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Dynamics of Intermodal Partial Functions and Body Scheme Orientation in Children and Pupils of 5-8 Years

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The article provides insight into the procedural aspect and theoretical framework of investigating the factors which influence educability and school success/failure rate in children in a research project of the Faculty of Education, Palacký University in Olomouc. The article focuses on the structure and dynamics of the function of body scheme orientation and on partial functions of an intermodal nature in children during their last year at nursery school and their first two years of primary school.

Keywords: educability, pupils with the need for support measures, partial function deficits, school failure, basic research, intermodal functions, body schema orientation.

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Валента М. Динамика интермодальных парциальных функций и ориентации схемы тела у детей и учеников в возрасте от 5 до 8 лет [Электронный ресурс] // Клиническая и специальная психология. 2018. Том 7. № 4. С. 61–75. doi: 10.17759/psyclin.2018070404

An introduction to the issues

The article evaluates partial results of ongoing research carried out at the Institute of Special Education Studies within the Faculty of Education in Olomouc. The research has

been focused on factors which affect the dynamics of educability in children and pupils with the need for special-education support measures; i.e. with special education needs. It focuses on (for the needs of this study) the dynamics of the following partial (basal) functions:

- spatial orientation (body scheme orientation);
- auditive-visual intermodal connections – words;
- visual-auditive intermodal connections – images.

Theoretical framework is based on the grounded theory of deficits in partial (basic) functions (further DBF) Affolter F. [1] and Sindelar B. [11] and on empirical evidence provided by these authors extended with the empirical evidence of so called partial reduction in performance by Scharinger and Scharinger [9]. 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 [1; 8; 11] – 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 [e.g. 2-3; 7; 15]. 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 [3]. 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 [4].

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.).

J. 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 [5]. 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.

Methodology Aspects of the Investigation

The aim of the whole project Palacký University in Olomouc is the identification, description, and comparison of the determinants of educability and its dynamics amongst children and pupils with the need for special education support measures.

This is a complex and multi-year research project; the published part is only a fraction of this research. The study design uses cross-sectional approach. *The partial aim of the survey*, which is the subject of this article, was to find out differences in test results in the hypotheses below (spacial orientation and intermodal connection).

The quantitative design of the investigation was applied to the data collections using the variable “test battery DPF Sindelar internationally reeducational and diagnostic exercises” [12] focused on the below stated markers. For the comparison (and the analysis of factors which affect the dynamics of individual basal functions, thus also affecting the educability of a child or pupil) between the target groups (nursery school – first grade of primary school - second grade of primary school) a unified stimulus material was used (“mid” material from the testing tasks for the target group of the first grade of primary school):

A. spatial orientation (body scheme orientation);

B. auditive-visual intermodal connections – words;

C. visual-auditive intermodal connections – images.

The research has been carried out through investigation of children (pupils) from four Moravian regions and Prague in the form of longitudinal research – the children are observed from their last (preparatory) year of pre-school education (nursery school) to the second grade of primary school (i.e. children and pupils ranging between 5 – 8 years of age).

The selection of children and pupils for the research sample was executed in the form of an intentional institutional selection, with 547 children and pupils in total (Table 1).

Table I

Research group

Child/pupil	5yrs	6yrs	7yrs	8yrs	Total by grade
Nursery school	122 (46/76)	110 (42/68)	6 (4 /2)	0	238
First grade primary	9 (3/6)	97 (40/57)	114 (61/53)	17 (11/6)	237
Second grade primary	0	0	29 (16/13)	43 (22/21)	72
Total by age	131	207	149	60	547

Note: The number in brackets indicates the number of boys and girls, respectively.

The statistical analysis did not demonstrate any difference in the performance of girls and boys in the monitored subtests. The sample included intact children and pupils with no DPF diagnosed (nor any deficit suspected). The table also indicates how many and how old the children were attending the nursery school and both grades of primary school – the statistical analysis of the collected data worked with these differentiations as well.

The research itself was preceded by *pre-research* which verified the methodology tools and the process scheme of investigation on a selection of target groups with the following numbers of respondents (testing stimulus material).

The research problem and the question of the published stage of investigation were phrased in the following way:

Is there some dynamics in the development of auditory partial functions in intact children and pupils on the continuum preparatory year at nursery school – first grade primary school – second grade primary school? If so, what are its dynamics?

The factual hypotheses were verified by statistical processing of quantitative data aimed at the differences in maturation of the observed partial functions in intact children of the preparatory year at nursery school and in intact pupils of the first and second grade of primary school.

Statistical hypotheses (without null H):

H1: There is a statistically significant difference in the results of spatial orientation – the body scheme orientation subtest in intact children of the preparatory year of nursery school and in intact pupils of the first and second grades of primary school.

H2: There is a statistically significant difference in the results of the auditive-visual intermodal connections subtest in intact children of the preparatory year of nursery school and in intact pupils of the first and second grades of primary school.

H3: There is a statistically significant difference in the results of the visual-auditive intermodal connections subtest in intact children of the preparatory year of nursery school and in intact pupils of the first and second grades of primary school.

A. Stimulus material for the subtest of spatial orientation (body scheme orientation), subtest E of the test battery:

The pupil copies the movements we show, while we sit or stand next to him or her so that he or she can see us as well; we look in his or her direction.

Instructions: I will show you some movements, watch me carefully and then copy me as accurately as possible.

Movements to be copied:

1. right hand on right hip and left hand on left ear
2. right hand on head and left hand on left shoulder
3. right hand on right shoulder and left hand on chin
4. right hand on chin and left hand on head
5. right hand on left shoulder and left hand on left knee
6. right hand on right shoulder and left hand on right ear
7. right hand on head and left hand on right shoulder
8. right hand on left knee and left hand on chin
9. right hand on left ear and left hand on right shoulder.

Assessment: each mistake (regardless of whether only one or both hands take a wrong position) is subtracted as one point from a maximum score of 9 points. If the pupil corrects the wrong position on his or her won, we do not count the mistake.

B. Stimulus material for the subtest of auditive-visual intermodal connections (words), subtest H of the test battery.

We say seven words to the pupil with a pause of one second after each word: *a tower – a caterpillar – a tractor – a lamp – curtains – a cube – an alarm clock.*

Opening instructions: I will say some words to you, try to remember them.

We then present a set of 28 picture cards to the pupil (seven cards show the words we said to the pupil); showing one card after another we ask the pupil if we named the object in the picture. If the pupil does not know what the picture shows, we ask first: *What do you think*? We only name the picture if the pupil does not know. We put the cards aside on two piles – one with the words named and the second with the words not named at the beginning of the exercise. Stimulus material see in Appendix A.

Instructions: I will show you some pictures now, tell me if there are things which I named and which you remembered.

Assessment: For each correct answer (a card) we add one point, for a wrong answer we subtract one point (max. 7 points).

The weakness of the stimulus material is the possibility of mixing up the pairs: a bulb – a lamp, a cube – a domino, a tower – a church. Therefore, if the pupil makes a mistake in these words and then (when presented with the second picture from the pair) he or she subsequently corrects him or herself, we do not count the mistake. The stimulus material for the subtest was composed of semantic Czech words; there is a need with other languages to create a set of words which stem from the grammar of the particular language, while the number of words as well as the sound monitored might be equal with the presented investigation.

C. Stimulus material for the subtest of visual-auditive connections (images), subtest CH of the test battery.

We place a set of eight pictures in front of the pupil with an interval of two seconds per picture. The pictures show an umbrella, pliers, a flower, a wellington boot, a bird, a spoon and a bell.

Opening instructions: I will show you some pictures, try to remember all of them. Stimulus material see Appendix B.

We then read a set of 29 words to the pupil: a dog – a cup – an apple – *an umbrella* – a girl – a hare – *pliers* – a hammer – a fork – a finger – plums – a tree – a house – *a flower* – a car – *a wellington boot* – a shoe – a table – a radio – the sun – *a bird* – a chair – a knife – a clock – *a spoon* – a bag – *a bell* – a stove – a door.

We pause after reading each word so that the pupil can say whether it is a word – an object in the picture or not, while we avoid eye-contact with the pupil and naturally say all the words with the same diction.

Instructions: I will now say some words to you and you will tell me if you saw them in the pictures or not.

Assessment: For each correct answer (a card), we add one point, for a wrong answer we subtract one point (max. 7 points).

The weakness of the stimulus material is the possibility of mixing up the pairs: a wellington boot – a shoe. If the pupil makes a mistake with these words and then (when the second word of the pair is said) he or she subsequently corrects him or herself, we do not count the mistake. The stimulus material for the subtest was composed of semantic Czech words; there is a need with other languages to create a set of words which stem from the grammar of the particular language, while the number of words as well as the sound monitored might be equal with the presented investigation.

Results of investigation

In this subchapter, the results of the survey can be found in the form of a table of statistical significance and a clear graph.

1. *Spatial orientation (body scheme orientation)*, subtest E of the test battery. We compared the distribution of different age groups with respect to a to the median of an analysis variable using the nonparametric Mann–Whitney test (see Table 2-3, Graph 1). The statistically significant differences in spatial orientation scores were obtained in groups of children from nursery and first grade primary school, and in pupils of 7-8 years in the first and second grades.

Table 2

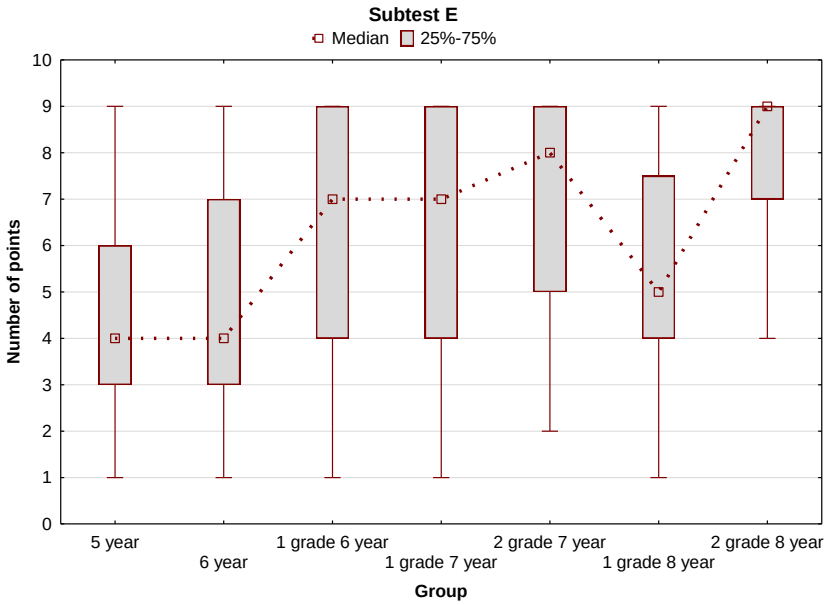
Median of Spatial orientation variable in different age groups

GROUPS	nursery 5yrs	nursery 6yrs	first grade 6yrs	first grade 7yrs	second grade 7yrs	first grade 8yrs	second grade 8yrs
medians	4.0	4.0	7.0	7.0	8.0	5.0	9.0

Table 3

P-values when comparing median of Spatial orientation in the groups (for Mann–Whitney test)

GROUPS	nurs. 5yrs: nurs. 6yrs	nurs. 6yrs: first gr. 6yrs	first gr. 6yrs: first gr. 7yrs	first gr. 7yrs: second gr. 7yrs	second gr. 7yrs: first gr. 8yrs	first gr. 8yrs: second gr. 8yrs	All groups mutually
p	0.32	0.00	0.72	0.16	0.03	0.00	0.000



Graph 1. The results of the subtest E

2. *Auditive-visual intermodal connections (words)*, subtest H of the test battery. We compared the distribution of different age groups with respect to a to the median of an analysis variable using the nonparametric Mann-Whitney test (see Table 4-5, Graph 2). The statistically significant differences in auditive-visual intermodal connections(words) scores were obtained in groups of children from nursery and first grade primary school (6 year), and in pupils of 8 years in the first and second grades.

Table 4

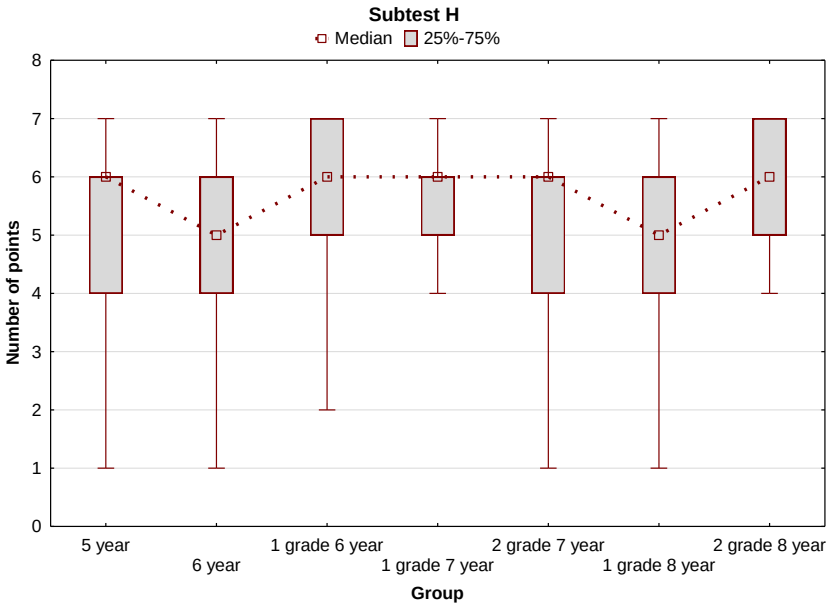
Median of Auditive-visual intermodal connections in different age groups

GROUPS	nursery 5yrs	nursery 6yrs	first grade 6yrs	first grade 7yrs	second grade 7yrs	first grade 8yrs	second grade 8yrs
medians	4.0	4.0	4.0	4.0	4.0	6.0	5.0

Table 5

P-values when comparing Auditive-visual intermodal connections in the groups (for Mann-Whitney test)

GROUPS	nurs. 5yrs: nurs. 6yrs	nurs. 6yrs: first gr. 6yrs	first gr. 6yrs: first gr. 7yrs	first gr. 7yrs: second gr. 7yrs	second gr.7yrs: first gr. 8yrs	first gr. 8yrs: second gr. 8yrs	All groups mutually
p	0.07	0.00	0.92	0.44	0.60	0.01	0.000



Graph 2. The results of the subtest H

3. *Visual-auditive connections (images)*, subtest CH of the test battery. We compared the distribution of different age groups with respect to a to the median of an analysis variable using the nonparametric Mann-Whitney test (see Table 6-7, Graph 3). We did not find statistically significant differences.

Table 6

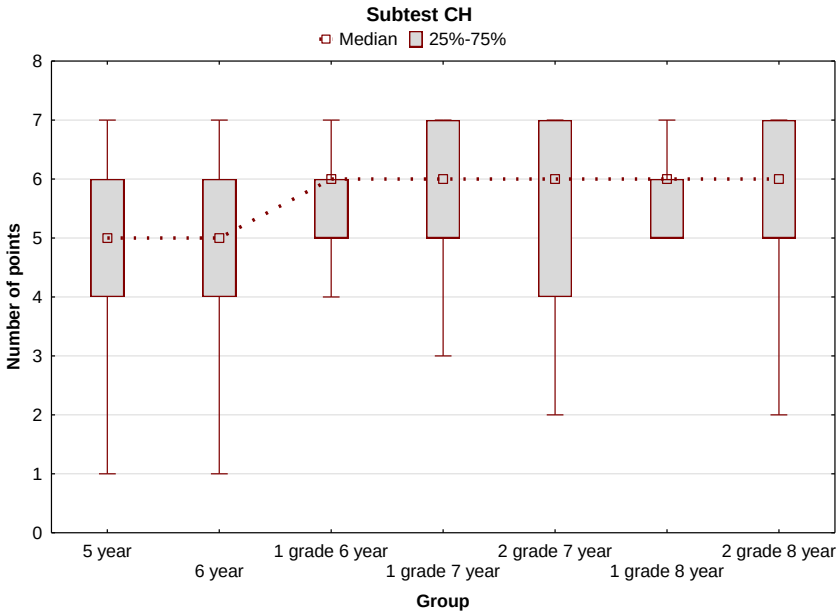
Median of Visual-auditive connections in different age groups

GROUPS	nursery 5yrs	nursery 6yrs	first grade 6yrs	first grade 7yrs	second grade 7yrs	first grade 8yrs	second grade 8yrs
medians	5.0	5.0	6.0	6.0	6.0	6.0	6.0

Table 7

P-values when comparing Visual-auditive connections in the groups (for Mann-Whitney test)

GROUPS	nurs. 5yrs: nurs. 6yrs	nurs. 6yrs: first gr. 6yrs	first gr. 6yrs: first gr. 7yrs	first gr. 7yrs: second gr. 7yrs	second gr.7yrs: first gr. 8yrs	first gr. 8yrs: second gr. 8yrs	All groups mutually
p	0.84	0.26	0.13	0.96	0.91	0.73	0.000



Graph 3. The results of the subtest CH

Discussion of the investigation results and a conclusion

The above stated quartile graphs reveal in a relatively clear way the data distribution in samples which focused on intermodal partial functions and body scheme orientation. The Mann-Whitney test tables then show the statistical significance of differences on the level of significance .05. The dynamics of the observed functions is evident from the graphs with the fact that:

- in case of body scheme orientation (subtest E) there is a clear rising trend in the maturation of the function in time with the fact that the quartile graph recorded a drop in the case of 8-year-old pupils in the first grade of primary school. This might be explained by potential issues in the area of school readiness (and deferred entry to primary school in these children).

- in auditive-visual intermodality (subtest H), there is a noticeable moderately rising trend in maturation of the partial function with a drop in the maturation of the function in 6-year-old children at nursery school (compared with 5-year-old children) and in 8-year-old pupils in the first grade of primary school (compared with 7-year-old second graders). The explanation seems to be the same as with the previous basal function.

- visual-auditive intermodality is characterized by a steady course over time; an exception is the boundary of 6-year-old children at nursery school and 6-year-old first graders at primary school, where there is a noticeable rise in the function.

It can be stated in conclusion that is it possible to reject (under the entire sample) null hypotheses of all three hypothetical statements.

The above stated results represent the third published part of an extensive investigation. The previous research reports focused on visual differentiation and memory, auditory differentiation of figure and background on the level of consonants, auditory memory and differentiation of speech on a verbal level.

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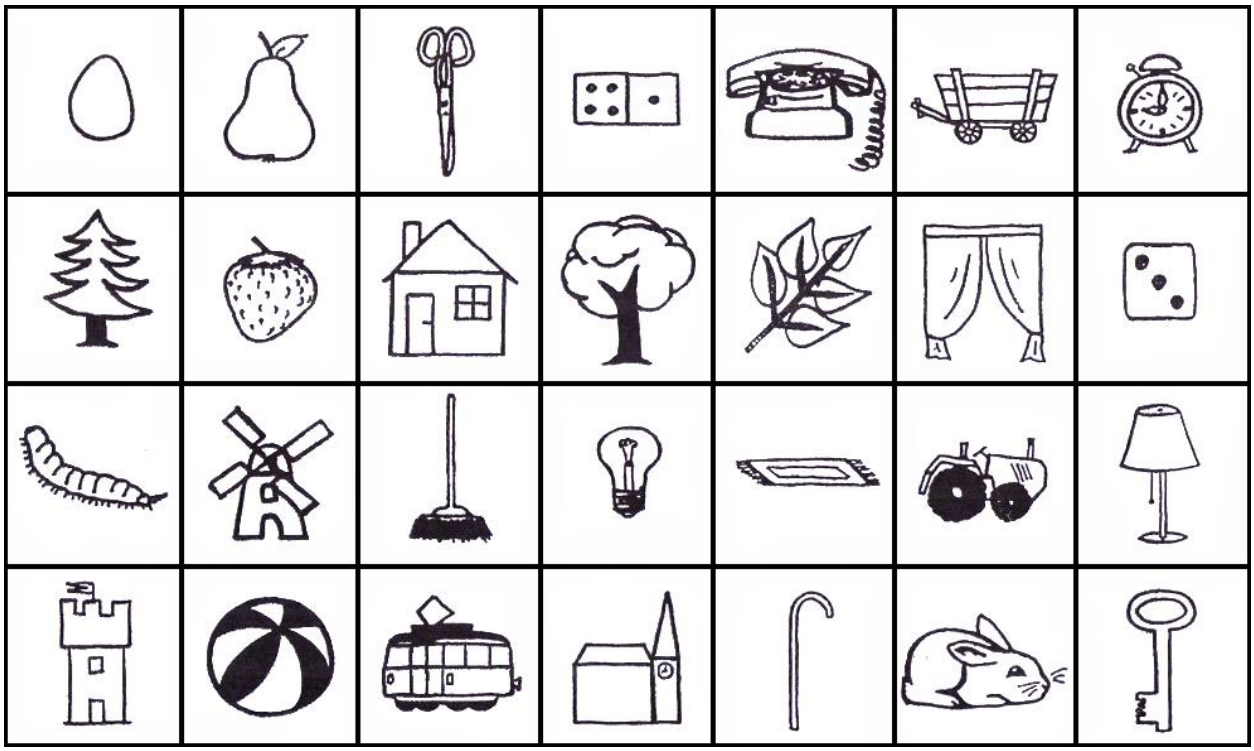
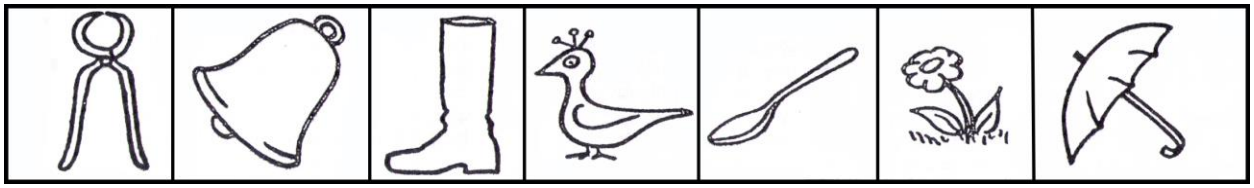
APPENDIX A

Stimulus material for subtest H



APPENDIX B

Stimulus material for subtest CH



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Динамика интермодальных парциальных функций и ориентации схемы тела у детей и учеников в возрасте от 5 до 8 лет

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Настоящая статья дает понимание процедурного аспекта и теоретических основ исследования факторов, влияющих на обучаемость и школьную успеваемость/ неуспеваемость у детей, включенных в исследовательский проект факультета образования Университета Палацкого в Оломуце. Статья посвящена структуре и динамике функции ориентации схемы тела, а также парциальным функциям, носящим интермодальную природу у детей последнего года обучения в детском саду и первых двух лет обучения в начальной школе.

Ключевые слова: обучаемость; ученики, требующие сопровождения; нарушения парциальных функций, школьная неуспеваемость, базовое исследование, интермодальные функции, ориентация схемы тела.

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