceed in the order found in the Table 2. Again, proceeding from left to right, turn over the cards, one by one, so that the images are no longer visibly. Give the child a shuffled stack of cards with the same images on them and ask it to replicate the sequence of images – to help the child understand, you can compare it to the card game Concentration. Stimulus material: Picture 3. Evaluation – using initial letters, enter the sequence in which the child arranged the cards into the table – assign one point per each correctly placed picture.

Table 2: Record sheet – visual memory subtest (pictures)

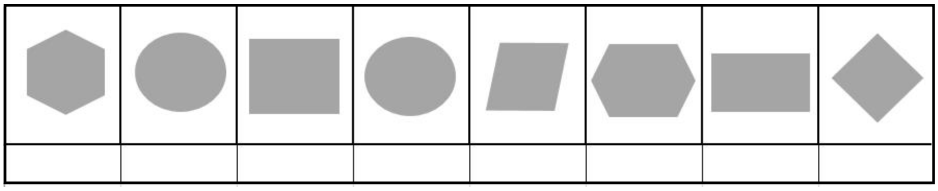
C ar	**H** at	**T** ea	**J** ester	**D** og	**A** pple	**B** ag	**T** ube

Picture 3: Template – material for the visual memory subtest (pictures)

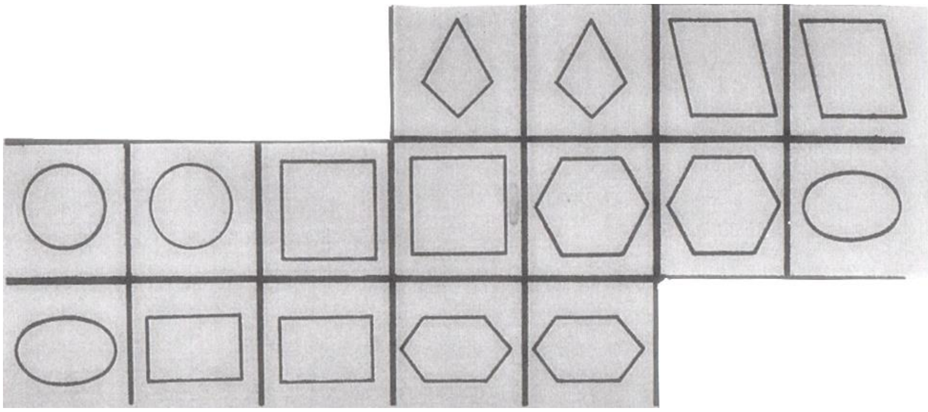


Ad 4: Assignment: *"Observe me closely and try to memorize these geometric shapes".* Place the cards in front of the child from left to right at the speed of one card every two second – proceed in the order found in the Table 3. Again, proceeding from left to right, turn over the cards, one by one, so that the shapes are no longer visibly. Give the child a shuffled stack of cards with the same shapes on them and ask it to replicate the sequence of images – to help the child understand, you can compare it to the card game Concentration. Stimulus material: Picture 4. Evaluation – using initial letters, enter the sequence in which the child arranged the cards into the table – assign one point per each correctly placed shape. Evaluation – enter the sequence in which the child arranged the shapes into the table – assign one point for each correctly placed shape.

Table 3: Record sheet – visual memory subtest (shapes)



Picture 4: Template – material for the visual memory subtest (shapes)



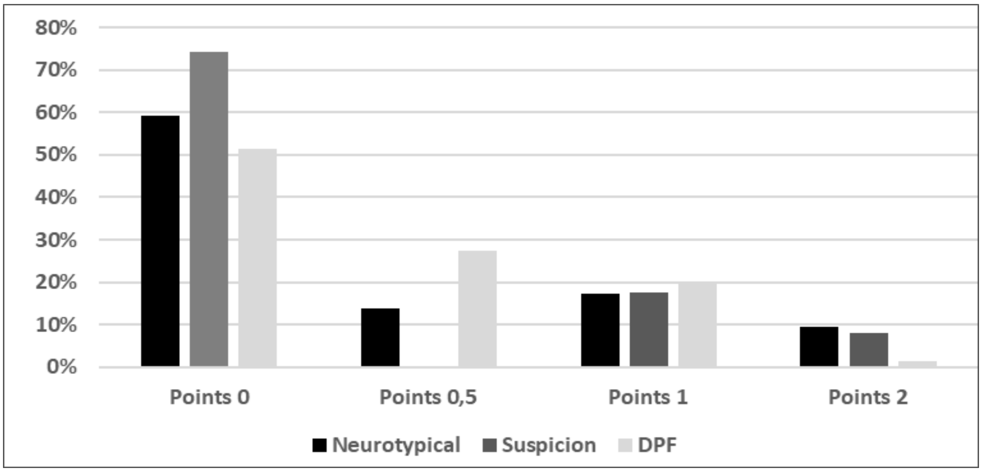
Results

Ad. 1: Subtest B of the test battery – visual classification subtest (copying a shape). First-grade students (neurotypical vs. suspicion of DPF vs. DPF).

Table 4: Results of subtest B – visual classification

Subtest B	First-grade elementary school pupils					
	Neurotypical		Suspicion		DPF	
Points	Frequency	Valid %	Frequency	Valid %	Frequency	Valid %
0	251	59,3	93	74,4	41	51,3
0,5	59	13,9	0	0	22	27,5
1	73	17,3	22	17,6	16	20
2	40	9,5	10	8	1	1,3
Total	423	100	125	100	80	100

Figure 1: Results of subtest B – visual classification



Statistically significant differences:

- neurotypical: Suspicion (p = 0.020);
- suspicion: DPF (p = 0.035).

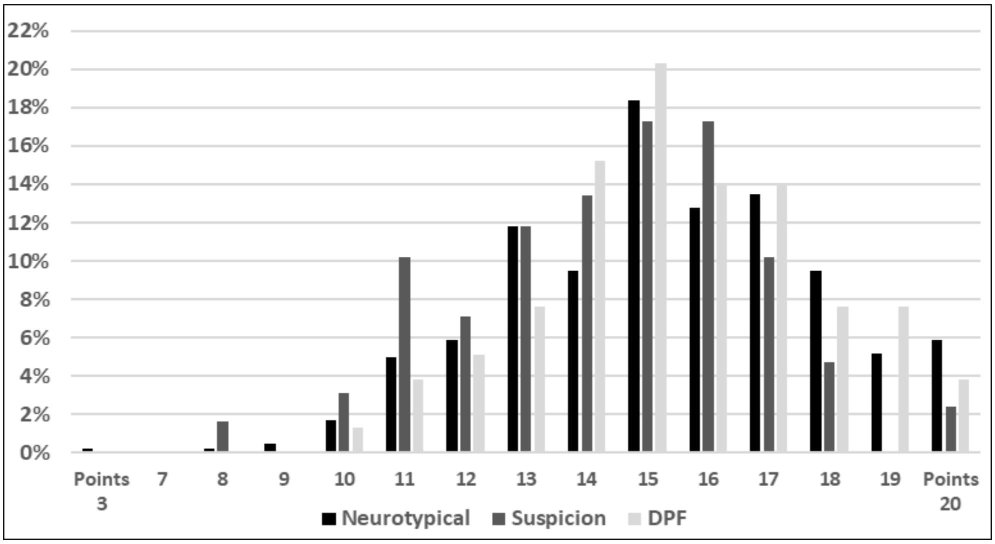
Ad. 2: Subtest D of the test battery – visual differentiation of image pairs. First-grade students (neurotypical vs. suspicion of DPF vs. DPF).

Table 5: Results of subtest D – visual differentiation of image pairs

Subtest D	First-grade elementary school pupils					
	Neurotypical		Suspicion		DPF	
Points	Frequency	Valid %	Frequency	Valid %	Frequency	Valid %
3	1	0,2	0	0	0	0
7	0	0	1	0, 8	0	0
8	1	0,2	2	1,6	0	0
9	2	0,5	0	0	0	0
10	7	1,7	4	3,1	1	1,3
11	21	5	13	10,2	3	3,8
12	25	5,9	9	7,1	4	5,1

13	50	11,8	15	11,8	6	7,6
14	40	9,5	17	13,4	12	15,2
15	78	18,4	22	17,3	16	20,3
16	54	12,8	22	17,3	11	13,9
17	57	13,5	13	10,2	11	13,9
18	40	9,5	6	4,7	6	7,6
19	22	5,2	0	0	6	7,6
20	25	5,9	3	2,4	3	3,8
Total	423	100	127	100	79	100

Figure 2: Results of subtest D – visual differentiation of image pairs



Statistically significant differences:

- neurotypical: Suspicion (p = 0.000);
- suspicion: DPF (p = 0.005).

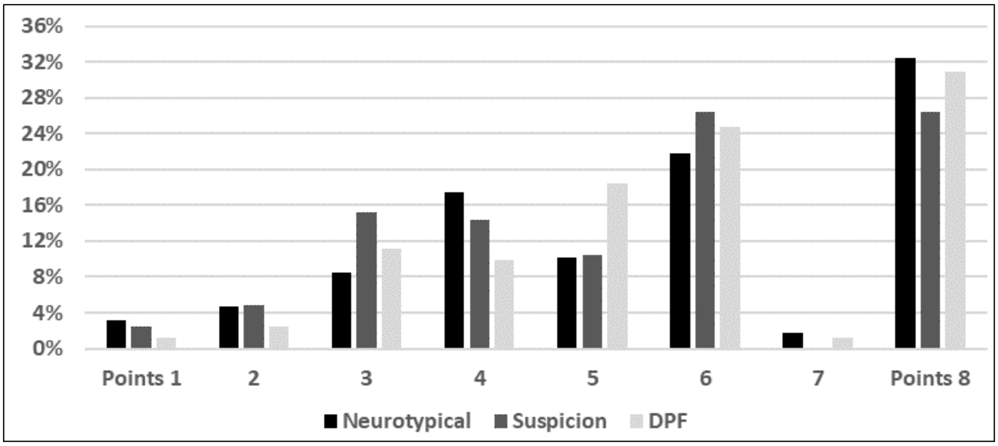
Ad. 3: Subtest Ga of the test battery – visual memory (pictures). First-grade students (neurotypical vs. suspicion of DPF vs. DPF).

Table 6: Results of subtest Ga – visual memory (pictures)

Subtest Ga	First-grade elementary school pupils					
	Neurotypical		Suspicion		DPF	
Points	Frequency	Valid %	Frequency	Valid %	Frequency	Valid %
1	13	3,1	3	2,4	1	1,2
2	20	4,7	6	4,8	2	2,5
3	36	8,5	19	15,2	9	11,1
4	74	17,5	18	14,4	8	9,9
5	43	10,2	13	10,4	15	18,5

6	92	21,8	33	26,4	20	24,7
7	7	1,7	0	0	1	1,2
8	137	32,5	33	26,4	25	30,9
Total	422	100	125	100	81	100

Figure 3: Results of subtest Ga – visual memory (pictures)

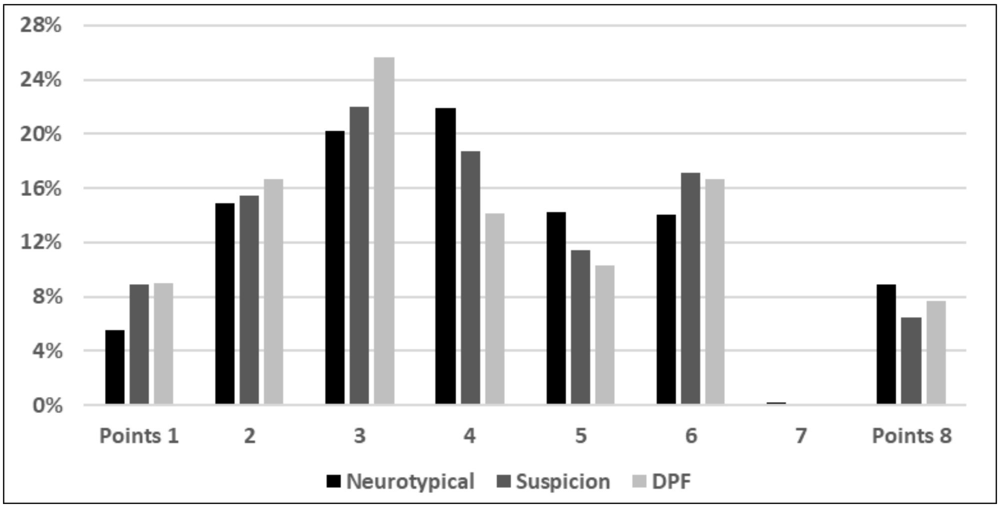


Ad. 4: Subtest Gb of the test battery – visual memory (shapes). First-grade students (neurotypical vs. suspicion of DPF vs. DPF).

Table 7: Results of subtest Gb – visual memory (shapes)

Subtest Gb	First-grade elementary school pupils					
	Neurotypical		Suspicion		DPF	
Points	Frequency	Valid %	Frequency	Valid %	Frequency	Valid %
1	23	5,5	11	8.9	7	9
2	62	14,9	19	15,4	13	16,7
3	84	20,2	27	22,0	20	25,6
4	91	21,9	23	18,7	11	14,1
5	59	14,2	14	11,4	8	10,3
6	58	14,0	21	17,1	13	16,7
7	1	0,2	0	0	0	0
8	37	8,9	8	6,5	6	7,7
Total	415	100	123	100	78	100

Figure 4: Results of subtest Gb – visual memory (shapes)



Statistically significant difference (Mann-Whitney test, p = 0.035)

Reliability:

- cronbach's alpha: .787253398;
- standardized alpha: .793981430.

Discussion

The above tables and figures clearly show the distribution of data in sets focused on perception-visual partial functions – a comparison of neurotypical first-grade students vs. those suspected of DPF vs. diagnosed with DPF.

The statistical significance of differences in the response set is indicated (incl. the significance p) below the frequency tables in cases where the statistical test showed a difference.

Statistically significant differences were found in the subtests:

- Subtest B: visual classification (copying a shape) with a significance of neurotypical students vs. students with DPF = .020 and students with suspicion of DPF vs. students with DPF = .035. The analysis shows that neurotypical students achieved better results than students from the other two groups (students suspected of having DPF achieved better results than those with DPF).
- Subtest D: visual differentiation of image pairs – significance neurotypical vs. suspicion of DPF = .000, students with suspicion of DPF vs. students with deficiencies = .005. Neurotypical students

showed the best results, while students with deficiencies did better than students suspected of having deficiencies.

- Subtest Gb: visual memory – shapes, statistically significant difference $p = 0.035$, the best results were, again, achieved by the neurotypical students.

Statistical analysis of the data did not reveal any statistically significant differences for the subtest Ga (visual memory – pictures). Nevertheless, the frequency table shows that neurotypical students and students with DPF performed the best in this subtest.

From what has been stated above, we may generalize that in tests focused on visual memory, perception and differentiation, there are statistically significant differences between respondent groups in the subtests B, D and Gb (visual classification – copying a shape, visual differentiation of image pairs, visual memory – shapes). In contrast, the Ga subtest – visual memory for pictures – did not show any statistically significant differences.

In the individual subtest, neurotypical students scored the highest. Between students suspected of DPF and students with deficiencies, the suspected group achieved better results in subtest B (visual classification – copying a shape), while students with deficiencies did better in subtest D (visual differentiation of image pairs). The results of subtests focused on visual memory (Ga, Gb) did not show major differences between the two groups.

Conclusion

In conclusion, we can reject null hypotheses for three hypothetical statements (H1, H2 and H4). In contrast, null H may be accepted for H3, the Ga subtest (visual memory - pictures).

With reference to the research, we may accept one of the premises of a part of our analysis – namely that, in certain subtests of the test battery (B. Sindelar), students with DPF achieve results similar to those of students suspected of having DPF.

In contrast to auditory subtests (auditory memory and differentiation) and subtests of orientation within the body schema which, in prior research, showed a clear right-side dominance (see distribution curve) of performances (i.e. the prevalence of average and above-average results), visual subtests show a different pattern – subtests D and Gb appeared somewhat balanced, subtest B appeared too difficult for the subjects and subtest Ga was too easy.

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