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Preschool linguistic indicators of elementary reading achievement

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Literacy is a relatively new development in the evolution of human cognitive abilities. This biological-cultural gap can be bridged only by explicit instruction that modifies the operation of the underlying visual and linguistic neural structures. Literacy development relies on very different fundamental abilities, some of which are genetically determined while others are shaped by early experiences. The process of reading acquisition is therefore very vulnerable as it depends on the early development of different cognitive domains. The main questions of the current research are: (1) What characterises children who are at risk of reading disorders among Hungarian preschool children? (2) What are the early linguistic indicators of poor reading development? Our short-term longitudinal study followed 148 children from kindergarten to first grade through the initial processes of learning to read. We explored the relationship between earlier linguistic skills and later reading achievements by measuring a set of linguistic skills in kindergarten age and reading performance in first grade. Our preliminary results suggest that the group of children with the poorest reading outcomes has not only been significantly weaker in phonological processing tasks but in a number of language skills according to preschool assessments. Poor readers showed significantly lower levels than children with average reading outcomes in phonological, lexical and morphosyntactic tasks. Results suggest that reading outcomes among first-grade children might be predictable based on a screening test measuring linguistic skills at different levels of language. This result makes the early identification and development of children at risk for reading disorders possible.

Keywords: linguistic skills, risk of reading disorders, cognitive – linguistic indicators, preschool

Introduction

In today's (post-literal) age, many say that due to a new iconic turn, literacy has lost its hegemony in the transmission of information, and thus some of its roles. However, this loss can not only be interpreted as a rearrangement in terms of individual well-being, but also in terms of social change. In social development, it is still treated as a statistical fact that educated countries are able to sustain a more efficient economy than the uneducated (Glaser et al., 2004; Diamond, 2006; quoted by Keller, 2011, p. 15–16). Reading is therefore one of the most important human abilities even in our technology-based society: especially in

the age of life-long learning, it is the skilled application of reading that enables us to access our cultural heritage. Failure to use literacy skills efficiently will not only result in a disadvantageous position among fellow students, but also in all areas of daily life, positions in the labour market as well as the advocacy of our own interests. Other than their financial consequences, these handicaps manifest in serious distress and lower quality of life. Hungarian PISA results suggest that about 25% of fifteen-year-old students do not reach the initial level of functional reading (Ostorics et al., 2016). This means that when they start vocational training, they do not have the minimum comprehension skills needed to learn any profession. Moreover, the Hungarian education system currently conserves or even increases socio-cultural disadvantages during the primary school period. It is therefore crucial to understand more precisely the process of development of literacy and its underlying skills in order to gain an even more differentiated picture about the initial phase of reading acquisition through the detection of typical and atypical ways of development. Screening the risks of written language acquisition in preschool age could provide the basis of an evidence-based, efficient preventive intervention which has long been a tradition in the Hungarian language therapy introduced by *Ildikó Meixner* and *Emőke Vass-Kovács.*

Theoretical background of the research

Current research is established on interdisciplinary foundations applying the tools and methodology of cognitive sciences. From a linguistic aspect it works within the framework of oral-written paradigm, therefore reading acquisition is regarded as the process of written language acquisition (Benczik, 2001; Ong, 2002). According to cognitive pedagogy, literacy is a complex multidimensional ability, which is in Kampis's (1991) view a psychical component system organised from cognitive routines, cognitive skills, and a store of learning. These are the elementary parts of knowledge, from which an ability-system is built. According to the views of József Nagy (2002), the acquisition of written language has two interrelated component systems which he calls text-comprehension and text-creation competences. According to cognitive psychology, reading ability can be divided into two major components involving the ability of decoding and text comprehension, both of which contribute to successful reading. Researchers assume that these component processes are driven by different underlying skills. The exploration of the linguistic skills underlying the decoding ability has been ongoing ever since the 70's, therefore we know considerably more about its developmental processes whereas the detection of the underlying variables of text comprehension seems to be a more complex task. In the present research, we examined the results of the initial phase of reading acquisition. Thus, we mainly tracked the results of decoding as well as elementary text comprehension. Accordingly, in our study, we placed more emphasis on the linguistic-cognitive skills behind decoding and less on the language skills behind text comprehension.

The cultural recycling hypothesis

Literacy is a relatively new development in the evolution of human cognitive abilities, thus our brains are not innately pre-wired to reading. This biological-cultural gap can be bridged – in Dehaene's view (Deahane & Cohen, 2007) – by our brains adapting to written language. Instead of creating a specialised, morphologically distinct processing unit for the new function, brain areas close to that function are 'reused'. The three basic ideas of Dehaene's theory of neural recycling are the following: (i) The evolutionary feature of the human brain is that its anatomy and connections are inherently limited. Already at an early age, ordered neural formulas appear that greatly influence the direction of later learning. (ii) Every new cultural invention must find its own neural 'niche', that is, a neural network whose function is close enough to the new function to be learned and whose resources can be used efficiently enough to serve the new learning process. (iii) When the skills required by a new culture 'occupy' the former neural organisation, it is not erased. This means that neural barriers significantly affect the acquisition of the new skill (Dehaene, 2005, p. 152–154).

During reading acquisition, the child relies on the existing cognitive structures of visual processing and spoken language abilities. These early mechanisms transform during the acquisition of writing and reading and form a special network enabling skilled reading. Literacy development relies on very different fundamental abilities, some of which are genetically determined while others are shaped by early experiences. The process of reading acquisition is therefore very vulnerable as it depends on the early development of different cognitive domains. Due to the complexity and vulnerability of the process, reading can only be mastered in its entirety by explicit instructions even if some children might spontaneously reach the level of early reading. In this conscious, learning-teaching process designed according to the peculiarities of the mother tongue, the neural structure and functioning of the underlying visual and linguistic systems are also modified in the right direction.

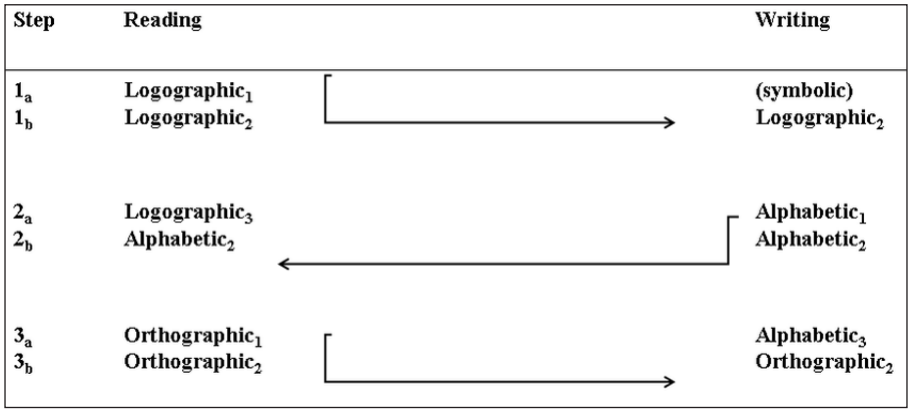
The development of reading

The basis of the decoding ability is the fact that the majority of European languages use alphabetical writing in which each speech sound (phoneme) is mapped by a letter (grapheme). By this means, a finite (22-44) number of graphemes can be combined to create an infinite variation of words. As a first step, children have to understand the letter-sound correspondences, then learn the graphemes belonging to each of the phonemes (Csépe, 2006). When using this strategy, the child reaches the decoding of single words by mapping the graphemes respectively, a time-consuming and tiresome process (Shaywitz & Shaywitz, 2009; Vaessen, 2010; Csépe, 2014). During this process, more and more graphemic images of words get imprinted into the visual word-form area of the brain (Deahane, 2005; Deahane & Cohen, 2007). The reading of single words thereby becomes increasingly fluent. Finally, the child can apply this acquired skill during reading larger units, words, sentences, and texts. By this time the graphemic sequence is directly linked to its phonological and semantic equivalent as well. During this development, the emphasis shifts more and more from the slow sequential letter-by-letter reading

to rapid automatic word recognition performance. This shift can be considered typical in other learning processes, too (Blomert & Csépe, 2012; Csépe, 2014a).

The afore mentioned development of reading ability has been described by several level- or phase-models displaying more or fewer differences. It has been found that children typically develop through similar levels using different reading strategies. Frith (1985), for example, determines three levels that are further divided into three more transitional levels taking the development of writing levels into account. At the logographic level, children do not recognise the word as a whole but instead guess the word by finding one or two visually significant feature within the context. This process cannot be considered real reading: it is rather an example of visual sample recognition. Within the logographic level, development acts in the direction of segmentation. The child recognises more and more internal features of the word, until it eventually reaches the smallest unit to letter. When the child recognises the rule that each letter corresponds to a speech sound, he enters the alphabetical level of reading, wherein the phoneme-grapheme mapping and phonological level of language play a great role. The last level is called the orthographic level of reading, where the direct transformation of the visual word form to a complete speech sound sequence becomes possible. At this level, the visual form of the word is already engraved in full sublexical detail into the visual word form lexicon. This will also allow for the development of spelling.

Figure 1
Six Step Model of Literacy acquisition from Frith (1985, p. 311)



Frith's model, as well as other level and phase models, has been shown in a new light by Share's "self-teaching theory" (2008). Share draws attention to the fact that a child's strategy usage not only depends on which level or phase their development is currently at, but also on the familiarity of the word they are actually facing. The more of the given text they are able to recognise by using their visual word-form area, the more experienced their reading is. However, even an experienced adult reader can face unknown words, or a specialised text, which can only be decoded by means of grapheme-phoneme mapping, that is to say, with the alphabetic strategy. According to Share, the reading performance can be regarded as a continuum as opposed to the practice of classifying the readers into well-defined categories. This continuum

ranges from unfamiliar to familiar with regards to the text; however, from the point of view of the reader it ranges from the level of beginner to experienced.

Cognitive-linguistic indicators underlying decoding performance

Since reading is a rather complex cognitive ability, it is worth investigating what underlying skills and abilities are needed in order to achieve accurate and fluent reading. Since the 1980s, researchers' attention has turned to linguistic abilities, most especially to those which are in specific relationship with other cognitive abilities. The most significant underlying factor proved to be phonological processing, particularly phonological awareness (PA) which not only means the skill of differentiating speech sounds, but also the meta-ability for the explicit analysis and manipulation of the phonological form of words. This enables us to perceive the units of speech smaller than a word (syllable, rhyme, and phoneme) for performing different operations. For example, the first phoneme can be isolated from the speech sound sequence of the word and can be replaced by another resulting in a different meaningful word, etc. (Adamikné, 2006; Lőrik, 2006; Vaessen, 2010; Blomert & Csépe, 2012; Jordanidisz, 2012).

Research suggests that the majority of individuals exhibiting written language disorders perform significantly poorer in PA tasks compared to average readers (Shaywitz & Shaywitz, 2009; TÓTH & Csépe, 2008; Pennington, 2009; Peterson – Pennington, 2012; Jordanidisz, 2012; Csépe, 2014b). The pace of the development of PA especially accelerates between the age of five to eight years. In the case of Hungarian children, the first level to appear is the syllable level, followed by the rhyme operation level, and finally the phoneme operation level. More detailed observations have proven that reading acquisition and PA have a reciprocal relationship. Thus, PA is both a precondition and consequence of reading acquisition.

The basic function of word recognition relies on rapid and smooth access to items in the mental lexicon based on visual information. This skill has its precursor in rapid automatic naming (RAN) of overlearned items such as colours or simple objects, etc. The process means practically the 'translation' of visual stimuli to verbal ones and has a close relationship not only to the accuracy and pace of reading but with reading comprehension as well (Peterson & Pennington, 2012; Blomert & Csépe, 2012).

Recent studies emphasise the determining role of the automatic letter-speech sound mapping among the background indicators (Vaessen, 2010; Blomert & Csépe, 2012; Mohai, 2013). During reading acquisition, a strong association has to be established through which a tight integration of several modalities emerges. While it was previously believed that the process of letter-speech sound integration is completed in the initial phases of reading acquisition, it has recently been accepted that the child needs years for this relationship to be imprinted and integration to be used automatically (Vaessen, 2010). As a result of this, a new quality, a completely automatised skill is at the skilled reader's disposal as opposed to beginners. Current research proved that this transmodal connectivity problem contributes to the emergence of a severe reading disorder (Blomert & Csépe, 2012).

Contemporary researchers suggest that the three skills mentioned above form the classic triad of the cognitive-linguistic indicators that underlie reading

acquisition. These three skills are supported by verbal working memory which has a less clarified relationship with reading (Pennigton, 2009). At the moment, it is not exactly known to what proportion and way its domain-general and language-specific components contribute to reading performance (Peterson & Pennigton, 2012). However, it can be claimed with certainty that the phonological loop, the articulatory repetition, and the executive functions must be taken into account as well (Baddeley, 2003; Németh, 2006).

Cognitive-linguistic foundations of elementary text comprehension

The first but not sufficient condition for text comprehension is proper decoding. After word recognition, the reader has access to the content of the text. The complex process of text comprehension involves word recognition, access to meaning, activation of prior knowledge, and their continuous interaction that Nation and Angell (2006) describe as a system of calculations from conclusions and reanalysis. Nation and Snowling's four-year study (2004) showed that individual differences in reading comprehension were related in all cases to speech comprehension, vocabulary, and semantic performance. The organisation of the mental dictionary develops along lexical nodes. It includes (1) the linguistic role of a word (e.g., word type, stem type), (2) its form (pronunciation and spelling), (3) its hierarchical or associative relationship with other terms, (4) its reference to the world (external psychosemantics), and (5) includes images and concepts. Thus, it stores lexical, phonological, visual, morphological, syntactic, and semantic information as well (Lukács et al., 2014). Moreover, written texts are more complex grammatically. While a conventional conversation displays low lexical density and high redundancy being less coherent due to its interactive nature. In contrast, written language prefers different grammatical structures, typically with high lexical density and low redundancy (Kamhi & Catts, 2014). Thus, it can be assumed that the lexical, morphosyntactic, semantic, and pragmatic levels of language are all involved in the process of comprehension.

Aims and questions of the research

In Hungary, several studies have examined the performance of decoding and the related language skills among preschool and first-grade children. According to descriptions in the international literature, these studies mainly assessed phonological awareness or phonological discrimination performances (Csépe et al., 2000; Csépe et al., Szűcs 2001; Tóth & Csépe, 2008; Lőrik & Kászonyiné, 2009; Jordanidisz, 2009, 2012). As a new aspect, the present research not only focuses on the phonological level of language when examining the relationships between language performances and reading outcomes. It adopts a broader perspective with wider scope of different levels of language skills. We hope that speech and language therapists and teachers can attain a more detailed picture of the linguistic skills behind reading, especially decoding. This might contribute to the preventive treatment of reading disorders in a broader context.

The purpose of our research is twofold. First, the aim is to investigate the initial phase of reading acquisition as studied at the end of first year's first semester of

school, from a cognitive-linguistic point of view, and involving the exploration of Hungarian children's reading performance while measuring aspects related to accuracy, fluency, and sentence comprehension. The second goal is to explore the relationship of these three reading outcomes with the cognitive-linguistic skills in the final kindergarten year and first grade. Beyond the role of phonological processing as a core deficit of decoding, it is essential to identify its correspondence with rapid lexical access, working-memory functions, and lexical and morphosyntactic linguistic skills. Our results should also serve as a validity study of the Hungarian reading readiness screening procedure.

The present study focuses on the growth of linguistic skills from kindergarten to school-age, the variance in elementary reading outcomes during first grade and early linguistic characteristics of the children at risk for low reading achievement. Accordingly, we raised three research questions:

1. What kind of developmental dynamic is characteristic of the linguistic skills related to reading readiness between the final year of kindergarten and the initial year of school in the case of native Hungarian children?
2. What characterises children at risk for reading disorders among Hungarian kindergarten children?
3. What are the early linguistic indicators of poor reading development in Hungarian?

Method

Sample and procedure

To explore the initial processes of learning to read, our short-term longitudinal study followed 148 randomly selected children from their final year of kindergarten to the first grade of school up to the end of first semester. As regards demographics, our sample consisted of 78 children from Budapest and 70 from the countryside (Fejér County) and included 80 males and 68 females. Two assessment waves has been conducted: (1) an assessment of reading readiness (core linguistic skills) has been administered during the first two months (Sept-Oct) of their final year of kindergarten and (2) an assessment of reading achievement and related core linguistic skills has been conducted at the end of first semester (February) of their first school year. Participants' average age at the kindergarten assessment was 71.2 months (range: 59-89 months; standard deviation: 6.2 months). Reading readiness (core linguistic skills) has been assessed with the same tests in both waves allowing for a direct comparison between kindergarten-age and school-age performances to explore developmental trends. A preliminary analysis did not reveal any significant differences in reading performance according to age and gender within the group of first graders, therefore we can consider them as a unified group in the following part of the research.

Assessment tools

The assessment of skills related to reading readiness in both kindergarten and school age used the screening procedure known as *SZÓL-E?* (Kas et al., 2012).

Figure 2 shows the structure of the screening test by listing the subtests in the top two rows with arrows leading to categories of speech, language and reading difficulties that signal possible risks based on the subtests' results. In the present study, we have restricted ourselves to presenting only the core seven subtests that assess linguistic and verbal memory skills. Brief descriptions of the subtests are given below grouped according to the levels of the language hierarchy with the characteristic of cognitive processing.

Phonological skills:

- Nonword discrimination: a phonological processing task requiring the child to judge the conformity or difference between two nonwords spoken by the investigator;
- Nonword repetition: a classic phonological working memory task requiring the child to repeat nonwords exactly after the investigator;
- Phonemic awareness: a classic PA task requiring identification and segmentation of word-initial phonemes;

Morphosyntactic skills:

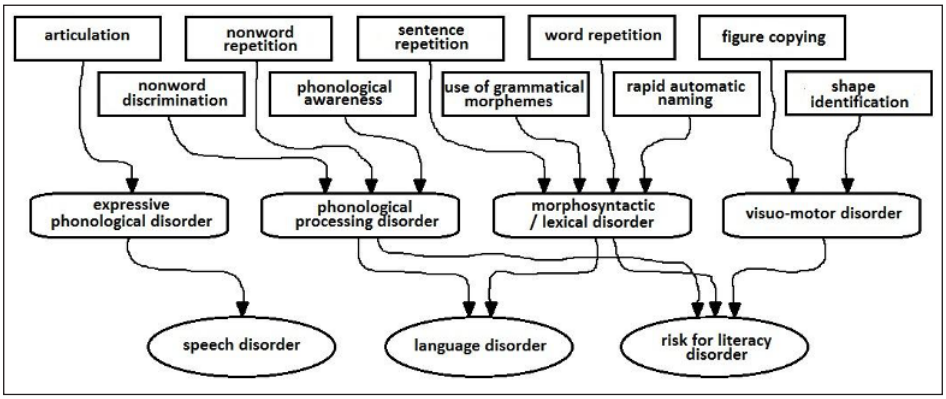
- Sentence repetition: a syntactical processing and working memory task requiring immediate repetition of spoken sentences with different syntactic complexity;
- Use of grammatical morphemes: a morphological task consisting of two parts requiring the child (i) to provide verbal descriptions of actions with toys performed by the experimenter using locative inflections and function words (Expressive morphology) and (ii) to act out instructions for placement of the same toys (Receptive morphology);

Lexical skills:

- Word retrieval: a verbal memory task requiring immediate retrieval of short lists of one-syllable words;
- Rapid automatic naming: a classic RAN task requiring sequential speeded naming of object pictures under time pressure;

Figure 2

Structure of the Hungarian speech and language screening test SZÓL-E? (Kas et al., 2012)



In the kindergarten studies, in addition to the language test, the children's intellectual ability was examined with Raven's Coloured Progressive Matrices (Raven, 1984).

Assessment of reading outcomes has been carried out using a self-developed test consisting of basic decoding tasks measuring sequential reading of letters, syllables, nonwords and common words. The Hungarian professional tradition – unlike the usual one in the English language – does not interpret letter-sound correspondence as a linguistic indicator of decoding but as an elementary reading skill. Therefore, the task of letter-sound matching was also included in our study as the first reading task along with syllable reading, which is traditionally part of Hungarian reading tests due to the peculiarities of the Hungarian language. Below, we present in detail the tasks of the reading test.

Elementary reading performances:

- reading letters: measuring basic letter-speech sound correspondences (25 vowels and 30 consonants);
- reading syllables: measuring sublexical elementary reading performance of CV and VC syllables (30 syllables);

Reading performance of the alphabetical level in Frith's sense:

- reading nonwords: measuring the efficiency of alphabetical strategies (Frith, 1985) without semantic support (25 nonwords consisting of 1-4 syllables);
- reading common words: measuring the level of orthographic reading (Frith, 1985) with the possibility of word-retrieving from the visual word form lexicon representing semantic support (60 commonly used word with 1-3 syllables).

For all the above sections, the number of correctly read items and the duration of the reading (in seconds) has been recorded to measure both the accuracy and the efficiency of the individuals' reading skill. For the purposes of the current study, a variable expressing reading efficiency has been constructed. The sum of all the numbers of correctly read items in each of the elementary reading performance sections (letters, syllables, nonwords and common words) has been divided by the sum of the durations (in seconds) of the same reading sections. This way, a single variable expressing basic reading efficiency that involves both reading accuracy and speed has been created for each participant. This variable served as the grouping variable to distinguish participants with different levels of elementary reading performance for the analyses of early indicators of later reading achievements.

Elementary reading comprehension:

- reading comprehension: a comprehension task requiring the child to draw simple pictures depicting the content of written sentences (six sentences consisting of double and triple instructions, e.g. 'Draw an ice cream in the hands of the little boy and a flower in the hands of the little girl!').

In parallel with taking the tests, we also conducted interviews with the teachers involved, consisting of semi-structured questions. In this, we also asked about

the reading instruction's method used. For the sake of brevity, results of the comprehension task and the interviews will not be presented here.

Results

Firstly, the results of repeated assessments of core reading-related linguistic skills will be presented (3.1.), then the variance of elementary reading performance in first grade and the grouping according to reading efficiency will be introduced (3.2.). Finally, the correspondences between preschool verbal skills and first-grade reading performance will be explored (3.3.).

Growth of linguistic skills related to reading readiness

To explore the developmental characteristics of the core linguistic skills related to reading readiness, a comparison of performances in the same tasks between the final year of kindergarten and the initial school year of school has been conducted. Descriptive data is shown in Table 1.

Table 1
Descriptive statistical data of school readiness test results (raw scores) in the first (kindergarten) and second (school) wave of assessments

Subtest	N	Mean	Median	SD	SE
Word retrieval (kindergarten)	148	7.71	8.00	3.015	0.2479
Word retrieval (school)	148	9.47	10.00	2.538	0.2086
Nonword discrimination (kindergarten)	148	7.76	8.00	1.839	0.1512
Nonword discrimination (school)	148	9.32	10.00	1.131	0.0930
Visual shape discrimination (kindergarten)	148	3.49	4.00	1.431	0.1176
Visual shape discrimination (school)	148	4.39	5.00	0.952	0.0783
Expressive morphology (kindergarten)	148	8.69	9.00	3.075	0.2527
Expressive morphology (school)	148	10.74	12.00	2.097	0.1723
Receptive morphology (kindergarten)	148	11.64	12.00	1.011	0.0831
Receptive morphology (school)	148	11.91	12.00	0.386	0.0317
Nonword repetition (kindergarten)	148	23.84	25.00	8.335	0.6852
Nonword repetition (school)	148	26.70	27.50	7.222	0.5937
Sentence repetition (kindergarten)	148	8.42	9.00	3.141	0.2582
Sentence repetition (school)	148	9.86	11.00	2.317	0.1905
Phonological awareness (kindergarten)	148	4.44	4.00	2.298	0.1889
Phonological awareness (school)	148	7.91	8.00	0.605	0.0498
Graphomotor sequence reproduction (kindergarten)	148	8.13	9.00	3.472	0.2854
Graphomotor sequence reproduction (school)	148	9.76	10.00	2.384	0.1959
Rapid automatic naming accuracy (kindergarten)	148	35.05	36.00	1.953	0.1605

Subtest	N	Mean	Median	SD	SE
Rapid automatic naming accuracy (school)	148	35.62	36.00	1.431	0.1176
Rapid automatic naming time (kindergarten)	148	64.40	60.00	24.597	2.0218
Rapid automatic naming time (school)	148	43.80	40.00	13.384	1.1001

Descriptive data shows age-related growth in each task with decreasing variance. Paired sample t-tests conducted on the raw scores of the same tasks administered in the first assessment wave (kindergarten) and in the second assessment wave (1st school grade) marked significant growth in each task performance (Table 2.). Cohen's d values revealed small to large effect sizes, with the greatest growth being observable in phonological awareness, rapid automatic naming (speed), nonword discrimination, expressive morphology and sentence repetition (in descending order).

Table 2

Paired sample t-tests and effect sizes comparing kindergarten and school assessment data by subtest

Subtest	Student's t	df	p	Effect Size (Cohen's d)
Word retrieval	6.38	147	< .001	0.525
Nonword discrimination	10.94	147	< .001	0.900
Expressive morphology	9.20	147	< .001	0.757
Receptive morphology	3.30	147	0.001	0.271
Nonword repetition	3.99	147	< .001	0.328
Sentence repetition	7.51	147	< .001	0.617
Phonological awareness	18.17	147	< .001	1.494
Rapid automatic naming (accuracy)	3.19	147	0.002	0.262
Rapid automatic naming (speed)	-11.23	147	< .001	-0.923

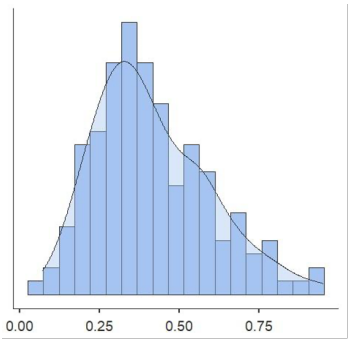
These results show that linguistic and verbal memory skills related to reading readiness such as morphosyntactic processing, word retrieval, phonological discrimination, and manipulation are still in progress in children between five to seven years of age.

Variance in reading outcomes

For the purposes of the current study, basic reading achievement of the participants is represented by a variable combining measures of reading accuracy and speed. This 'reading efficiency' measure has been derived as the ratio of the sum of all the numbers of correctly read items in each of the elementary reading performance sections (letters, syllables, nonwords

and common words) and the sum of the durations (in seconds) of the same reading sections. The mean value is 0.414 (SD = 0.179). The population data is mesokurtic (kurtosis = 0.116; Std. error = 0.396) but considerably positively skewed (skewness = 0.687; Std. error = 0.199) and deviates significantly from normality (Shapiro-Wilk W = 0.963; $p < 0.01$). This is a result of the greater variation of children's data on the positive side of the average (Fig. 3.).

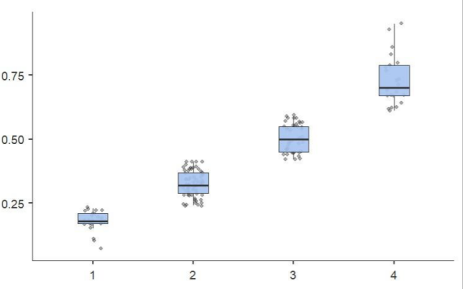
Figure 3
Distribution of reading efficiency in first-grade children



Thus, a single variable expressing elementary reading efficiency that involves both reading accuracy and speed has been created for each participant. This 'reading efficiency' variable served as the grouping variable to distinguish participants with different levels of elementary reading performance for the analyses of possible early indicators of later reading achievements. Based on each child's reading efficiency score, four groups with different reading achievement has been created in accordance with their deviation from the average (Fig. 4.). The resultant groups were the following:

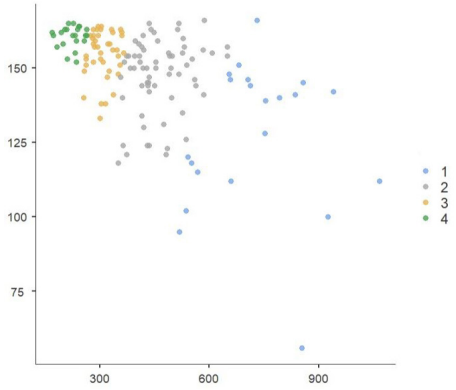
1. more than 1 SD below average – 21 children (14%)
2. less than 1 SD below average – 64 children (43%)
3. less than 1 SD above average – 41 children (27%)
4. more than 1 SD above average – 22 children (15%)

Figure 4
Reading efficiency in first-grade children by group



The proportion of students in Group 1 compared to the total sample is almost twice as high (14%) as the proportion of children with developmental dyslexia within a population (7%) according to statistics (Peterson, & Pennigton, 2012). Based on their reading efficiency results, we can say that the current poor performance of Group 1 suggests the risk of a future reading disorder. Figure 5 also demonstrates that the interaction between reading accuracy and reading speed is not constant across groups with different reading achievement. Children with more successful reading performance (Groups 3 and 4) exhibit consistently accurate and fast reading without significant deviance in any of these dimensions. However, the interaction between speed and accuracy in children with lower reading performance (Groups 2 and, mostly, 1) are much more scattered. There is a great inter-individual variation in both speed and accuracy and there are children with significant problems with either speed or accuracy while showing average or even better results in the other dimension.

Figure 5
Sums of reading accuracy raw scores (y axis) and reading times in seconds (x axis) in first-grade children by group



Early Indicators Of Reading Achievement

To explore the correspondence between preschool linguistic skills and elementary reading performance at the end of first semester of first-grade school year, we compared the above groups with different reading achievement in each of the subtests administered during the preschool assessment of school readiness. Checking the normality of the data using the Shapiro-Wilk test revealed that normality is violated in most of the subtests' data: Word retrieval ($W = 0.990$; $p = 0.344$), Nonword discrimination ($W = 0.970$; $p = 0.002$), Expressive morphology ($W = 0.928$; $p < .001$), Receptive morphology ($W = 0.580$; $p < .001$), Nonword repetition ($W = 0.967$; $p = 0.001$), Sentence repetition ($W = 0.943$; $p < .001$), Phonological awareness ($W = 0.951$; $p < .001$), Rapid automatic naming (accuracy) ($W = 0.643$; $p < .001$), Rapid automatic naming (speed) ($W = 0.958$; $< .001$). Thus, the one-way analysis of variance of

the four groups' data has been carried out using the non-parametric Kruskal-Wallis rank sum test.

The analysis revealed a significant effect of Group in *Word retrieval* (χ^2 = 14.03, df = 3, p = 0.003), *Nonword discrimination* (χ^2 = 10.47, df = 3, p = 0.015), *Expressive morphology* (χ^2 = 10.14, df = 3, p = 0.017), *Receptive morphology* (χ^2 = 16.76, df = 3, p < 0.001), *Nonword repetition* (χ^2 = 10.11, df = 3, p = 0.018), *Sentence repetition* (χ^2 = 20.21, df = 3, p < 0.001), *Phonological awareness* (χ^2 = 8.46, df = 3, p = 0.037), *Rapid automatic naming (accuracy)* (χ^2 = 11.94, df = 3, p = 0.008), *Rapid automatic naming (speed)* (χ^2 = 21.66, df = 3, p < 0.001).

For pairwise comparisons Dwass-Steel-Critchlow-Fligner tests were conducted (Table 3). These tests revealed a quite uniform pattern with the lowest achieving readers in Group 1 exhibiting significantly lower scores than the other groups that did not differ from each other. Examples of the performance of the groups in the different subtests are demonstrated in Figure 6.

Table 3

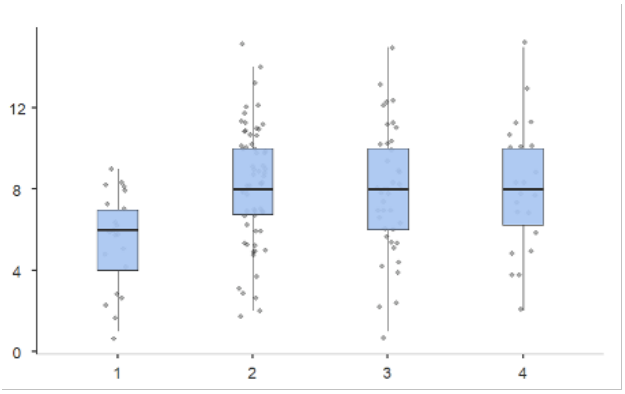
Summary of Dwass-Steel-Critchlow-Fligner pairwise comparisons between groups with different elementary reading efficiency by subtests administered in the first (preschool) wave (< marking significant differences at 0.05 level)

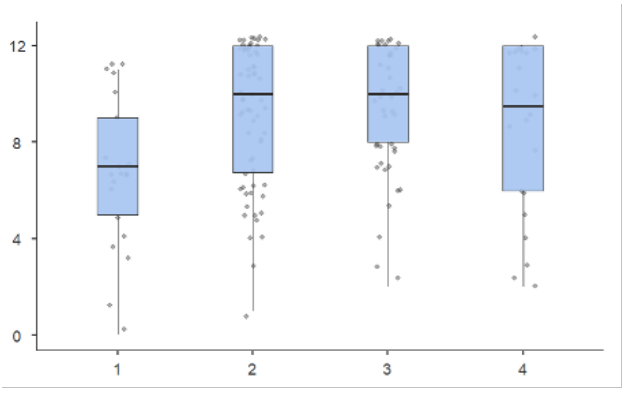
Subtest	Pairwise comparisons
Word retrieval	1 < 2 = 3 = 4
Nonword discrimination	1 < 2 = 3 = 4
Expressive morphology	1 < 2 = 3 = 4
Receptive morphology	1 < 2 = 3 = 4
Nonword repetition	1 < 2 = 3 = 4
Sentence repetition	1 < 2 = 3 = 4
Phonological awareness	1 < 2 = 3 = 4
Rapid automatic naming (accuracy)	1 < 2 = 3 = 4
Rapid automatic naming (speed)	1 < 2 = 3 = 4

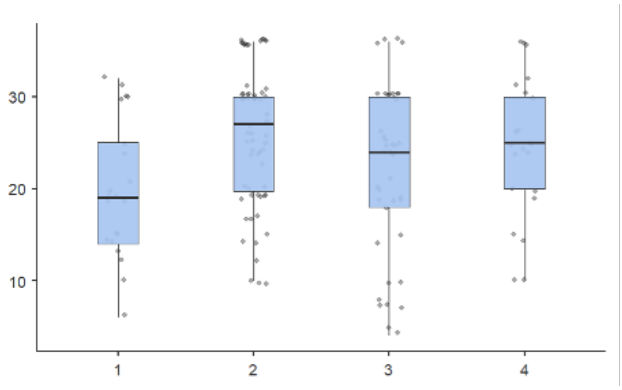
Group 1 has thus proved to perform consistently lower in each task measuring linguistic skills in preschool children. To control for general intelligence and non-linguistic skills, the Raven Coloured Progressive Matrices test as well as a graphic figure sequence reproduction task and a visual form discrimination task has also been administered. Although children in Group 1 performed significantly lower in the graphomotor task, they did not perform significantly lower in visual discrimination and exhibited the same level of general intelligence as it was revealed by Kruskal-Wallis rank sum tests: Visual form discrimination (χ^2 = 7.75, df = 3, p = 0.052), Figure sequence reproduction (χ^2 = 8.27, df = 3, p = 0.041), Raven IQ (χ^2 = 4.71, df = 3, p = 0.195).

Figure 6

Average raw scores of subtests administered in the preschool assessment by groups with different elementary reading efficiency (p. 139). Word retrieval: up, Expressive morphology: middle, Nonword repetition: down (p. 140). Phonological awareness: up, Sentence repetition: middle, Rapid automatic naming (time): down)







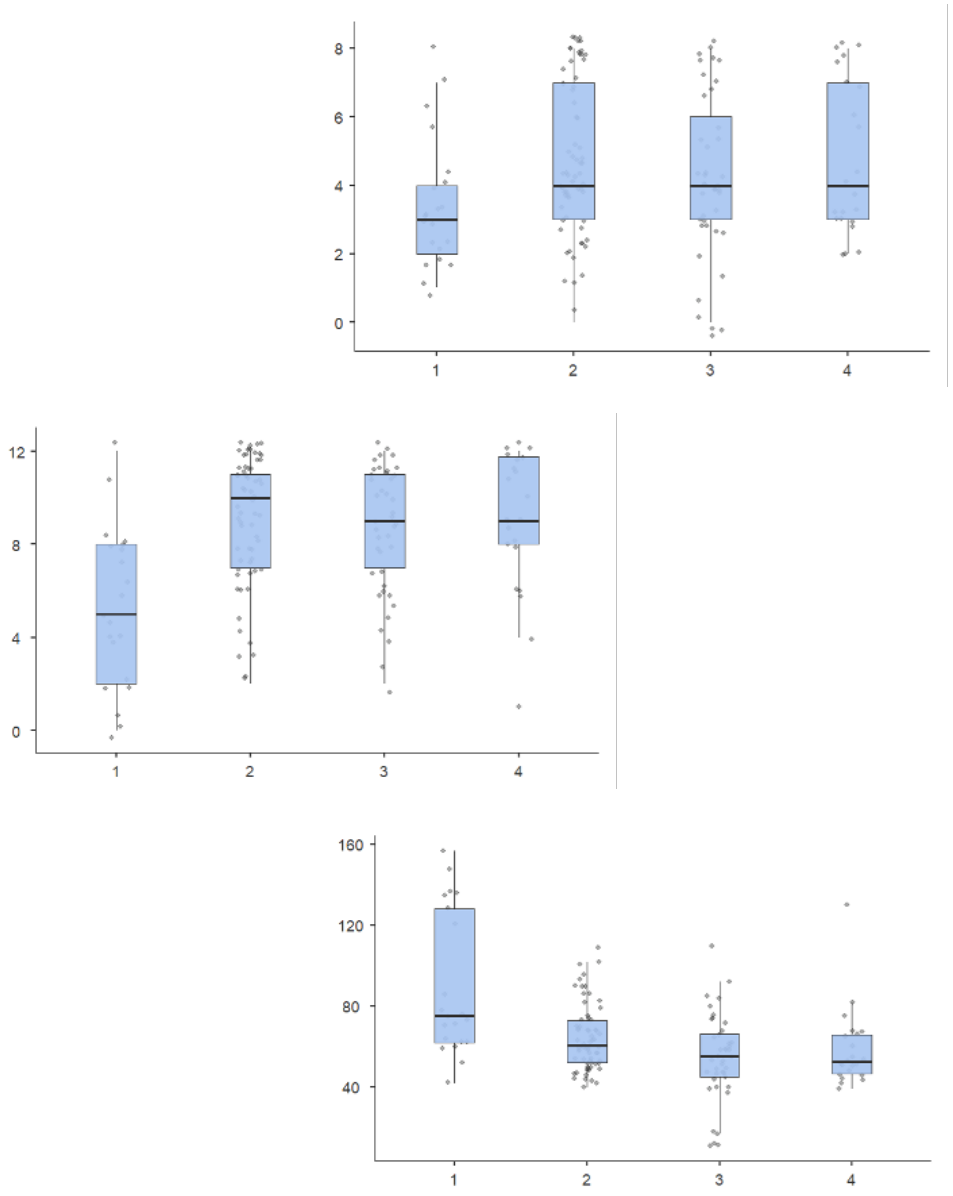


Figure 6 shows that there is great variation between individuals in terms of language skills in all groups. In general, the best performing students in Group 1 do not reach the highest levels in Group 2, such as in word retrieval, expressive morphology, nonword repetition or phonological awareness. It can also be discovered that there are language skills in which the 75 percentile value of Group 1 is at the 25 percentile value of Group 2, for example: word retrieval and sentence repetition. Based on this, it can be stated that children with the lowest reading outcomes (Group 1) perform significantly under Group

2 in all linguistic measures, while the linguistic performance of Group 2 does not differ significantly from those of Group 3 and Group 4. Thus, a group of students with poor decoding in the first grade showed lower performance at all linguistical levels during preschool. Further analysis of item-based predictive correspondences between preschool skills and first-grade reading outcomes are plausibly the next directions of the current research.

Discussion

Based on the data presented above, we can give the following answers to our research questions:

1. What kind of developmental dynamics is characteristic of the linguistic skills related to reading readiness between the final year of kindergarten and the initial year of school in the case of native Hungarian children?

When comparing the linguistic skills, a significant growth can be observed in the kindergarten-school transition in all language skills related to reading readiness. Phonological awareness shows the greatest developmental change. Among kindergarten children, only 13 percent can recognize the first speech-sound of the word, but in the middle of first class almost every child is mastering this skill. While nonword discrimination – as an early developing skill that requires less awareness – does not show a similarly high rate of development, this also represents a statistically significant change. Both Hungarian and international studies claim that phonological awareness is a reciprocal ability (Tóth & Csépe, 2008; Lőrik & Kászonyiné, 2009; Vaessen, 2010; Peterson & Pennigton, 2012). The syllable-operational level of phonological awareness shows strong development in the case of Hungarian children even before learning to read (Lőrik, 2006; Jordanidisz, 2009). However, in the first stage of learning to read, there is a significant change primarily in the operations of phoneme-level consciousness. During this reading phase, the emphasis is on learning letter – speech sound correspondence. In accordance with Frith's theory, this is the alphabetical level of reading acquisition. The rate of change in phoneme awareness during this period is so significant that it is doubtful whether preschool values can predict school performance in all cases.

Significant change can be detected even in those background skills related to reading, which almost show a ceiling effect already in kindergarten. The accuracy of rapid automatic naming has already reached a ceiling effect, but regarding fluency, first graders solve the task in a much shorter time. However, there is very few data available in the Hungarian literature on typical language development in the preschool period. When using the screening procedure SZÓL-E?, our results showed that significant development takes place not only in the skills closely related to reading readiness, but at all three linguistic levels (phonological, lexical, grammatical) from the beginning of the last kindergarten year to the end of the first semester of school. We emphasise the importance of the grammatical level that is characterized by a significant change during this period.

2. What characterises children at risk for reading disorders among Hungarian kindergarten children?

According to the reading efficiency index created based on reading (decoding) performance, four groups could be distinguished. Group 1, consisting of children with the lowest reading achievement, lag significantly behind all other groups in all of the language skills related to reading readiness including the two skills traditionally mentioned the most: phonological awareness and rapid automatic naming (accuracy and time). The other groups consisting of children exhibiting at least average reading levels do not differ in either of these skills. This means that the risk of reading difficulties can be recognized in the last year of kindergarten on the basis of two or three language indicators determined by international consensus. Preschoolers who perform under average levels in phonological awareness and/or phonological (nonword) discrimination, and rapid automatic naming during preschool language screening are also expected to show weakness in reading acquisition, thus they are at risk for written language disorder (more precisely, for dyslexia as a decoding disorder). This result is consistent with studies claiming that in transparent orthographies, fast and accurate reading develops between the ages of seven and nine, and its pace is also influenced by the level of orthographic consistency and the method of teaching to read (Ziegler & Goswami, 2005).

Our results are also in line with the double deficit hypothesis of Bowers and Wolf (1993), according to which phonological awareness is a significant weakness of all dyslexics and fast automatic naming for some dyslexics. Despite the ceiling effect, it seems that the rapid automatic naming accuracy is an essential element of linguistic screening, as weak accuracy in kindergarten predicts poor decoding performance. The combined presence of the two impairments (phonological awareness and rapid automatic naming) can not be compensated for easily, it detracts the prognosis of the reading disorder, presumably because, in addition to phonological categorization difficulties (that shake the foundations of the alphabetical level of reading according to Frith's theory), they will also perform poorly in orthographic reading, as words are retrieved from the visual word form lexicon with inadequate speed or accuracy.

Phonological working memory performance, which is closely related to phonological distinction and phonological awareness, is also worth considering in the early stages of learning to read. A novice reader who is only capable of alphabetic decoding should keep the deciphered phonemes in phonological working memory until the whole word is decoded, otherwise there is no chance of understanding. The role of phonological working memory in reading development so far is not so clear. In our investigation it seems to play a supporting role in determining the variance, but poor readers (accuracy and comprehension) show a significant difference in all verbal memory skills measured.

3. What are the early linguistic indicators of poor reading development in Hungarian?

Our research showed that novice readers with poor decoding performed significantly lower in not only phonological awareness and rapid naming tasks considered well-established risk factors for dyslexia, but also in lexical, morphological, and syntactical tasks. These linguistic difficulties are not viewed as general developmental deficits since they do not differ from their well-reading peers in visual discrimination tasks or non-verbal IQ levels.

As lexical-level processing (word repetition, rapid automatic naming) was not strongly represented in the preschool screening test, in the following analysis of the results we compare the reading performance with the results at the morphological, syntactic-linguistic levels. While we obtained the same result as international and Hungarian references for the language indicators behind decoding (phonological awareness and rapid automatic naming), our results for other language skills do not fully agree with previous studies. The morphological-syntactic level of language (for example, receptive and expressive morphology and the sentence repetition) is mostly associated with the ability of text-comprehension and not as the main underlying skills of early decoding (Peterson & Pennigton, 2012; Blomert & Csépe, 2012; Mohai, 2013). Lyytinen and Lyytinen (2004) for Finnish novice readers have shown that morpheme identification problems pose a higher risk in identifying dyslexia. Still, it seems that in Hungarian language (probably related to agglutinating morphology and variable word order in the sentences) these higher language skills have a stronger role in the initial phase of reading acquisition. In their preschool age, these students showed the same weakness in receptive language skills (morpheme comprehension) as in expressive language tasks (morpheme production and sentences repetition). Despite the ceiling effect in the preschool population, it seems that morpheme comprehension is an essential element of linguistic screening as a criterion-based task, as weak morpheme comprehension plays a role apart of the puzzle in kindergarten predicts poor decoding performance.

Overall, in our research, we identified a group of novice readers (Group1) with poor reading efficiency that differed not only in their decoding performance from average- or excellent-readers (Group 2, 3, 4), but also in their preschool language skills. This group showed marked differences at all levels of language performances, while the linguistic performance of the other three groups did not differ significantly. The same group (Group 1) showed no difference in verbal IQ performance and visual discrimination from other groups, so it is their linguistic weakness that is related to poor decoding performance. Our results only partially correspond to previous international and Hungarian data. From the present research, it seems that the success of initial reading acquisition in Hungarian children is not only predicted by the known linguistic-cognitive indicators (such as phonological awareness and quick automatic naming), but morphosyntactic skills are also part of the picture.

In addition to interpreting the results, we also consider it important to draw some practical conclusions of the research. Conclusions regarding pedagogical and speech therapy practice:

1. In preschool children, development of language skills should be monitored as being crucial for learning to read. There is a significant growth in the lexical and grammatical levels of receptive and expressive language, and the recognition and manipulation of sublexical elements should also be treated as a priority area.
2. The use of evidence-based screening tests in the preschool year is of great importance because reading disorders can be prevented with the evidence-based help of screened children. This is not only professionally but also economically relevant, as prevention is easier and less costly than subsequent prolonged treatment.
3. Most of the currently used Hungarian teaching methods recommend a short (4-6 weeks) preparatory phase and a relatively fast letter learning phase. From the present research, it seems that this concept is not sufficiently preventive and proactive, as a significantly lower developing group has to be reckoned with already in the first grade. The reasons for this are summarized as follows:
   – Although the orthography of the Hungarian language is among the most transparent alphabetic languages (almost one by one), the Hungarian alphabet contains a relatively high number of letters. Many of them are phonologically and / or visually similar. Therefore, more time should be devoted to their careful, separate learning.
   – Based on interviews with the teachers of the examined children, it can be stated that the lettering phase is preceded by a four- to six-week preparatory phase at the beginning of the first school year. It is likely that this time will not be enough for students with poorer language skills.
   – In addition, most (except one) of the reading instruction procedures used in the study group do not follow the principle of the closest development zone in the structure of skill development, for example they go with too big steps in the development of sublexical breakdown.
4. It would be necessary to monitor children at risk for reading difficulties until at least the second grade, until the initial stage of reading learning is completed.
5. Contrary to current general practice, school development educators should pay much more attention to preventive language assistance in the early reading era. Today, these children often receive treatment only when they are diagnosed with dyslexia (in the third grade). Thus, it usually takes two years without help.
6. It would be worthwhile to develop short-term phonological awareness programs for school developmental educators. In this way, they can support the teacher's proactive work to developing phonological skills and carry out preventive short-term interventions for children to reduce the risk of dyslexia.

The authors offer the present study to emphasise the professional tasks aiming to support building a bridge between oral and written language for children over the biological cultural divide.

References

Adamikné Jászó, A. (2006). *Az olvasás múltja* és *jelene*. Trezor Kiadó.

Baddeley, A. (2003), Working memory and language: an overview. *Jurnal of Communication Disorders. 36*(3), 189–208. https://doi.org/10.1016/S0021-9924(03)00019-4

Benczik V. (2001). *Nyelv,* írás*, irodalom kommunikációelméleti megközelítésben.* Trezor Kiadó.

Blomert, L. & Csépe V. (2012). Az olvasástanulás és –mérés pszichológiai alapjai. In Csapó, B. & Csépe, V. (Eds.), *Tartalmi keretek az olvasás diagnosztikus* értékeléséhez (pp. 17–86). Nemzeti Tankönyvkiadó.

Bowers, P. G. & Wolf, M. (1993). Theoretical links among naming speed, precise timing mechanisms and orthographic skill in dyslexia. *Reading and Writing: An Interdisciplinary Journal* 5, 69–85. https://doi.org/10.1007/BF01026919

Csépe, V. (2006). *Az olvasó agy.* Akadémia Kiadó.

Csépe, V. (2014a). Az olvasás rendszere, fejlődése és modelljei. In Pléh, Cs. & Lukács, Á. (Eds.), *Pszicholingvisztika 1.* (pp. 339–370). Akadémia Kiadó. .

Csépe, V. (2014b). Az olvasás zavarai és a diszlexia. In Pléh Cs. Lukács, Á. (Eds.), *Pszicholingvisztika 2.* (pp. 1325–1344). Akadémia Kiadó..

Csépe, V., Szűcs, D. & Osmanné Sági, J. (2000). A fejlődési diszlexiára (FDL) jellemző beszédhang-feldolgozási zavarok Eltérési Negativitás korrelátumai. *Magyar Pszichológiai Szemle, 55*(4), 475–500. https://doi.org/10.1556/mpszle.55.2000.4.8

Csépe, V., Szűcs, D. & Lukács, Á. (2001). Mindegy, hogy hogyan tanulunk olvasni? Eltérő tréning, eltérő összemérés, változó eltérési negativitás. In Pléh, Cs., László, J. & Oláh, A. (Eds.), *Tanulás, kezdeményezés, alkotás* (pp. 198–213). ELTE Eötvös Kiadó.

Dehaene, S. (2005). Evolution of human cortical cirquits for reading and arithmetic: the neuronal recycling hypothesis. In Dechaene, S., Duhamel, j., Hauser, M. & Rizolatti, G. (Eds.), *From Mankey Brain to Human Brain. A Fyssen Fondation Symposium* (pp. 133–157). Bradford Book. https://doi.org/10.7551/mitpress/3136.003.0012

Dehaene, S. & Cohen, L. (2007). Cultural recycling of cortical maps. *Neuron,* 56(2), 384–398. https://doi.org/10.1016/j.neuron.2007.10.004

Frith, U. (1985). Beneath the surface of developmental dyslexia. In Patterson, K., Marshall, J.& Coltheart, M. (Eds.), *Surface Dyslexia, Neuropsychological and Cognitive Studies of Phonological Reading* (pp. 301–330). Erlbaum. https://doi.org/10.4324/9781315108346-18

Jordanidisz, Á. (2009). A fonológiai tudatosság fejlődése az olvasástanulás időszakában. *Anyanyelv-pedagógia, 2*(4), *http://www.anyanyelv-pedagogia.hu/cikkek.php?id=222* (14.03.2021.)

Jordanidisz, Á. (2012). Az olvasási nehézség és a fonológiai tudatosság kapcsolata. In Váradi, T. (Ed.), *IV. Alkalmazott nyelvészeti doktori konferenciakötet* (pp. 69–79). MTA Nyelvtudományi Intézet.

Kamhi, A. & Catts, H. (2014). *Language and Reading Disabilities*. Pearson Education Limited.

Kampis, Gy. (1991). *Self Modifying Systems in biology and Cognitive Science. A New Framework for Dinamics, Information and Complexity.* Pergamon Press.

Kas, B., Lőrik, J., Molnárné Bogáth, R., Szabóné Vékony, A. & Szatmáriné Mályi, N. (2012). *SZÓL-E? – Szűrőeljárás az* óvodáskori *logopédiai ellátáshoz.* Logotech Kiadó.

Keller, T. (2011). *Társadalmi* értékek és *fenntartható fejlődés.* Nemzeti Fenntartható Fejlődési Tanács Műhelytanulmányok 7. TÁRKI Társadalomkutatási Intézet Zrt. https://www.parlament.hu/documents/1238941/1240165/T%C3%A1rsadalmi+%C3%A9rt%C3%A9kek+2011.pdf/e27f1e43-1248-4602-b87a-0b512638be59?t=1490005530000 (14.03.2021.)

Lőrik, J. (2006). A gyermeki fonológiai tudatosság megismeréséről. *Beszédgyógyítá*s, *17*(2), 32–60.

Lőrik, J. & Kászonyiné Jancsó, I. (2009). A fonológiai tudatosság fejlesztése és hatása az írott nyelv elsajátítására. In Marton, K. (Ed.), *Neurokognitív fejlődési zavarok vizsgálata* és *terápiája* (pp. 11–41). ELTE Eötvös Kiadó.

Lukács, Á., Pléh, Cs., Kas, B. & Thuma, O. (2014). A szavak mentális reprezentációja és az alaktani feldolgozás. In Pléh, Cs. & Lukács, Á. (Eds.), *Pszicholingvisztika 1.* (pp. 167–250). Akadémia Kiadó..

Lyytinen, P. & Lyytinen, H. (2004). Growth and predictive relations of vocabulary and inflectional morphology in children with and without familial risk for dyslexia. *Applied Psycholinguistics, 25*(3), 397–411. https://doi.org/10.1017/S0142716404001183

Mohai, K. (2013). *Szempontok az olvasási zavarok azonosításához* és *differenciáldiagnosztikájához.* Doktori (PhD) értekezés. ELTE Pedagógiai és Pszichológiai Kar Pszichológiai Doktori Iskola, Kognitív Fejlődés Program.

Nagy, J. (2002). *XXI. századi nevelés.* Osiris Kiadó.

Nation, K. & Angell, P. (2006). Learning to read and learning to comprehend. *London Review of Education, Special Issue: The psychology of reading, 4*(1), 77––87. https://doi.org/10.1080/13603110600574538

Nation, K. & Snowling, M. (2004). Beyond phonological skills: Broader language skills contribute to the development of reading. *Journal of Research in Reading, 27*(4), 342–356. https://doi.org/10.1111/j.1467-9817.2004.00238.x

Németh, D. (2006). A nyelvi folyamatok és az emlékezeti rendszerek kapcsolata. Akadémia Kiadó.

Ong, W. (1982). *Orality and Literacy. The Technologizing of the Word.* Methuen and Co. Ltd. https://doi.org/10.4324/9780203328064

Ostorics, L., Szalay, B., Szepesi, I. & Vadász, Cs. (2016). *PISA 2015* összefoglaló *jelentés.* Oktatási Hivatal.https://www.oktatas.hu/pub_bin/dload/kozoktatas/nemzetkozi_meresek/pisa/PISA2015_osszefoglalo_jelentes.pdf (

Pennington, B. (2009). *Diagnosing Learning Disorders. A Neuropsychological Framework.* The Gilford Press.

Peterson, R. & Pennington, B. (2012). Seminar: Developmental Dyslexia. *The Lancet, 379*(9830), https://doi.org/10.1016/S0140-6736(12)60198-6

Raven, J. C. (1984). *Manual for the Coloured Progressive Matrices* (Revised). NFER-Nelson.

Share, D. (2008). Orthographic learning, phonology and the self-teaching hypothesis. *Child Development and Behavior, 36*, 31–82. https://doi.org/10.1016/S0065-2407(08)00002-5

Shaywitz, B. & Shaywitz, S. (2009). Functional Brain Imaging in Studies of Reading and Dyslexia. In *Encyclopedia of Language and Literacy Development.* Canadian Language and Literacy Research Network. .

Tóth, D. & Csépe, V. (2008). Az olvasás fejlődése kognitív pszichológiai szempontból. *Pszichológia, 28*(1), 35–52. https://doi.org/10.1556/Pszi.28.2008.1.3

Vaessen, A. (2010). *Cognitive Dynamics of Fluent Reading and Spelling Development.* Cognitive Neuroscience, PhD Doctoral Thesis, Universiteit Maasricht.

Ziegler, J. & Goswami, U. (2005). Reading acquisition, developmental dyslexia, and skilled reading across languages: A psycholinguistic grain size theory. *Psychological Bulletin*, *131*(1), 3–29. https://doi.org/10.1037/0033-2909.131.1.3