PARTIAL COGNITIVE FUNCTIONS AND READING COMPETENCE OF STUDENTS WITH MILD INTELLECTUAL DISABILITIES

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Study is the partial outcome of the research project *APVV-15-0071 Man with handicap in the literature for children and youth* (2016 – 2020).

Abstract: Aim of the research study is to analyse the relationship between partial cognitive functions (visual separation – figure/background differentiation, visual differentiation of shapes, visual memory, auditory separation - figure/background differentiation, auditory differentiation of speech, auditory memory, intermodal relations, perception of time sequence) in the context of reading competence development (reading technique and method, reading comprehension) of 4th grade pupils with mild intellectual disabilities educated in school integration in the Prešov region, Slovakia, in which we have followed current level of the variables (reading competence, partial cognitive functions) in selected research respondents. The research findings might contribute to the creation of targeted cognitive stimulation programme in the context of reading competence development of pupils with mild intellectual disabilities in younger school age.

Keywords: partial cognitive functions, reading competence, a pupil with mild intellectual disability, school integration.

Intention of the study roots in the current educational issue in Slovakia, which is related to full-valued and functional education of students with mild intellectual disabilities in the school inclusion settings. Our intention is focused on the issue of reading competence development through the stimulation of partial cognitive functions, which is a part of curricula of Slovak language and literature in elementary school (ISCED 1, 2016). It is necessary in this discourse that a teacher, in a process of school inclusion, will improve this key competence in pupils with mild intellectual disabilities as possible and in regard to current developmental state of their cognitive processes, because we cannot accept that the development of partial cognitive functions will be equable in each pupil, resp. that all the partial cognitive functions will be developed equably, which to a large extent predict also a level of their academic skills, including reading. A teacher cannot omit spontaneous individual development of a pupil with mild intellectual disabilities, which is delayed, but ongoing and thus predicts his learning potential.

The subject of our interest is searching the way, how to overcome dysfunctions, which a pupil with mild intellectual disabilities (MID) in the process of acquiring reading competence (reading technique and method, reading comprehension) has. In this regard we formulate the main objective – analyse the mutual relationship between selected partial cognitive functions in the context of reading competence development in pupils with mild intellectual disabilities educated within the school inclusion in 4th grade of elementary school, in fulfilling which we based on current level of the variables (reading competence, partial cognitive functions) in selected research respondents. Since there have not been noticed any similarly focused researches, our research findings were compared with available literature in the end.

1 Cognitive aspects of the reading competence stimulation of pupils with mild intellectual disabilities

The attributes of cognitive modifiability, respect for a pupil's potential including the student's complex development, these are the preconditions standing behind the philosophy of cognitive education which focuses, besides acquisition of knowledge and skills in individual learning areas, on the targeted development of cognitive processes needed by the pupil to master the curriculum as well as everyday life (Liptáková, 2012; Kovalčíková, 2010, 2017). It is viewed as a "purposeful and systematic development of the plasticity of functioning and use of the "matured" and the yet immature cognitive structures, as well as the development of future modifiability of thought under the influence of direct or indirect perception and recognition of the stimuli coming from the environment" (Kovalčíková, 2010, p. 38). Leeber (2006) adds that this teaching approach is process-oriented, i.e. it does not focus on the acquisition of knowledge, but also on how it is acquired, making this approach different from the traditional approach of education which is mainly result-oriented.

Strategies employed by a pupil in reading need to be considered as well. Of course, these vary depending on whether the reading is a beginner's reading or advanced reading. The Education Program for Pupils with MID (ISCED 1, 2009, 2016) incorporates the option of teaching strategy application into the learning-how-to-learn competence. Here we should realise that it is the teacher who drives a pupil to acquire this competence employing appropriate teaching styles (Terry, 2002; Ewing et al., 2011).

These pupils allow us to state that cognitive theory has disproved the outdated hypotheses claiming that pupils with lower intellect are unable to develop complex thought processes and cognitive functions. This is also confirmed by Sindelar (2007), Pokorná (2010), Medina (2012) who advocate the opinion that brain damage manifested as lower intellect (below-average IQ) does not necessarily mean that the cognitive processes (attention, perception, memory) have to be below average as well. On the contrary, they rather emphasise that partial cognitive functions predicate and influence school success more than the intellect, this also applies to the key skill of reading, which is not dependent primarily on the intellect, but on the development of cognitive functions. This opinion is also reflected in the research works of Stanovich (1986), Perfetti & Lesgold (1977, In: Blachman, 1991), Siegel (1999, In: Pokorná, 2010a), Blachman, (1984, 1989), Wagner (1986), Wagner & Torgesen (1987), Williams (1986) (In: Pokorná, 2010a), Feuerstein et al. (2002, 2008).

According to psycho-assessment, in Slovakia as the most complex method for assessment and remedy is considered the method Deficits of cognitive functions (Sindelar, adapted by Černý, 2008), which aim is to recognise in detail, in which perceptual and cognitive functions a pupil of school age manifests developmental deficit. This method aims to identify in detail the perceptual and cognitive functions showing developmental deficit in the pupil in order to develop an individualised remedial program, because the pupil does not suffer from the deficit itself but rather from its effect which manifests itself in school skills. The methodology offers training materials elaborated in detail for stimulation of individual partial cognitive functions respecting the order and succession of the cognitive development of a pupil (Sindelar, 2008). Different cognitive processes do not work in isolation but are intensively interconnected and are exhibited in the form of partial functions (basic, fundamental functions) in cognitive area. These are defined by Sindelar (2007, p. 8) as "...basic abilities which allow differentiation and development of higher mental functions, such as speech and thought. In the next development, they are prerequisite for the skills of reading, writing and appropriate behaviour." If their development is uneven, i.e. they are immature and less developed than the others, it results in the so-called deficits of partial functions. Graichen (1973, In: Pokorná 2010a, p. 95) defines them as a "decreased performance of individual factors or elements within a larger functional system which is necessary to master certain complex adaptation processes." Sindelar (2007, p. 8) defines them as "weakening of basic abilities which leads to problems with learning and behaviour."

We have been inspired by the method Deficits of partial functions in creation the cognitive stimulation programme in the context of reading competence development of pupils with MID in younger school age. The basis for its creation was examination of currently achieved level in the dimension of

partial cognitive functions and the level in the dimension of reading competence. Therefore, the objective is to analyse the relationship between the selected variables (reading competence, partial cognitive functions) of 4th grade pupils with mild intellectual disability educated in the conditions of school inclusion at the Slovak Language and Literature classes. This creates a research space, within which the research intentions in the context of examination of current level of reading competence and partial cognitive functions in cognitive processes of pupils with MID educated in school inclusion in elementary school is formulated.

2 Materials and Methods

Research problem and hypotheses formulation

Authors Doidge (2012), Medina (2012), Siegel (2003), Rolloff (1989, In: Sindelar, 2008), Stanovich (1986), Perfetti & Lesgold (1977, In: Blachman, 1991), Pokorná (2010b), Co-author (2015); Zezulková (2011), Valenta & Petráš et al. (2012), Žovinec (2014) point out the causal influence of cognitive processes and the related partial cognitive functions on school skills (reading, writing, counting, etc.) allowing us to deduce that these predictors also influence the reading competence of the pupils with MID despite their deficiencies stemming from the primary diagnosis. Therefore, our task is to uncover mutual relations between reading competence and partial functions in cognitive processes, employing targeted cognitive stimulation of this competence. Even though researchers have been paying enough attention to this issue in recent times, there has been no research which would analyse the mutual relationship between reading competence of the pupils with MID and partial cognitive functions.

The research problem was formulated as follows: What is the mutual relationship between the reading level (reading technique and method, reading comprehension) and the level (or deficits) of partial cognitive functions of 4th grade pupils with mild intellectual disability educated in school inclusion? Since we have not gained any relevant information concerning this view, we have also been searching for the answers to the research questions which have resulted from the research problem:

What is the reading level (reading technique and method, reading comprehension) of 4th grade pupils with mild intellectual disability educated in school inclusion?

Which deficits in partial cognitive functions are exhibited in 4th grade pupils with mild intellectual disability educated in school inclusion?

The main objective of the research is to analyse the relationship between the selected variables (reading competence, partial cognitive functions) of 4th grade pupils with mild intellectual disability educated in the conditions of school inclusion at the Slovak Language and Literature classes.

In relation to the main research objective and the analysis of the relationship of the selected variables (reading competence, partial cognitive functions), we formulate the following research hypotheses:

Hypothesis 1: The reading level within the reading method of 4th grade pupils with mild intellectual disability educated in school inclusion at an elementary school is under the statistically significant influence of the level of partial cognitive functions.

Hypothesis 2: The reading level within the mistakes in reading technique of 4th grade pupils with mild intellectual disability educated in school inclusion at an elementary school is under the statistically significant influence of the level of partial cognitive functions.

Hypothesis 3: The reading level within the reading comprehension of 4th grade pupils with mild intellectual disability educated in school inclusion at an elementary school correlates to a statistically significant extent with the level of partial cognitive functions.

Deductions from hypotheses 1, 2, and 3

In the hypothesis testing process, we work on the assumption that specific modalities (visual perception, auditory perception, tactile perception and kinaesthetic sense, memory, perception, attention) are one of the pillars of reading competence (reading method and technique, reading comprehension). These modalities are not isolated from each other, but overlap and can be observed as partial cognitive functions (visual separation or background/figure differentiation, visual differentiation of shapes, visual memory, auditory separation or figure/background differentiation, auditory differentiation of speech, auditory memory, intermodal relation, time sequence perception, tactile perception and kinaesthetic sense, spatial orientation) which are necessary for a pupil to produce a complex outcome, i.e. to be able to read, write, etc. Therefore, we suppose that the fewer deficits pupils with MID show in partial cognitive functions, the higher the level of their reading competence (reading technique and method, reading comprehension). This relationship is also indicated by specialised literature which describes the influence of cognitive functions on school skills (Blachman, 1991; Siegel, 2003; Leeber, 2006; Sindelar, 2007; Pokorná, 2010; Zezulková, 2011; Doidge, 2012; Liptáková, 2012; Krejčová, 2013; Žovinec, 2014) and we use it to support our presupposition.

Variable operationalisation

We will work with the following variables in the above-mentioned hypotheses:

1. Reading competence of a pupil with mild intellectual disability, where the attention will be focused on the level of reading technique and method, reading comprehension, which a pupil with MID in the 4th grade of elementary school is supposed to have. In this regard their dependence on partial cognitive functions, with the intention to point out their mutual relationship, resp. individual differences in the research sample will be analysed.
2. Partial cognitive functions of a pupil with mild intellectual disability, where partial cognitive functions mean cognitive functions which are not isolated, but overlap each other and can be observed in the form of partial cognitive functions, i.e. visual separation (background/figure differentiation), visual differentiation of shapes, visual memory, auditory separation (figure/background differentiation), auditory memory, tactile perception and kinaesthetic sense, spatial orientation. In this regard the dependence of reading competence level on partial cognitive functions, with the intention to point out their mutual relationship, resp. individual differences in the research sample will be analysed.

Research methods and research tools characteristics

To acquire representative data, we used a test as the research method and this test consisted of oral exercises. The test battery consisted of Deficits of Partial Functions (Sindelar, adapted by Černý, 2008), Pedagogical Diagnostics of Reading of the Pupils (Čižmarovič & Kalná, 1991). These tests are, based on specification of the objectives researched, knowledge tests classified as optimum performance tests (from the perspective of knowledge quality) with combined exercises (i.e. multiple choice and open response exercises) (Kompolt, In: Švec et al., 1998).

Pedagogical Diagnostics of Reading of the Pupils (Čižmarovič & Kalná 1991) is a test instrument to assess reading quality and analyse mistakes in a pupil's reading. Mistakes in the reading technique and method were scored in four main areas which were evaluated in more detail depending on the specification of the mistake made as follows: reading method area: a) spells, b) syllabifies, c) leaves words out, d) guesses words, e) double reading, f) fluent reading; mistakes in reading technique – this area consisted of two sub-areas: letters/sounds – a) confuses letters (confuses similarly shaped letters, confuses acoustically similar letters, confuses dissimilar letters), b) leaves letters out, c) adds letters; syllables –a) confuses syllables, b) leaves

syllables out, c) adds syllables; understanding – a) reproduces independently, b) reproduces only with the help of questions, c) does not understand the text)

Deficits of Partial Functions (Sindelar, adapted by Černý, 2008) is designed for the evaluation of partial cognitive functions. The test assesses the number of mistakes made by the pupil in an exam. This test contains oral exams, written exams and a practical exam. It consists of individual sub-tests focusing on: visual separation (figure/background differentiation) – exercise 9 – pictures, exercise 13 – words; visual differentiation – exercise 5, part 1 – pictures, exercise 5, part 1 – words; visual memory – exercise 11, part 1 – pictures, exercise 11, part 2 – pictures, exercise 11, part 3 – letters; auditory separation (figure/background differentiation) – exercise 2, part 1 – O, exercise 2, part 2 – N, exercise 6, part 3 – H, exercise 6, part 4 – EU; auditory differentiation – exercise 10; auditory memory – exercise 8, part 1 – sounds, exercise 8, part 2 – words 1, exercise 8, part 3 – words 2, exercise 8, part 4; visual-auditory intermodal relationship – exercise 14, part 1 – pictures, exercise 14, part 2 – letters; auditory-visual intermodal relationship – exercise 4, part 1 – words, exercise 4, part 2 – letters; time sequence perception – visual – exercise 7; time sequence perception – auditory– exercise 12.

Participants

The research was carried out in elementary schools in the Prešov Self-governing Region in Slovakia. To verify the research instruments, we made an intentional selection of the sample – 46 pupils with MID who were educated in the form of school inclusion in the 4th grade of an elementary school in the Prešov Self-governing Region, 26 boys (56.52%) and 20 girls (43.48%) – joined the testing. The testing involved students aged 10 to 12 years. The average age of students was 10.739 years. For statistical purposes, median at the level of 11 years was, considering the nature of the data, considered to be the mean value. The largest group – mode was comprised of students who had reached 10 years of age. All students (100%) attended the 4th grade of an elementary school, and for 26 of them (78.26%) it was the 4th year of school attendance and for 10 of them (21.74%) it was the 5th year of school attendance.

3 Results

3.1 Reading Competence of the Pupils with Mild Intellectual disability

Looking at the reading method of the pupils in the sample group allows us to state that their reading method is heterogeneous. According to the Education Program for Pupils with Mild Intellectual Disability (ISCED 1, 2009), 4th graders should be able to read short texts (in the area of reading technique) correctly and they should be able to comprehend the texts. What is more, they should already be training proper accent and natural intonation. However, the results (table 1) reveal that only 54.35% of the pupils have attained the fluent reading level, while 41.30% of the pupils utilise spelling in reading which should not occur by now in this grade. Double reading continues to be present in 47.83% of the pupils, whereas as many as 56.52% of the pupils guess words during reading and 26.09% of the pupils leave words out when reading.

A more detailed analysis of the mistakes in the reading technique and reading method revealed that dissimilar letters are confused by as many as 67.39% of the pupils; similarly, shaped letters are confused by 32.61% of the pupils; and 8.70% of the pupils confuse acoustically similar letters. Mistakes were also noted in adding letters, which occurred in 26.09% of the pupils, while 34.78% of the pupils left letters out. Syllables were confused by 10.87% of the pupils; 32.61% left syllables out; and 23.91% of the pupils added syllables, which is illustrated in table 2.

The deficits found in the reading method and the mistakes in reading technique of the pupils reflect insufficient acquisition of the reading comprehension skill, when only 26.09% of the pupils (12 pupils) of the total count were able to reproduce the text independently; 30.43% of the pupils (14 pupils) could reproduce the text with the help of questions; as many as 43.48% (20 pupils) did not understand the text read (more details in table 3).

As regards reading duration, we found out that the average reading duration was 246.48 seconds. Since the data was not normally distributed ($p<0.005$), the median which reached 168.50 seconds was taken as the mean value. The shortest time measured was 56.00 seconds, the longest 601.00 seconds. Based on the above data we can say that approximately 2/3 of the pupils read in a time span ranging from 56.00 to 340.17 seconds.

The average number of correctly read words was 66.70 words (out of the maximum 81 words). In the statistical processing of the number of correctly read words, the median (Med) reaching the level of 75 words was, considering the nature of data, taken as the mean value. The lowest number of correctly read words was 18, the highest 81 words. The average number of mistakes pupils made was 14.89. The median – 7 is taken as the mean value since the p-value calculated by the Anderson-Darling normality test is less than $\alpha = 0.05$. Not a single mistake has been observed with 6 pupils, the maximum number of mistakes was 65 (noticed with 1 student). The standard deviation is 18.27.

3.2 Partial Cognitive Functions of the Pupils with Mild Intellectual Disabilities

Relationship between Reading Competence and Partial Cognitive Functions

In order to be able to purposefully stimulate reading competence, we first need to know the cognitive determinants influencing it. Having collected the data above, we can now sink into evaluation and analysis of the relationships between the variables observed. The independent variable – reading competence – we measured was divided into the following areas: reading method, mistakes in reading technique, reading comprehension, and these areas were observed within this variable (considering the extent of the data collected, only the most significant data is provided). These measurable categories were then analysed in relation to the selected dependent variables, namely partial cognitive functions (considering the extent of the data collected, only the most significant data is provided). If the data entering statistical evaluation was not normally distributed, the non-parametric Mann-Whitney U-test was used to compare the groups. If the data was normally distributed, we used the parametric t-test. The calculated p-value in both tests was lower than 0.05, so there is a statistically significant difference between the analysed groups.

Relationship between Reading Competence – Reading Method and Partial Cognitive Functions

In the evaluation of the independent variable – reading method – the following categories were observed: spells, leaves words out, guesses words, double reading, fluent reading.

Based on the data provided in table 5, and the calculated p-value, it can be noted that pupils who employed spelling method in their reading (41.3% of the pupils) made more mistakes to a statistically significant extent in the areas of tactile perception and kinaesthetic sense ($p=0.001$), auditory separation (figure/background differentiation) ($p=0.000$), auditory differentiation of speech ($p=0.038$), auditory memory ($p=0.001$), visual separation (figure/background differentiation) ($p=0.032$), visual differentiation of shapes ($p=0.008$), two-dimensional spatial orientation ($p=0.007$), time sequence perception – visual ($p=0.013$), time sequence perception – auditory ($p=0.000$) than the students who did not employ spelling method during their reading (58.7% of the pupils). Based on the results we can reason that this area is not directly related to visual memory ($p=0.631$); however, all the more is it dependent on the other tiers of visual perception (visual separation, visual differentiation). Furthermore, a statistically significant difference was not confirmed in the area of spatial orientation – body scheme ($p=0.188$), auditory-visual ($p=0.174$) and visual-auditory intermodal relationship ($p=0.070$).

Based on table 6 and the calculated p-value it is evident that pupils who leave words out in reading (26.08% of the pupils) make more mistakes to a statistically significant extent, mainly in the areas of visual separation (figure/background differentiation) (p=0.005) and in spatial (two-dimensional) orientation (p=0.013) than the students who do not leave words out in reading (73.91% of the pupils). This area is not, based on the calculated p-value, and directly related to auditory perception, visual differentiation and memory, spatial orientation – body scheme, time sequence perception and intermodal relationships.

Regarding the word guessing category, table 7 makes it evident that pupils (56.52%) who guess words in reading make more mistakes on a statistically significant basis in the area of auditory separation (p=0.005); these findings were confirmed in all three exercises in the subtest for this area. Furthermore, these pupils make more mistakes in the areas of auditory differentiation of speech (p=0.001), in visual separation (p=0.031), in time sequence perception-auditory (p=0.000), in visual-auditory intermodal relationship (p=0.049) than pupils who do not guess words in reading (43.48%).

Table 8 shows that pupils who are held back in the transition phase of double reading (47.83%) make more mistakes (statistically significant) in the area of auditory separation (p=0.000), auditory differentiation of speech (p=0.001), auditory memory (p=0.002), visual separation (p=0.033), visual differentiation of shapes (p=0.018), spatial orientation (p=0.009), time sequence perception-auditory (p=0.000), time sequence perception-visual (p=0.028), visual-auditory intermodal relationship (p=0.020) than pupils not employing double reading in reading.

The above facts were proved for the dependent variable fluent reading (table 9), since students whose reading method was fluent reading (45,65% of the pupils) made fewer mistakes on a statistically significant basis in the areas of auditory separation (p=0.000), auditory differentiation of speech (p=0.005), auditory memory (p=0.005), visual separation (p=0.011), spatial orientation (p=0.001), time sequence perception- auditory (p=0.001), visual-auditory intermodal relationship (p=0.008) than pupils who could not read fluently (54.35% of the pupils).

Mistakes in Reading Technique and Partial Cognitive Functions

In evaluation of the independent variable – mistakes in reading technique, the following categories were observed and analysed: pupil confuses letters (similarly shaped, dissimilar letters), leaves letters out, confuses syllables, leaves syllable out, and adds syllables.

Analysing the variable – confusion of similarly shaped letters (table 10), it was evident that pupils who confuse similarly shaped letters (32.61%) make more mistakes on a statistically significant basis in the areas related to the visual sphere, particularly in visual separation (p=0.021), visual differentiation of shapes (p=0.029) than pupils not confusing similarly shaped letters (67.39% of the pupils). However, this variable has also been confirmed in the relationship to auditory separation (p=0.013), auditory differentiation of speech (p=0.036) including spatial orientation (p=0.010).

Viewing table 11, it is evident that pupils who leave letters out in reading (34.78% of students) make more mistakes on a statistically significant basis mainly in the area of spatial orientation (p=0.034), time sequence perception-visual (p=0.022) including visual separation (p=0.019), auditory separation (p=0.000), auditory differentiation of speech (p=0.008) than pupils who did not leave letters out during reading (65.22%).

Researching the variable – leaving syllables out (table 12) similar results were found as for the variable of letters omission. Furthermore, pupils who omitted syllables when reading (32.61% of the pupils) made more mistakes on a statistically significant basis in the areas of spatial orientation (p=0.006), time sequence perception-visual (p=0.000), time sequence perception-auditory (p=0.000) including visual separation (p=0.009), auditory separation (p=0.000), auditory differentiation of speech (p=0.001) than the pupils who did not leave syllables out (67.39% of the pupils).

Reading Comprehension and Partial Cognitive Functions

All the above described facts have also been confirmed by the following analysis, which was conducted within the context of evaluating the independent variable – reading comprehension using the correlation analysis method and its results are summed up in the correlation table 13. The first row of the table states the calculated Pearson correlation coefficient (r). To evaluate the extent of correlation, we used Cohen's scale (1988) (table 13).

Thus table 14 allows us to state that the worse the pupil reproduced the text the higher error rate he/she reached in partial cognitive functions, i.e. in tactile perception and kinaesthetic sense (r = 0.61), auditory separation (r = 0.64), auditory differentiation of speech (r = 0.46), auditory memory (r = 0.55), visual separation (r = 0.42), visual differentiation of shapes (r = 0.47), in spatial orientation (r = 0.41), time sequence perception-auditory (r = 0.44), time sequence perception-visual (r = 0.38), visual-auditory intermodal relationship (r = 0,52), in which the measured correlation was moderate up to strong. The correlation relationship measured for the auditory-visual intermodal relationship was small (r = 0.21) and for the visual memory it was insubstantial (r = 0.10).

4 Discussion

In connection to research results from descriptive and inductive statistics of the current state and significant mutual relationships of examined variables, the most important findings will be described and compared with the available theoretical views, since we have not registered any research works, whether in Slovakia or abroad, dealing with the level and relationship of reading competence and partial cognitive functions in 4th grade pupils with MID educated in the conditions of school inclusion. These most important findings are provided based on the main research objective, particularly the analysis of the relationship between the selected variables (reading competence, partial cognitive functions) in 4th grade pupils with mild intellectual disability educated in school inclusion at the Slovak Language and Literature classes.

Research question 1: What is the reading level (reading technique and method, reading comprehension) of 4th grade pupils with mild intellectual disability educated in school inclusion?

Based on the data collected, we can say that there are substantial differences among 4th grade pupils with MID who are educated by way of school inclusion in the area of reading method which was documented in the preceding statistics. Out of the total number of tested pupils (46), 54.35% of students could read the text fluently; however, the pupils' reading method showed errors which resided in reading by spelling (41.30% of the pupils), confusion of letters during reading (15.22% of the pupils), guessing words (56.52% of the pupils), in leaving words out (26.09% of the pupils). The deficits of the pupils found in the reading method also correlated with the higher error rate in the area of spatial orientation.

This diversity in the reading technique and method in the pupils with mild intellectual disability was also exhibited in the insufficient reproduction of the text read, when less than a third of the pupils was able to reproduce the text independently and as many as 43.48% of the pupils did not understand the text they had read. Furthermore, we have also found out that the pupils are unable to reproduce the text even if assisted by questions, which is a task which should already have been mastered in the 3rd grade.

Regarding the time required to read the text, which is another indicator of the reading level, we found out that approximately 2/3 of the pupils needed 56.0 to 340.17 seconds to read the text (of 81 words).

Research question 2: Which deficits in partial cognitive functions are exhibited in 4th grade pupils with mild intellectual disability educated in school inclusion?

Based on the collected data we can evaluate current level of individual partial cognitive functions in the cognitive processes of pupils with MID:

Tactile perception and kinaesthetic sense, body scheme and spatial orientation - as many as 58.70% of the pupils could not distinguish materials by touch; as Bednářová & Šmardová (2007) and Sindelar (2008) note, tactile perception and kinaesthetic sense preconditions the perception of body scheme; the fact that as many as 76.09% of the pupils made a maximum number of mistakes only confirms this theoretical hypothesis; the pupils with MID have problems with spatial orientation, but researchers believe that if they receive adequate leadership and stimulation, problems in this area do not have to come to the surface (Lečbych, In: Valenta, Michalík, Lečbych et al., 2012); our sample group confirmed this fact in the re-drawing exercise when as many as 73.91% of the pupils failed to correctly place the re-drawn pictures in space although they isolated them from the background (visual separation), and so this area opens room for considering the influence of another variable, namely the social environment.

In the area of visual perception – the area of visual separation (figure/background differentiation) is described by specialised literature in terms of limited discrimination of figure and background in the pupils with MID with pictures from the background or letters in a text. However, this generalising view was not confirmed to the full extent since only 13.04% of the pupils could not isolate a picture from the background and as many as 30.43% of the pupils did not make a single mistake in the word re-writing exercise. This allows us to conclude that pupils with MID do not suffer from significant difficulties in this area. However, this does not apply to visual differentiation described below; visual differentiation is characterised by professional literature (Petráš, In: Valenta, Michalík, Lečbych et al., 2012) as troublesome in the pupils with MID when they perceive the whole as a set of details and relations between them. This view was confirmed when nearly two thirds of the pupils made 6 to 10 mistakes (out of the maximum number of 10 mistakes). The opinion described in specialised literature that pupils with mild intellectual disability often confuse similarly shaped letters was only confirmed for a third of the pupils. This allows us to conclude that pupils with MID have more difficulties in this second phase of visual perception, which also influences the level of visual memory and so we can presuppose that if pupils with MID fail to correctly distinguish details by sight, this deficiency also hinders their theoretical memorisation, retaining and recalling; as regards the area of visual memory of the pupils with mild intellectual disability, Svoboda (In: Valenta, Michalík, Lečbych et al., 2012) makes a general note about the memory of the pupils with mild intellectual disability, that it is predominantly mechanic, concrete and short-term, while Pipeková (2006) adds that it is conditioned by insufficient quality of primary reception of information by way of perception, in our case visual perception. In our testing, we only assessed the short-term visual memory which exhibited, as has already been mentioned, significant deficiencies in the pupils with mild intellectual disability, also owing to the above described facts. In this area, pupils with mild intellectual disability employed compensatory techniques engaging auditory perception showing better scores compared to visual perception. This was also confirmed by the results recorded in the part requiring pupils to work with unknown shapes (complex geometric shapes), in which nearly 2/3 of the pupils made 5 to 8 mistakes (out of the maximum number of 8 mistakes). Nevertheless, it should be emphasised here that 2/3 of the pupils made 0 to 4 mistakes in the exercise requiring them to remember letters. This allows us to reason that pupils with mild intellectual disability do not work in this area with visual memory only, since it shows significant limitations resulting from the deficiencies in other areas. They can compensate for deficiencies in this area to some extent by employing auditory perception which is described below.

In the area of auditory perception – seems to be better in the pupils with MID than the visual perception, within the auditory separation (figure/background differentiation), nearly a half of students did not make a single mistake in differentiation of phonemes in a word. This finding was also confirmed in reading when only 8.70% of the pupils confused acoustically similar letters. This allows us to reason that these results do not confirm the views held by some authors (Petráš, In: Valenta, Michalík, Lečbych et al., 2012) that pupils with mild intellectual disability have low phonological awareness (auditory analysis and synthesis). We agree with Zezulková (2011) who asserts, based on the research she made that these pupils reached a good up to very good level in the areas of first sound isolation (74.6% success) and in sound synthesis (56.00% success); in the area of auditory differentiation, pupils with mild intellectual disability achieved positive results. As many as 41.30% of the pupils did not make any mistake and 91.30% of the pupils made 0 to 7 mistakes (out of the maximum number of 15 mistakes). Based on this, we can conclude that pupils with mild intellectual disability do not have any significant difficulties in this phase either. This finding is confirmed in Zezulková's research (2011) as well (N = 50 pupils with mild intellectual disability), resulting in low figures in omission of sounds (11.6%), syllables (13.6%), rhyme production (28.8%), sound substitution (34%) and word analysis to sounds (40.4%) in the pupils with mild intellectual disability; a good level in the first syllable isolation (55.2%), synthesis of sounds (56%), recognition of rhymes (64.4%), first sound isolation (74.6%); and a very good level in synthesis of syllables (82%) and analysis of words into syllables (94%); the peculiarities in the area of auditory memory described in specialised literature as a difficulty appearing in the pupils with mild intellectual disability with retaining words and sentences heard in the short-term memory (Pipeková, 2006) were also confirmed by the results of our research. Findings in this area and the greatest percentage of mistakes allow us to conclude that pupils with mild intellectual disability can remember 3 to 5 successive phonemes, 3 rhyming and non-rhyming words.

Analysis of the Relationship between Partial Cognitive Functions and Reading Competence in the Pupils with Mild Intellectual Disability

Given that the data included in statistic do not have normal distribution, for the comparison Mann-Whitney U-test and T-test were used, where applicable that if the calculated p-value is lower than 0,05, then there is statistically significant difference among analysed groups. In our testing of hypotheses, we presuppose that one of the pillars of reading competence (reading technique and method, reading comprehension) includes specific modalities (visual perception, auditory perception, tactile perception and kinaesthetic sense, as well as memory, perception, attention) which do not work in isolation but rather overlap, and which can be observed as partial cognitive functions which are necessary for the pupil to produce a complex performance, i.e. to be able to read, write, etc. Therefore, we suppose that the fewer mistakes pupils with mild intellectual disability make in the area of partial cognitive functions, the fewer mistakes in the reading method and techniques in quantitative tests. This relationship is also implied in specialised literature which describes the influence of cognitive functions on school skills (Blachman, 1991; Siegel, 2003; Leeber, 2006; Sindelar, 2007, 2008; Author, 2009; Pokorná, 2010; Zezulková, 2011; Doidge, 2012; Liptáková, 2012; Krejčová, 2013; Co-author, 2013); Žovinec, 2014) which we have used to support our hypothesis.

Hypothesis 1: The reading level within reading method of 4th grade pupils with mild intellectual disability educated in school inclusion at an elementary school is under a statistically significant influence of the level of partial cognitive functions.

The independent variable – reading method – was observed in detail and the hypothesis defined was verified by the areas: (pupil) spells, leaves words out, guesses words, employs double reading, fluent reading. The sample group was divided by the variables monitored into two groups depending on whether the variable occurred or did not occur.

Hypothesis 1 was confirmed in the pupils, who:

- employed spelling made more mistakes on a statistically significant basis particularly in visual and auditory separation as well as in the tactile perception and kinaesthetic sense and in the interconnected areas than the pupils who did not use spelling in the reading assessment test. This also confirms the findings in specialised literature (Sindelar, 2008; Zezulková, 2011) that the weakening of a pupil's basic tiers of partial cognitive functions also influences higher tiers which are built upon them, and we also observed a statistically significant difference in the subsequent tiers of visual differentiation of shapes, auditory differentiation of speech, auditory memory, two-dimensional spatial orientation including time sequence perception – visual and auditory.;
- employed double reading when reading made more mistakes on a statistically significant basis in visual separation and auditory separation and in tactile perception and kinaesthetic sense than pupils who did not read using the double reading method. Furthermore, these pupils also make more mistakes on a statistically significant basis in the areas of auditory differentiation of speech, auditory memory, spatial orientation, time sequence perception – auditory and visual. This finding is congruent with the findings of Bednářová & Šmardová (2011), Zezulková (2011), who state that if a pupil's auditory perception is weakened, he/she reads a particular word or its part twice or several times in a row, pre-reads it, etc.;
- read by way of fluent reading made fewer mistakes on a statistically significant basis in visual and auditory separation, in auditory differentiation and memory, in tactile perception and kinaesthetic sense, and in the interconnected two-dimensional spatial orientation including time sequence perception – auditory and visual-auditory intermodal relationships than pupils who did not read fluently. The results we arrived at are also in agreement with the results of Stanovich (1986) (In: Lechta, 2002); Lurija (1983) (In: Lechta, 2002); Sindelar (2008); Pokorná (2010); Bednářová & Šmardová (2011); Kulišťák (2011); Zezulková (2011); Co-author (2017);
- left words out (26.08% of the pupils) made more mistakes on a statistically significant basis in the area of visual separation, spatial orientation and time sequence perception than pupils who did not leave words out in the reading assessment test; the same finding is also confirmed by Bednářová & Šmardová (2011), Sindelar (2008);
- guessed words (56.52% of the pupils) made more mistakes on a statistically significant basis mainly in the area of auditory separation, auditory differentiation and in visual separation than pupils who did not guess words in the reading assessment test. These findings are in agreement with the assertion of Torgesen (In: Pokorná, 2010), who notes that pupils do not guess words based on the first or last sound or its shape, which requires a perfect analysis of the word in the auditory as well as visual area.

Hypothesis 2: The reading level within mistakes in reading technique of 4th grade pupils with mild intellectual disability educated in school inclusion at an elementary school is under a statistically significant influence of the level of partial cognitive functions.

The independent variable – mistakes in reading technique – was carefully observed and the hypothesis was verified according to areas: confusion of letters (similarly shaped, acoustically similar, dissimilar), leaving letters out, adding letters, confusion of syllables, leaving syllables out, adding syllables. The sample group was divided by the variables observed into two groups depending on whether the relevant variable appeared or did not appear in the pupils. Hereafter we only describe the variables for which the hypothesis was confirmed.

Hypothesis 2 was confirmed in the pupils, who:

- confused similarly shaped letters made more mistakes on a statistically significant basis in the area of visual separation and differentiation, auditory separation and differentiation and in spatial orientation than pupils who did not confuse similarly shaped letters in the reading assessment test. These findings coincide with the theoretical findings of Sindelar (2008), Bednářová & Šmardová (2011) and Zezulková (2011), who claim that confusion of dissimilar letters is caused by the deficiencies in the visual area and this consequently leads to mistakes in reading;
- left letters or syllables out made more mistakes on a statistically significant basis particularly in the area of auditory separation, differentiation and in spatial orientation than pupils who did not leave letters or syllables out in the reading assessment test;
- added letters only in the area of time sequence perception – auditory, which means that pupils who added letters during reading made more mistakes on a statistically significant basis in the area of time sequence perception – auditory than the pupils who did not add letters;
- added syllables only for the dependent variable – spatial orientation and time sequence perception – auditory.

Hypothesis 3: The reading level in reading comprehension of 4th grade pupils with mild intellectual disability educated in school inclusion at an elementary school correlates to a statistically significant extent with the level of partial cognitive functions.

When analysing the independent variable – reading comprehension – the hypothesis was confirmed: strong correlation was found in tactile perception and kinaesthetic sense, auditory separation, auditory memory, visual-auditory intermodal relationship; moderate correlation was found in the areas of auditory differentiation of speech, visual differentiation of shapes, spatial orientation, time sequence perception – auditory, time sequence perception – visual which showed moderate up to strong correlation. Thus, the worse the pupil's reproduction of the text, the higher the error rate in the above described areas of cognitive functions. These findings confirm mutual relations between reading competence and partial cognitive functions described in the analysis of the relationship of partial cognitive functions and reading competence, which is also indicated by Zelinková (1994), Gavora (2003, 2008), Sindelar (2008), Pokorná (2010b).

5 Conclusion

Based on the understanding of the current state of reading competence and partial cognitive functions of pupils with MID was our intention to know the mutual relationships between reading competence and partial cognitive functions for the potential and intentional stimulation. Individual relations were analysed in a relation to different assessed categories examined within the reading competence variable (reading method, mistakes in reading techniques, reading comprehension) and subsequently described the most important and statistically significant relationships. At the same time, it is necessary to consider further variables which influence the reading level of these pupils including the social factors as well (family, school, educational approach, methods of pedagogues, etc.), while we should not forget the spontaneous development, although delayed and partially limited, requiring pupils to try harder and teachers to pay more attention for their optimal development.

Despite that the research findings might be expected, we consider it very important to deal with the issue, particularly regarding the inclusive trends and inclusion of pupils with MID into the mainstream education. The results we have found indicate at least two important issues, which require further examination. The first is the development of reading competence

of a pupil with MID by a teacher or a teacher's assistant as a presumption of overall academic skills development and functioning in other academic subjects. The second is specific support of a pupils with MID either in terms of teaching subjects upgrade focused on the partial cognitive functions' stimulation or the implementation of verified and qualified methodologies and stimulation programmes into practice.

We conclude that with the paper we attempted to point out one of possible solutions of effective education of pupils with MID in the mainstream education in Slovakia, in the context of current trend of inclusive education of pupils with special educational needs with focus on the cognitive stimulation of their reading competence.

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Primary Paper Section: A

Secondary Paper Section: AM, AN

Tables

Table 1: Reading Method

		spells	syllabifies	leaves words out	guesses words	double reading	fluent reading
Reading method	number of pupils	19	7	12	26	22	25
	share in %	41.30	15.22	26.09	56.52	47.83	54.35

Table 2: Mistakes in reading technique

Mistakes in reading technique		letters/sounds					syllables		
		confuses letters							
		similarly shaped	acoustically similar	dissimilar	leaves letters out	adds letters	confuses syllables	leaves syllables out	adds syllables
	number of pupils	15	4	31	16	12	5	15	11
	share in %	**32.61**	**8.70**	**67.39**	**34.78**	**26.09**	**10.87**	**32.61**	**23.91**

Table 3: Reading comprehension

Comprehension		reproduces independently		reproduces only with the help of questions	does not understand the text
	number of pupils	12		14	20
	share in %	26.09		30.43	43.48

Table 4: Evaluation of Partial Cognitive Functions of the Pupils with Mild Intellectual

Variables	Average	Standard deviation	Dispersion	Minimum	Median	Maximum
Tactile perception and kinaesthetic sense	3.609	2.902	8.421	0	6	6
Auditory separation	3.804	5.536	30.65	0	1	18
Auditory separation	4.261	5.651	31.93	0	1	18
Spatial orientation – body scheme	7.435	3.264	10.651	0	9	9
Auditory-visual intermodal relationship	4.761	2.531	6.408	0	5	14
Auditory-visual intermodal relationship	3.848	2.385	5.687	0	4	10
Visual differentiation of shapes	7.043	2.812	7.909	2	7.5	10
Auditory separation	4.348	5.595	31.299	0	2	17
Time sequence perception – visual	9.83	6.78	46.01	0	10	25
Auditory memory	1.217	0.987	0.974	0	1	3
Auditory memory	2.087	0.755	0.57	1	2	3
Auditory memory	2.087	0.865	0.748	0	2	3
Two-dimensional spatial orientation/ visual separation	-	-	-	-	-	-
Two-dimensional spatial orientation/ visual separation	10.739	5.771	33.308	1	10.5	22
Two-dimensional spatial orientation/ visual separation	15.239	5.77	33.297	2	16.5	25
Auditory differentiation of speech	2.609	3.409	11.621	0	2	15
Visual memory	2.326	1.989	3.958	0	2	7
Visual memory	5.5	1.986	3.944	2	6	8
Visual memory	3.391	2.38	5.666	0	4	8
Time sequence perception – auditory	10.457	5.141	26.431	0	10	25
Visual separation	6.87	14.33	205.32	0	1	62
Visual-auditory intermodal relationship	4.891	4.9	24.01	0	3	20
Visual-auditory intermodal relationship	8.087	5.577	31.103	0	8	18

Table 5: Analysis of the relationship between reading method – spelling and partial cognitive functions

Independent variable	Spells – Number of students 19						Does not spell – Number of students 27							
Dependent variable	Average	Standard deviation	Minimum	Median	Maximum	Normality test	Average	Standard deviation	Minimum	Median	Maximum	Normality test	Type of test*	P-value
Tactile perception and kinaesthetic sense	5.368	1.892	0	6	6	<0.005	2.37	2.871	0	0	6	<0.005	1	0.001
Auditory separation	7.89	6.07	0	7	18	0.171	0.926	2.586	0	0	13	<0.005	1	0.000
Visual differentiation of shapes	8.368	1.95	4	9	10	<0.005	6.111	2.979	2	7	10	0.010	1	0.008
Time sequence perception - visual	12.74	5.61	5	10	25	0.204	7.78	6.88	0	7	25	0.080	2	0.013
Auditory memory	1.789	0.976	0	2	3	<0.005	0.815	0.786	0	1	2	<0.005	1	0.001
Visual separation	12.89	5.36	5	12	21	0.467	9.22	5.65	1	9	22	0.788	2	0.032
Two-dimensional spatial orientation	17.89	5.17	5	18	25	0.703	13.37	5.51	2	15	21	0.100	2	0.007
Auditory differentiation of speech	4	4.23	0	3	15	0.023	1.63	2.306	0	0	8	<0.005	1	0.038
Time sequence perception – auditory	13.63	5.67	2	13	25	0.010	8.222	3.309	0	10	15	<0.005	1	0.000

*Type of test: 1 – Mann-Whitney U-test, 2 – T-test

Table 6: Analysis of the relationship between reading method – leaving words out and partial cognitive functions

Independent variable	Leaves words out – Number of students 12						Does not leave words out – Number of students 34							
Dependent variable	Average	Standard deviation	Minimum	Median	Maximum	Normality test	Average	Standard deviation	Minimum	Median	Maximum	Normality test	Type of test*	P-value
Visual separation	18.5	23.88	0	4.5	62	<0.005	2.765	4.831	0	1	21	<0.005	1	0.005
Spatial orientation	18.58	5.93	5	20.5	25	0.275	14.059	5.308	2	15.5	24	0.036	1	0.013

*Type of test: 1 – Mann-Whitney U-test, 2 – T-test

Table 7: Analysis of the relationship between reading method – word guessing and partial cognitive functions

Independent variable	Guesses words – Number of students 26						Does not guess words – Number of students 20							
Dependent variable	Average	Standard deviation	Minimum	Median	Maximum	Normality test	Average	Standard deviation	Minimum	Median	Maximum	Normality test	Type of test*	P-value
Auditory separation	5.92	6.39	0	3	18	<0.005	1.05	2.188	0	0	9	<0.005	1	0.002
Auditory separation	6.62	5.88	0	5.5	18	0.019	1.2	3.563	0	0	16	<0.005	1	0.000
Auditory separation	6.62	5.78	0	4.5	17	0.009	1.4	3.747	0	0	16	<0.005	1	0.000
Auditory differentiation of speech	3.692	3.519	0	3	15	0.027	1.2	2.745	0	0	12	<0.005	1	0.001
Time sequence perception –	12.58	5.28	3	10	25	<0.005	7.7	3.435	0	10	10	<0.005	1	0.000

auditory														
Visual separation	10.46	18.08	0	2	62	<0.005	2.2	3.942	0	1	16	<0.005	1	0.031
Visual-auditory intermodal relationship	6.35	5.73	0	6	20	0.017	3	2.656	0	2.5	11	0.153	1	0.049

*Type of test: 1 – Mann-Whitney U-test, 2 – T-test

Table 8: Analysis of the relationship between reading method – double reading and partial cognitive functions

Independent variable	**Double reading – Number of students 22**						**Without double reading – Number of students 24**							
Dependent variable	**Average**	**Standard deviation**	**Minimum**	**Median**	**Maximum**	**Normality test**	**Average**	**Standard deviation**	**Minimum**	**Median**	**Maximum**	**Normality test**	**Type of test***	**P-value**
Auditory separation	6.86	6.22	0	6	18	0.028	1	2.735	0	0	13	<0.005	1	0.000
Visual differentiation of shapes	8.091	2.266	2	9	10	<0.005	6.083	2.962	2	6.5	10	0.036	1	0.018
Time sequence perception - visual	12.09	5.89	0	10	25	0,396	7.75	7	0	6	25	0.072	2	0.028
Auditory memory	1.682	0.995	0	2	3	<0.005	0.792	0.779	0	1	2	<0.005	1	0.002
Spatial orientation	17.5	5.1	5	18	25	0.803	13.17	5.66	2	13.5	21	0.182	2	0.009
Auditory differentiation of speech	4.318	4.052	0	3.5	15	0.080	1.042	1.546	0	0	6	<0.005	1	0.001
Time sequence perception – auditory	13.09	5.43	2	10	25	<0.005	8.042	3.47	0	10	15	<0.005	1	0.000
Visual separation	11.41	19.21	0	2	62	<0.005	2.71	5.18	0	1	21	<0.005	1	0.033
Visual-auditory intermodal relationship	6.77	5.82	0	5	20	0.008	3.167	3.088	0	2	11	0.025	1	0.020

*Type of test: 1 – Mann-Whitney U-test, 2 – T-test

Table 9: Analysis of the relationship between reading method – fluent reading and partial cognitive functions

Independent variable	**Fluent reading – Number of students 25**						**Reading is not fluent – Number of students 21**							
Dependent variable	**Average**	**Standard deviation**	**Minimum**	**Median**	**Maximum**	**Normality test**	**Average**	**Standard deviation**	**Minimum**	**Median**	**Maximum**	**Normality test**	**Type of test***	**P-value**
Auditory separation	0.611	3.054	0	0	15	<0.005	1.34	6.12	0	7	18	0.082	1	0.000
Auditory memory	0.16	0.8	0	1	2	<0.005	0.222	1.017	0	2	3	<0.005	1	0.005
Visual separation	1.16	5.78	1	8	22	0.454	1.08	4.95	5	12	21	0.450	2	0.011
Spatial orientation	1.09	5.44	2	12	21	0.338	1.05	4.81	5	18	25	0.377	2	0.001
Auditory differentiation of speech	0.411	2.056	0	0	8	<0.005	0.887	4.066	0	3	15	0.047	1	0.005
Time sequence perception – auditory	0.734	3.671	0	10	15	<0.005	1.21	5.55	2	10	25	<0.005	1	0.001
Visual-auditory intermodal relationship	0.584	2.922	0	2	11	0.028	1.28	5.86	0	7	20	0.016	1	0.008

*Type of test: 1 – Mann-Whitney U-test, 2 – T-test

Table 10: Analysis of the relationship between mistakes in reading technique – confusion of similarly shaped letters and partial cognitive functions

Independent variable	**Confuses similarly shaped letters – Number of students 15**						**Does not confuse similarly shaped letters – Number of students 31**							
Dependent variable	**Average**	**Standard deviation**	**Minimum**	**Median**	**Maximum**	**Normality test**	**Average**	**Standard deviation**	**Minimum**	**Median**	**Maximum**	**Normality test**	**Type of test***	**P-value**
Auditory separation	7.33	6.45	0	9	18	0.058	2.774	4.631	0	0	16	<0.005	1	0.013

Visual differentiation of shapes	8.4	2.063	3	9	10	<0.005	6.387	2.918	2	7	10	0.009	1	0.029
Visual separation	13.53	5.82	5	14	22	0.252	9.387	5.327	1	10	21	0.599	2	0.021
Spatial orientation	18.33	5.6	5	19	25	0.094	13.742	5.31	2	15	24	0.328	2	0.010
Auditory differentiation of speech	3.8	3.858	0	3	15	0.010	2.032	3.071	0	0	12	<0.005	1	0.036
Visual separation	15.93	22.28	1	2	62	<0.005	2.484	3.915	0	1	16	<0.005	1	0.011

*Type of test: 1 – Mann-Whitney U-test, 2 – T-test

Table 11: Analysis of the relationship between mistakes in reading technique – omission of letters and partial cognitive functions

Independent variable	**Leaves letters out – Number of students 16**						**Does not leave letters out – Number of students 30**							
Dependent variable	**Average**	**Standard deviation**	**Minimum**	**Median**	**Maximum**	**Normality test**	**Average**	**Standard deviation**	**Minimum**	**Median**	**Maximum**	**Normality test**	**Type of test***	**P-value**
Auditory separation	8.63	6.18	0	8	18	0.418	1.933	3.695	0	0	12	<0.005	1	0.000
Time sequence perception - visual	12.88	5.43	5	11.5	25	0.365	8.2	6.95	0	7.5	25	0.052	1	0.022
Spatial orientation	17.69	4.94	10	18	25	0.800	13.93	5.83	2	15.5	24	0.052	2	0.034
Auditory differentiation of speech	3.875	2.895	0	3.5	8	0.271	1.933	3.513	0	0	15	<0.005	1	0.008
Visual separation	11.5	17.61	0	2.5	62	<0.005	4.4	11.84	0	1	62	<0.005	1	0.019

*Type of test: 1 – Mann-Whitney U-test, 2 – T-test

Table 12: Analysis of the relationship between mistakes in reading technique – omission of syllables and partial cognitive functions

Independent variable	**Leaves syllables out – Number of students 15**						**Does not leave syllables out – Number of students 31**							
Dependent variable	**Average**	**Standard deviation**	**Minimum**	**Median**	**Maximum**	**Normality test**	**Average**	**Standard deviation**	**Minimum**	**Median**	**Maximum**	**Normality test**	**Type of test***	**P-value**
Auditory separation	8.27	5.27	0	10	18	0.473	2.323	4.799	0	0	18	<0.005	1	0.000
Spatial orientation – body scheme	8.867	0.516	7	9	9	<0.005	6.742	3.786	0	9	9	<0.005	1	0.050
Time sequence perception - visual	15.33	4.72	9	15	25	0.491	7.16	6.01	0	6	25	0.032	1	0.000
Spatial orientation	18.53	4.44	11	18	25	0.730	13.65	5.72	2	15	24	0.063	2	0.006
Auditory differentiation of speech	4.667	3.811	0	4	15	0.171	1.613	2.741	0	0	12	<0.005	1	0.001
Time sequence perception – auditory	14.67	5.45	9	15	25	0.035	8.419	3.557	0	10	15	<0.005	1	0.000
Visual separation	15.33	22.19	0	3	62	<0.005	2.774	5.005	0	1	21	<0.005	1	0.009

*Type of test: 1 – Mann-Whitney U-test, 2 – T-test

Table 13: Correlation scale
(*Source: http://www.nucem.sk/documents//25/maturita_2009/vysledky_a_vyhodnotenie/Prirucka_2009.pdf)*

r	**Correlation scale**
Under 0.10	insubstantial
0.11 – 0.30	small
0.31 – 0.50	moderate
0.51 – 0.70	strong
0.71 – 0.90	very strong
0.91 – 1.00	almost perfect

Table 14: Analysis of correlation between reading comprehension and partial cognitive functions

Variable	Tactile perception and kinaesthetic sense	Auditory separation	Auditory separation	Spatial orientation – body scheme	Auditory-visual intermodal relationship	Auditory-visual intermodal relationship	Visual differentiation of shapes	Auditory separation	Time sequence perception – visual	Auditory memory	Auditory memory	Auditory memory
r	0.61	0.64	0.63	0.34	0.21	0.34	0.47	0.64	0.38	0.55	0.55	0.54
P-value	0.000	0.000	0.000	0.023	0.157	0.020	0.001	0.000	0.009	0.000	0.000	0.000
Correlation	strong	strong	strong	moderate	small	moderate	moderate	strong	moderate	strong	strong	strong

Variable	Visual separation	Spatial orientation	Auditory differentiation of speech	Visual memory	Visual memory	Visual memory	Time sequence perception – auditory	Visual separation	Visual-auditory intermodal relationship	Visual-auditory intermodal relationship
p	0.42	0.41	0.46	0.06	0.10	0.03	0.44	0.37	0.52	0.38
P-value	0.004	0.005	0.001	0.695	0.530	0.830	0.002	0.012	0.000	0.009
Correlation	moderate	moderate	moderate	insubstantial	insubstantial	insubstantial	moderate	moderate	strong	moderate