

Исследование факторов, определяющих динамику обучаемости у детей с особыми образовательными потребностями (подготовительный этап)

Валента М., профессор, доктор психологических наук, Институт специального педагогического обучения, факультет Педагогики, Оломоуцкий университет им. Ф. Палацкого, Чехия, valentam22seznam.cz

Лудикова Л., заместитель декана по научно-исследовательской работе и докторантуре, профессор, Институт специального педагогического обучения, факультет Педагогики, Оломоуцкий университет им. Ф. Палацкого, Чехия, libuse.ludikova@upol.cz

Крейчова Л., психолог, доктор психологических наук, кафедра гуманитарных наук, факультет психологии, Карлов университет, Прага, Чехия, lenka.krejцова@ff.cuni.cz

Михалик Дж., профессор, Институт специального педагогического обучения, факультет Педагогики, Оломоуцкий университет им. Ф. Палацкого, Чехия, jan.michalik@upol.cz

Храстина Я., ассистент-профессор, доктор психологических наук, Институт специального педагогического обучения, факультет Педагогики, Оломоуцкий университет им. Ф. Палацкого, Чехия, jan.chrastina@upol.cz

Храска М., адъюнкт-профессор, доцент, доктор психологических наук, Институт специального педагогического обучения, факультет педагогики, Оломоуцкий университет им. Ф. Палацкого, Чехия, miroslav.chraska@upol.cz

Финкова Д., адъюнкт-профессор, доцент, Институт специального педагогического обучения, факультет педагогики, Оломоуцкий университет им. Ф. Палацкого, Чехия, dita.finkova@upol.cz

Лангер Г., адъюнкт-профессор, Институт специального педагогического обучения, факультет педагогики, Оломоуцкий университет им. Ф. Палацкого, Чехия, jiri.langer@upol.cz

Статья посвящена первому этапу лонгитюдного теоретико-методологического исследования факторов, благотворно влияющих на обучаемость и школьную успешность, а также факторов, провоцирующих академическую неуспеваемость. Исследование проводилось в течение трех лет на базе педагогического факультета университета Палацкого в Оломоуце. В статье описывается пилотажный этап исследования, целью которого являлись выявление дефицитарных функций, а также оценка их структуры и динамики у дошкольников и младших школьников первых трех лет обучения, имеющих особые образовательные потребности.

Ключевые слова: обучаемость, ученики с особыми образовательными потребностями, дефицитарность основных психических функций, школьная неуспеваемость, методологическая основа исследования.

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Factors affecting dynamics of educability in children and pupils in need of special educational support – research report (Part I – Pre-Research)

Valenta, M., full professor, Ph.D., Institution of Special Education Studies, Faculty of Education, Palacký University, Olomouc, Czech Republic, valentam22seznam.cz

Ludíková, L., vice-dean for Science, Research and Doctoral Studies, Institution of Special Education Studies, Faculty of Education, Palacký University, Olomouc, Czech Republic, libuse.ludikova@upol.cz

Krejčová, L., psychologist, Ph.D., Faculty of Arts, Dep. of psychology, Charles University, Prague, Czech Republic, lenka.krejцова@ff.cuni.cz

Michalík, J., professor, Institution of Special Education Studies, Faculty of Education, Palacký University, Olomouc, Czech Republic, jan.michalik@upol.cz

Chrastina, J., assistant professor, Ph.D., Institution of Special Education Studies, Faculty of Education, Palacký University Olomouc, Czech Republic, jan.chrastina@upol.cz

Chráska, M., associate professor, doc., Ph.D., Institution of Special Education Studies, Faculty of Education, Palacký University Olomouc,

Finková, D., associate professor, doc., Institution of Special Education Studies, Faculty of Education, Palacký University Olomouc, dita.finkova@upol.cz

Langer, J., associate professor, Institution of Special Education Studies, Faculty of Education, Palacký University Olomouc, jiri.langer@upol.cz

The article provides an insight into the processual side and theoretical frame of the research on factors affecting educability and school success/failure in children within a three year long project at Pedagogical Faculty at Palacký University in Olomouc. The first stage focuses on the structure and dynamics of deficits in basic functions in children attending their last year at nursery and first three years of primary school, and on the results of pre-research.

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Deficits of basic functions are tiny causes
that may lead to enormous suffering

Brigitte Sindelar

Introduction

The article represents an introduction into the course and partial results of a three years long study conducted at the Institute of Special Education Studies at Pedagogical faculty in Olomouc aimed at the factors that can affect educability dynamics in children and students in need of special educational support, i.e. with special educational needs – physical disabilities, physical (marginally also social) disadvantages and weak. The core of the multidisciplinary project is basic research of the described above dynamics and factors that may considerably affect school success/failure in pupils in target groups.

The basic research of the factual matter was extended with the issue of *methodology*, i.e. verification of the instruments measuring the dynamics of educability and its determinants. The project's main **objective** is to identify and describe, from both qualitative and quantitative perspective, those factors that can substantially affect the dynamics of educability in relation to the deficits of basic functions in preschool children and early years school pupils (Years 1–3 of primary school). In terms of methodology, *longitudinal qualitative approach* combined with *quantitative approach* was used (mixed method). Similar multidisciplinary research has not been conducted within our country so far and all the available data are unsatisfactory and obsolete for using with contemporary Czech population representing educational setting.

Theoretical framework is based on the grounded theory of deficits in partial (basic) functions (further DBF) B. Sindelar [17] and on empirical evidence provided by these authors extended with the empirical evidence of so called partial reduction in performance by Scharinger [11]. Theoretical foundation of the research is based on neuropsychology, cognitive psychology and ontogenetic psychology.

The necessity to look into this subject arises from the lack of similar research in our country, while deficits of basic functions – according to foreign research projects [15] – affect 15–20% of school population and have their share in school failures, and also in the role of determinants, in specific learning disorders, behavioural disorders, and a range of emotional disorders developed in childhood or adolescence. Reasonable estimate for our country gives the absolute number of two hundred thousand children and pupils as the population of interest. The actual prevalence is not known – to obtain this number is a part of our research project. However, foreign studies repeatedly point out the fact that reinforcing partial cognitive functions, as so called phonemic awareness, morphological awareness, visual differentiating etc. have the impact on learning and practicing reading and writing skills [19; 1; 2; 10]. In other words, supporting the development and minimizing the above mentioned deficits often play a key role later in learning the three Rs (reading, writing, arithmetics) and directly affect pupils' school success. Moreover, all the mentioned skills can be further segmented into actual basic components. For example, the research by Carroll and colleagues showed that the development of phonemic awareness is preceded by the development of syllabication skill, the beginning sound identification skill, and also development of language (articulation) skills [2]. A similar relationship is also emphasized by the study of Russian scientists Goryacheva and Makarova, who support the development of the sensorimotor experience and specific skills, when the latter contribute to their transfer to the cognitive activity of the child and its development [5].

Adequate maturation and balanced development of basic functions are prerequisites for the development of more complex processes and skills as, for example, three Rs – reading, writing, and arithmetics. That means that deficits of basic functions are one of the causes of specific learning and behavioural disorders which can then be included in the symptomatology of DBF (here, it is necessary to state that, for example, dyslexia is not a deficit of basic function – it can be caused by a set of deficits that form an individual's specific profile and show in difficulties related to reading and writing performance). That is why DBF show themselves mostly in school settings, although their prodromal signals can be detected even in preschool age children (drawing performance inadequate to the age, accompanied by graphomotor ineptitude, dysgrammatism, difficulties with game rules, etc.).

Graichen defines DBF as a decline in the performance in separate factors or elements of a larger functional system that is necessary for handling certain complex processes of adaptation [8]. Nevertheless, such general concept of the phenomenon included too wide a range of disorders so narrowing and specification of the whole concept was adopted for practical consultation and special educational needs.

From terminological point of view, basic functions overlap with more frequent and established concepts of *cognitive functions*, or *executive functions*, however, from methodological point of view, it is necessary to distinguish between deficits in basic functions and *deficit in cognitive functions* in Feuerstein's concept of cognitive structural modifiability that partially overlap with DBF [3], and also deficits in cognitive functions in „psychiatric diagnoses“ of schizophrenia types of disorders, dementias, disorders linked to tick-borne encephalitis, etc. On the other hand, the concept of deficits of basic functions is very close to the so called *partial reduction in performance* [11], even though this concept is narrower and relates primarily to re education of the affected functions.

Basic functions include (simplified and for research purposes only) a set of ten functions, deficit in each of them can affect pupil's educability and manifest themselves with similar symptoms (the same mistake, e.g. wrong spelling in dictations, the same reading mistakes). Re education of a basic function then has to be preceded by thorough diagnostic process that shows which basic function out of the whole set is affected. Sindelar presents a metaphoric image of individual basic skills as tree roots that cannot be seen – what we can see is a tree top reflecting the actual state of pupils' development – their more complex functions and skills, e.g. reading [14].

Sindelar (detto) demonstrates individual basic skills clearly by showing the example of a dictation written by a pupil in Year 2. To write down a dictated sentence right, they need to be able to:

1. distinguish the teacher's voice from other noises around (auditory attention – auditory figure-ground differentiation),
2. hold the dictated sentence in short term auditory memory,
3. divide the words in sounds – phonemes (auditory analysis),
4. discriminate isolated phonemes from similar phonemes (auditory differentiation – phonematic hearing),
5. match graphemes to individual phonemes (visual memory),
6. not to mix up similar graphemes (visual differentiation – graphomatic acuity),
7. associate phonemes with their corresponding graphemes, i.e. associate interperceptive information (intermodal function, basic ability to create intermodal relations),
8. coordinate fine motor skills (fingers) when writing (visual-motor coordination),
9. place letters correctly on the line – in the right place and position (spatial orientation),
10. not to transpose the phonemes and then graphemes within the sequence and not to forget any detail out of the whole set of the listed activities (perception of temporal sequence, seriality).

If one of the above basic functions is not adequately developed in a Year 2 pupil, it may become evident in a dictation in the form of a mistake, e.g. they write *paboušek* instead of *papoušek* [14]. If a pupil fails repeatedly in dictations, then it is advisable to consider individual deficits according to the above presented outline of basic functions.

The issue in such case might be that:

- they could not hear the word correctly because their attention was engaged by the sound of a car in the street (auditory figure-ground discrimination);
- they could not hold the word in memory;
- they analyzed phonemes incorrectly;
- their phonematic hearing is compromised and they do not fully discriminate between voiced and unvoiced sounds b-p;
- they cannot hold or find corresponding graphemes in their memory;
- their graphomotor acuity is compromised so they do not discriminate between similarly looking graphemes p-b;
- associated p phoneme with b grapheme (intermodally);
- confused two similarly looking graphemes.

This means that various DBF can be manifested by the same symptoms and it is not possible to base the DBF diagnosis on symptoms. Diagnostics of DBF is based on the above outlined procedural scheme and applies established psychological and special education methods (used in both counselling and clinical practice) of normative diagnostics, preferring methods of dynamic diagnostics [2; 9; 18].

The objective of the whole project is to identify, describe and compare determinants of educability and its dynamics in children and pupils in need of special educational support.

III. variable “DBF test battery Sindelar” focused on the below stated markers – for comparison (ad analysis of factors affecting the dynamics of particular basic functions and dynamics of children’s or pupils’ educability) of target groups (nursery – primary school Year 1– primary school Year 2), unified stimulus material was used (“middle” material taken from the test tasks for Year 1 primary school target group):

- A. auditory structuring (acoustic figure-ground discrimination) – 5 sets of stimulus material (A1 – nursery, A2a-b – PS Year 1, A3a-b – PS Year 2);
- B. visual structuring (visual figure-ground discrimination) – 3 sets of stimulus material (B1 – nursery, B2 – PS Year 1, B3 – PS Year 2);

- C. auditory differentiation of speech (verbal acoustic discrimination) – 4 sets of stimulus material (C1a-b – nursery, C2 – PS Year 1, C3 – PS Year 2);
- D. visual discrimination (visual discrimination of pictures and words) – 4 sets of stimulus material (D1a-b – nursery, D2 – PS Year 1, D3 – PS Year 2);
- E. orientation in the actual physical set - 3 sets of stimulus material (E1 – nursery, E2 – PS Year 1, E3 – PS Year 2);
- F. auditory memory (verbal/acoustic memory) – 6sets of stimulus material (F1a-b – nursery, F2a-b – PS Year 1, F3a-b – PS Year 2);
- G. visual memory (visual memory for pictures, shapes, graphemes) – 5 sets of stimulus material (G1a-b – nursery, G2a-b – PS Year 1, G3 – PS Year 2);
- H. auditory-visual intermodal tasks (auditory – visual matching words – graphemes) – 3 sets of stimulus material (H1 – nursery, H2 – PS Year 1, H3 – PS Year 2);
- I. visual-auditory intermodal tasks (visual – auditory matching pictures – graphemes) – 3 sets of stimulus material (I1 – nursery, I2 – PS Year 1, I3 – PS Year 2).

The battery of tests (specifically, for the target group of respondents of primary school age [13] and, for the target group of preschool children [14], meets the requirement for as isolated developmental level of individual basic functions as possible; another advantage is the possibility to reveal the compensation strategies that children with DBF have already developed. It consists of 35 sets of stimulus material for all three target groups with the following allocation:

- | | | |
|----|-----------------------|---|
| a. | Nursery | 13 sets of stimulus material |
| b. | Primary School Year 1 | 12 sets of stimulus material (that also serves as comparative material for monitoring the dynamics of basic functions development in all target groups) |
| c. | Primary School Year 2 | 11 sets of stimulus material. |

The research is carried out in the form of testing children (pupils) in four Moravian districts and Prague in the form of longitudinal research – children are monitored from the last (preparatory) year at nursery school up to Year 2 at primary school (i.e. children and pupils aged 5–7). Children and pupils for the research sample were selected by intentional institutional (stratified) sampling.

The research was preceded by *pre-research* verifying methodological instruments and procedural scheme of the research for selected target groups with the following numbers of respondents (stimulus test material).

1. Children in the last year at (majority) nursery school – 48 children in total, including 3 children at risk of (school) failure (DBF).
2. Pupils of Year 1 and 2 at primary schools:
 - a. Pupils with no obvious risk of school failure (INT) – 22 pupils.
 - b. Pupils at risk of (school) failure (DBF) – 15 pupils.
3. Pupils with visual impairment in special schools – 21 pupils (+16 children in special nursery schools).

This article describes the results of pre-research in Year 1 pupils. The structure of the research sample is shown in Table 1.

Table 1

The structure of the research sample for pre-research in Year 1

Category of a child	Gender (male)	Gender (female)	Total
Pupils at risk of (school) failure (DBF) in Year 1 of primary school	8	3	11
Pupils with no obvious risk of school failure (INT) in Year 1 of primary school	3	12	15
Pupils with visual impairment in Year 1 of special schools (ZRP)	8	8	16
All Grps	19	23	42

Note: only complete data collected from the pupils were used for the comparison (this is the reason why the number of pupils in DBF group is lower than the total number of respondents in this category)

Participatory interview with two parents of children with DBF has been conducted (part of qualitative strategy of the pre-research). The results of this part of the research project will be published in subsequent research report.

Methodological objective of the pre-research was to define how demanding the stimulus material is from the point of view of time and content, and its selection so that it is adequate to the age (nursery school, Year 1 at primary school, Year 2 at primary school) of the selected sample. Pre-research was carried out in the districts of Olomouc and in Prague.

The first stage of the project focused on finding out the frequency, structure and dynamics of deficits of basic functions in selected population, i.e. (im)maturity and

(un)balanced development in the above described basic functions (i.e. basic functions as one of possible determinants of pupil's educability).

Research issues and questions in the first stage of this research were formulated in the following way:

- What is the distribution of DBF in the samples?
- What is the structure of diagnosed DBF in the samples?
- Is there a certain dynamics in the development of DBF (in distribution and structure) on the timescale: Prep year at nursery school – Year 1 at primary school – Year 2 at primary school?

Research hypotheses verified by statistical processing of quantitative data were aimed at the relation (and correlations) of individual DBF in their dynamics (time) for research samples and at finding statistically significant differences between the data groups.

Statistical hypotheses – pre-research:

H₁: There is statistically significant difference in the results for individual test tasks between the groups of pupils in Year 1 – DBF (pupils with the risk of school failure at primary school), INT (pupils with no obvious risks of school failure at primary school) and ZRP (pupils with visual impairment at special schools).

H₂: Pupils in Year 1 with no obvious risks of school failure (group INT) achieve in separate test tasks statistically significantly better results than pupils at risk of school failure (group DBF).

Ad H₁. H₁ hypothesis was tested by the analysis of variance (ANOVA) in STATISTICA 12 software. The results are shown in Table 2. These results show that there are statistically significant differences in the results of separate test tasks (p=0.025) between the three groups of pupils. H₁ hypothesis was proven true (despite the fact that the pre-research sample was not very large).

The above mentioned differences show the most significantly in test tasks B2 – 5 (p=0.001), C2 (p=0.002), and F2a (p=0.015). For these, the comparisons of the results in individual groups were recorded in charts (see Fig.1 – 3). Vertical bars in these charts denote 0.95 confidence intervals for the results of the test task in the given group. The results clearly show that the group of pupils with visual impairment (ZRP) achieved significantly different results in the tests from the group of pupils at risk of school failure (DBF) and the group of pupils with no obvious risks of school failure (INT) – the results of the latter groups in test tasks were similar.

Table 2

**Comparison of the results achieved by Year 1 pupils in the groups
for individual test tasks, processed by ANOVA**

Results of ANOVA Group; LS Means (DATA Research, CLASS 1) Wilks lambda=0.1321, p=0.025 Effective hypothesis decomposition		Group			Significance p
Level of (Factor)	Total (n=36)	DDF (n=5)	INT (n=15)	ZRP (n=16)	
A2a (Mean)	18.78	19.80	17.67	19.50	0.324
A2b (Mean)	17.64	18.40	16.33	18.63	0.251
B2 - 1. (Mean)	0.82	1.20	0.90	0.63	0.172
B2 - 2. (Mean)	1.08	1.20	1.37	0.78	0.074
B2 - 3. (Mean)	0.69	1.00	0.73	0.56	0.290
B2 - 4. (Mean)	0.69	1.20	0.70	0.53	0.082
B2 - 5. (Mean)	1.17	1.50	1.53	0.72	0.001
C2 (Mean)	16.67	17.20	18.13	15.13	0.002
D2 (Mean)	14.67	13.80	15.67	14.00	0.378
E2 (Mean)	4.89	4.80	4.73	5.06	0.958
F2a (Mean)	3.92	2.40	2.87	5.38	0.015
F2b (Mean)	1.61	1.60	1.40	1.81	0.595
G2a (Mean)	5.58	5.00	6.13	5.25	0.385
G2b (Mean)	3.86	5.20	4.07	3.25	0.181
H2 (Mean)	4.69	5.40	4.93	4.25	0.254

CH2 (Mean)	5.11	5.40	5.47	4.69	0.319
Total (Mean)	101.88	105.10	102.63	100.16	0.753

Note: only complete data collected from the pupils were used for the comparison (that is the reason why the number of pupils in DBF group is lower than the total number of respondents in this category).

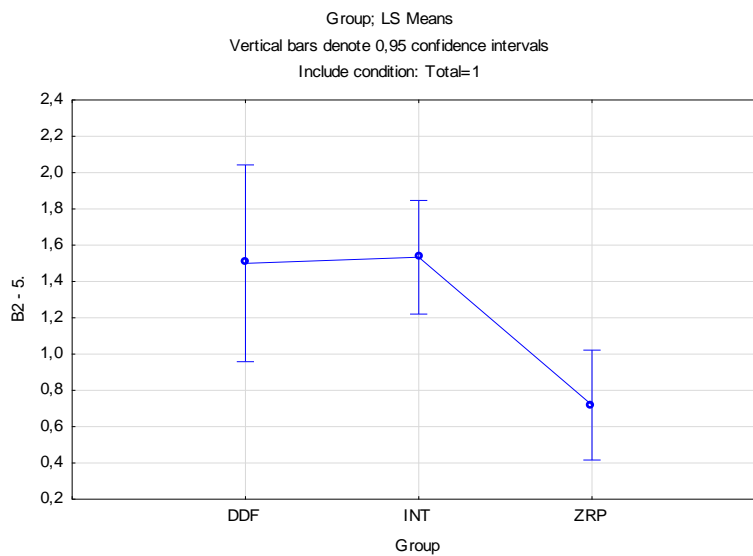


Figure 1. Comparison of the results for test task B2-5 in groups of pupils, processed by ANOVA

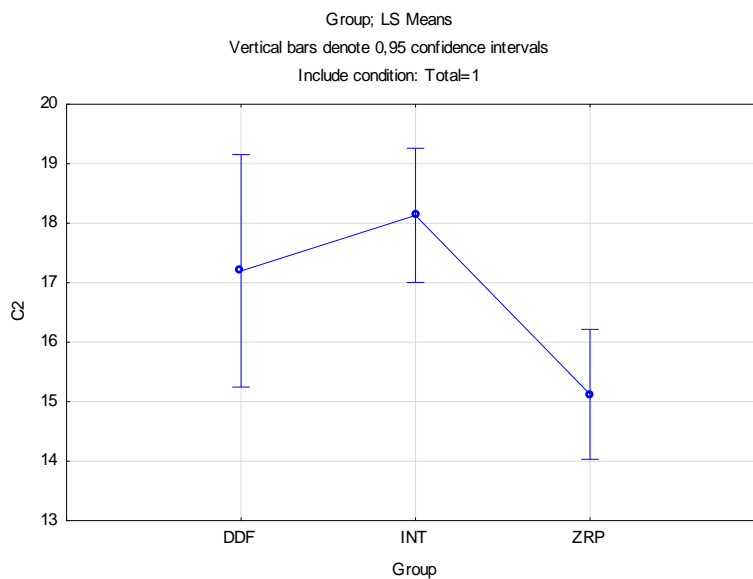


Figure 2. Comparison of the results for test task C-5 in groups of pupils, processed by ANOVA

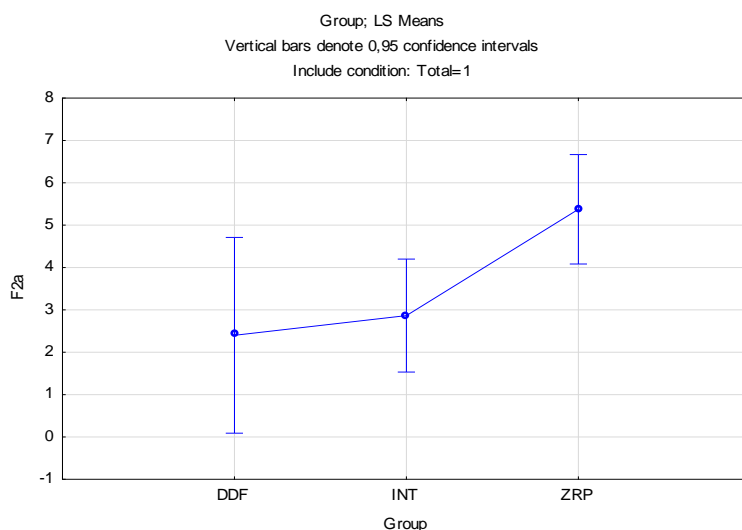


Figure 3. Comparison of the results for test task F2a in groups of pupils, processed by ANOVA

Ad H₂: Pupils in Year 1 at primary school with no obvious risks of school failure (INT) achieve better results in individual test tasks than pupils at risk of school failure (DBF).

H₂ hypothesis was tested by t-test that was processed by STATISTICA 12. The results of comparison are shown in Table 3.

Table 3

Comparison of the results in individual test tasks in pupils in Year 1 at primary school in DBF groups (pupils at risk of school failure) and INT (pupils with no obvious risks of school failure), processed by t-test.

Variable	T-tests; Grouping: Group (DATA PROJECT CLASS 1) Group 1: DDF; Group 2: INT; Include condition: Total=1										
	Mean (DDF)	Mean (INT)	t-value	df	p	Valid N (DDF)	Valid N (INT)	Std.Dev. (DDF)	Std.Dev. (INT)	F-ratio (Variances)	p (Variances)
A2a	19.80	17.67	1.31	18	0.21	5	15	3.56	3.02	1.40	0.57
A2b	18.40	16.33	1.12	18	0.28	5	15	1.95	3.90	4.01	0.19
B2 - 1.	1.20	0.90	0.97	18	0.34	5	15	0.84	0.51	2.72	0.14
B2 - 2.	1.20	1.37	-0.46	18	0.65	5	15	0.84	0.67	1.57	0.47
B2 - 3.	1.00	0.73	1.18	18	0.25	5	15	0.71	0.32	4.88	0.02
B2 - 4.	1.20	0.70	2.14	18	0.05	5	15	0.84	0.25	10.89	0.00

Variable	Mean (DDF)	Mean (INT)	t-value	df	P	Valid N (DDF)	Valid N (INT)	Std.Dev. (DDF)	Std.Dev. (INT)	F-ratio (Variances)	P (Variances)
C2	17.20	18.13	-1.30	18	0.21	5	15	1.10	1.46	1.77	0.62
D2	13.80	15.67	-1.69	18	0.11	5	15	1.92	2.19	1.30	0.87
E2	4.80	4.73	0.05	18	0.96	5	15	2.77	2.28	1.48	0.52
F2a	2.40	2.87	-1.07	18	0.30	5	15	0.89	0.83	1.15	0.75
F2b	1.60	1.40	0.75	18	0.46	5	15	0.55	0.51	1.17	0.73
G2a	5.00	6.13	-1.20	18	0.24	5	15	2.00	1.77	1.28	0.65
G2b	5.20	4.07	1.29	18	0.21	5	15	1.79	1.67	1.15	0.75
H2	5.40	4.93	0.75	18	0.46	5	15	1.67	1.03	2.63	0.16
CH2	5.40	5.47	-0.12	18	0.91	5	15	1.34	0.99	1.83	0.36
Total	105.10	102.63	0.43	18	0.67	5	15	8.79	11.61	1.74	0.63

Statistically significant differences between the results of pupils in groups DBF and INT were only proved with the results of the test task B2- 4 ($p=0.05$), in which the pupils at risk of school failure (DBF) achieved better results than pupils with no obvious risks of school failure (INT). Comparison of the results in this test task in graphic form is shown in box plot (Fig. 4).

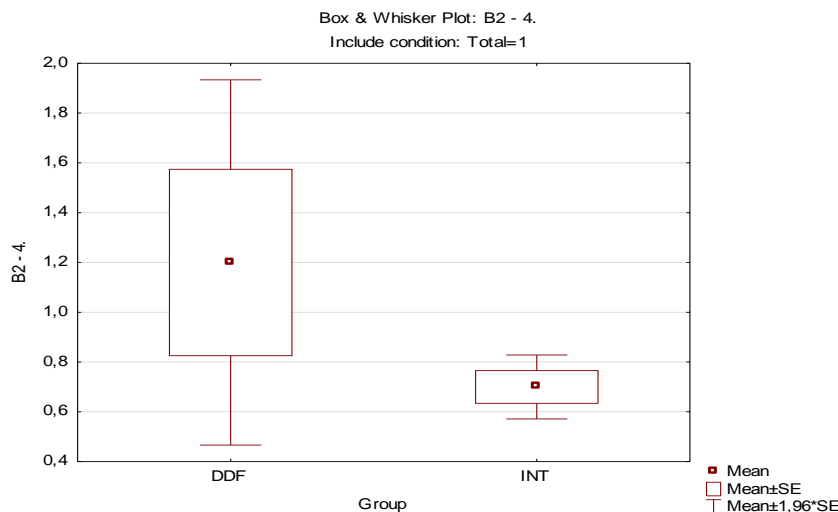


Figure 4. Comparison of the results in test task B2 – 4 in DBF group (pupils at risk of school failure at primary school) and INT (pupils with no obvious risks of school failure at primary school) in the form of a box plot.

However, H₂ hypothesis was not proved. Pupils with no obvious risks of school failure (INT) mostly achieve even worse results in separate test tasks than pupils at risk of school failure (DBF). Nevertheless, this result might be caused by very small sample in DBF group used for the pre-research.

Pre-research conclusion

Pre-research tested relevance and adequacy of the stimulus material in relation to the age and disabilities or disadvantages of individual groups of respondents. Statistical processing of the collected data revealed a surprising fact that pupils with no obvious risks of school failure (INT) mostly achieve lower scores in individual test tasks than pupils at risk of school failure (DBF). This result might be caused by very small sample of pupils in DBF group in the pre-research. Another possible interpretation of this result is the fact that the respondents are exposed to re-education and targeted intervention and are used to similar types of tasks so they can be more successful in them than the intact, “non-trained” group. Considering the fact that this is pre-research, this result has to be taken into consideration in the following stage – actual research. The research team will try to form two groups of research and comparison groups of respondents with DBF:

1. Group of children and pupils with DBF exposed to re-education
2. Group of children (and pupils) with compromised development related to DBF who are not exposed to any activities focused on eliminating the deficits (predominantly children in nurseries and those with deferred school entry)

In case that it is difficult to find sufficient number of respondents for both groups, it will be necessary to include at least one more group of respondents in the research – children and pupils with problems adequate to DBF and with no intervention.

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