

THESES

THE DEVELOPMENT OF HUNGARIAN CHILDREN'S
PHONOLOGICAL AWARENESS BETWEEN THE AGES
4–10 YEARS

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1. Introduction

The acquisition of the written language is a crucial stage in children's language development. Phonological awareness is one of the basic factors of successful learning to read and write. Some of the researchers differentiate between early and late development of the phonological awareness, meaning the formation of metalinguistic skills on the latter one (Mann–Stoel-Gammon 1996, Lőrík–K. Jancsó 2009, Graves et al. 1998, Konza 2011). Owning these skills, children become able to shift the focus of attention from the meaning of the words onto their formal attributes. This way they have access to the inner structure of the words and are able to break them into units of different grain size. During their language development they become able to do mental operations with smaller and smaller grain size (Csépe 2006, Ziegler–Goswami 2005). The pre-linguistic stage is characterized mainly by the syllable size, then children move towards the phonemes through the stage of the syllable structure of onset and rime. The phoneme level is acquired fully during the formal instruction of literacy.

Different mental operations can be carried out with the linguistic units. Reading requires the ability of blending phonemes or bigger units while in writing we need to segment the words into their fundamental units (Konza 2011). The most complex PA operation is the manipulation, in which we delete, insert, replace units or reverse their order within the words. The success of these manipulations depends on language skills, as well as on working memory and executive functions.

Children with written language disorder struggle on these areas. In the cases of dyslexic children, the phonological awareness was found to be the leading problem followed by the difficulty of the grapheme-phoneme correspondence and the rapid picture naming (Ziegler–Goswami 2005 Torrpa et al. 2010). The task for cross-linguistic researchers is to develop tests which consider the different characteristics of the examined languages. The complex examination of children and their problems also requires proper diagnostic tools (Csapó et al. 2012). Dynamic assessment offers a new method for this, giving a more holistic picture about the child with his/her potential level of development and showing their response to intervention (Vigotszkij 2000, Cunningham–Carroll 2013). According to the opinion of some researchers, the dynamic assessments of phonological awareness are better predictors of later literacy skills than the static tests (Bridges et al. 2011, Muter et al. 2004).

The aim of the present research is the examination of the phonological awareness development of Hungarian children between the ages 4 and 10 years. Further, we aimed to disclose the effects of reading in Hungarian and phonemic awareness on each other, and also

the processing of PA of 8–9 years old children with written language disorders. We wanted to find answers to questions concerning the types of cognitive processes involved in metalinguistic operations and the effect of gender on PA development. We were also interested in seeing the added information of the dynamic assessment in mapping the processing of phonological awareness. According to our hypotheses, the phonological awareness development of Hungarian children follows the universal patterns showed by cross-linguistic studies in certain aspects but also reveals the characteristics of the Hungarian language. We assumed significant language-based differences in rhyme awareness on the basis of previous research results (Surányi 2009, Damó 1998, Jordanidisz 2009a).

2. Participants, material, method

Altogether 450 children participated in the research. Everybody had at least average intellectual abilities, proper hearing and similar social background. The research had two main phases: (1) the examination of children with typical language development and (2) the examination of children with written language disorder. In the group of typical development, 60 children participated peerage groups. In the second phase, children came to the research with diagnosis of dyslexia or dysorthographia according to the BNO-10 (2004) categories.

We developed a tool for the present research, called the Phonological Awareness Test, based on the Hungarian adaptation of the Phonological Awareness Skills Survey (Barbour et al. 2003, Jordanidisz 2009b). The PA test consists of 10 subtests with 10 exercises in each. Five subtests offer a possibility to assess two skills. Therefore, the research covered the examination of the following 15 skills:

1. Rhyme-detection (subtest no.1)
2. Rhyme-production for nursery rhymes (subtest no.2/a)
3. Rhyme-production for words (subtest no.2/b)
4. Syllable blending of real words (subtest no.3/a)
5. Syllable blending of non-words (subtest no.3/b)
6. Syllable segmentation (subtest no.4/a)
7. Rule-based syllabication (subtest no.4/b)
8. Syllable deletion (subtest no.5/a)
9. Phoneme deletion (subtest no.5/b)
10. Phoneme isolation (subtest no.6)

11. Phoneme blending of real words (subtest no.7/a)
12. Phoneme blending of non-words (subtest no.7/b)
13. Phoneme segmentation (subtest no.8)
14. Phoneme identification of long speech sounds (subtest no.9)
15. Phoneme manipulation (subtest no.10)

The examination of children was administered individually, according to its protocol. Besides the administration of the 450 static tests, we continued with the dynamic assessment in 40 cases. This way we gained 53 900 data, which were statistically analyzed by SPSS 18. The parametric variables were analyzed by t-test, while we used the Mann-Whitney-, Spearman-, and Kruskal-Wallis tests for the non-parametric variables.

3. Results

3.1. The characteristics of the PA development in age groups 4-9

During language development, the PA areas develop differently. They are fully developed at the age 9-10 in the case of Hungarian children, when the ratio of the three main areas (syllable, rhyme and phoneme awareness) is 1:1:1. At age 4, the level of the development of all the three areas together is only the one third of the total developmental level and the ratio of the three areas is 5:10:1 (rhyme – syllable – phoneme). While the rhyme and the syllable awareness develops gradually, the phoneme awareness starts developing at about age 6 and then rapidly progresses (Figure 1).

Examining the syllable awareness, the research showed that Hungarian children are able to break a word into its syllables successfully at the age 4. Following the spontaneously developing syllabication stage, children reached the metalinguistic stage of syllable awareness at the age 5–6, when they were able to blend syllables and manipulate with them. This stage developed until the end of primary school years (age 10).

Rhyme awareness developed differently in early years (age 4–6). Spontaneously it developed only in the presence of nursery rhymes. Since producing rhyming words – which means the activation of the mental lexicon on the basis of rimes – requires good executive functions to direct the focus of attention to the rime instead of the onset, only school age children were able to do these tasks successfully.

Hungarian children develop rapidly in the phonemic areas due to the transparent orthography of their mother tongue. According to the present research, it develops in the first two years of formal schooling and literacy instructions. We also found the phoneme manipulation the most difficult task. Children had to solve three types of manipulations: deletion, replacement and pronouncing the inverse order of the phonemes. The manipulation of phonemes in inner word position proved to be the most difficult mental operation.

When we examined the correlations of the different phonological areas with regression analysis we found that the early developmental stage of rhyme awareness, rule-based syllabication and syllable blending were the best predictors for the school-age level of phoneme blending ($r^2=0,808$), phoneme segmentation ($r^2=0,857$) and phoneme manipulation ($r^2=0,850$), which are the most important phoneme awareness tasks for literacy.

The research also proved the importance of the language environment in the phonological awareness development of 4-year-olds. In the basic research, 4-year-old children came from pre-schools where children were placed in groups by age. We carried out an additional small-scale research with 30 4-year-old children, who attended mixed groups, which means that they could participate in those explicit phonological development tasks (games) which were given to older children. The results proved our hypothesis and showed significant difference in the rhyme and phoneme awareness of the two types of group for the benefit of those who attended the mixed age groups.

When we compared the PA development of girls and boys, we found no significant difference on the areas of syllable and rhyme awareness from age 4. Girls reached the phoneme level earlier than boys, as a result of spontaneous development before schooling. The phoneme awareness of the 6-year-old kindergarten girls reached significantly higher level than that of the boys ($Z=-2,854$, $p=0,004$). Boys' phoneme awareness started developing as a result of explicit literacy instruction at school and caught up with girls' level at age 9–10 (figure 2).

3.2. The phonological awareness of Hungarian children with written language disorders

The present research disclosed the characteristics of dyslexic children at the ages 8, 9 and in middle school. It showed that dyslexic children's PA development was significantly poorer than that of the typically developing children in the following areas:

1. In every subtest of rhyme awareness
2. On three areas of syllable awareness: syllable blending of non-words, rule-based syllabication and syllable deletion
3. On the following areas of phoneme awareness: phoneme blending (especially in non-word tasks), segmentation, phoneme identification of long speech sounds and most of all the manipulation tasks

We found that dyslexic children caught up with their typically developing peers on the areas of syllable segmentation, real word syllable blending and phoneme isolation by the end of the primary school. Tables 1–3 show the significant differences between children with dyslexia and typical development on the three areas of phonological awareness.

Table 1

The level of significance when compared the rhyme awareness of dyslexic and typically developing children

compared groups		rhyme detection	rhyming to nursery rhymes	rhyming to words
8 year-old D.	8 year-old T.	$p < 0,001$	$p < 0,001$	$p < 0,001$
9 year-old D.	9 year-old T.	$p < 0,001$	$p < 0,001$	$p < 0,001$

Table 2

The level of significance when compared the syllable awareness of dyslexic and typically developing children

compared groups		syl. deletion	syllabication	blending of non-words
8 year-old D.	8 year-old T.	$p = 0,001$	$p = 0,002$	$p = 0,002$
9 year-old D.	9 year-old T.	$p = 0,001$	$p < 0,001$	$p = 0,001$

Table 3

The level of significance when compared the phoneme awareness of dyslexic and typically developing children

compared groups		deletion	isolation	blending real words	blending non-words	ident. of sounds	segment.	manipulation
D8	T8	$p < 0,001$	$p = 0,045$	$p = 0,001$	$p < 0,001$	$p = 0,001$	$p = 0,002$	$p < 0,001$
D9	T9	$p = 0,003$	$p = 0,053$	$p = 0,001$	$p = 0,005$	$p < 0,001$	$p < 0,001$	$p < 0,001$

3.3. The dynamic assessment of phonological awareness

Concerning the dynamic assessment, the present research confirmed that it provides additional information about children's PA processing in both typical and atypical development. On the one hand, the typically developing children responded well to little intervention – namely to offering repetition – and corrected their error. On the other hand, dyslexic children needed intense intervention – for example, providing strategies for solving the PA task – and even with such a concrete assistance some of them were not able to succeed with the task. Although, their phonological awareness did not reach 100% in most cases even with the dynamic assessment, the change proved to be significant (Table 4).

Table 4

The comparison of static and dynamic assessment results of children with typical development and dyslexia

	static assessment				dynamic assessment			
	typical		dyslexic		typical		dyslexic	
	mean	szórás	mean	szórás	mean	szórás	mean	szórás
	%	%	%	%	%	%	%	%
rhyme-detection	93	9	79	25	96	6	81	24
rhyming 1	100	-	81	22	100	-	89	14
rhyming 2	80	23	45	32	87	19	54	31

	static assessment				dynamic assessment			
	typical		dyslexic		typical		dyslexic	
	mean %	range %	mean %	range %	mean %	range %	mean %	range %
syl.blending 1	100	-	100	-	100	-	100	-
syl.blending 2	99	4	97	6	99	4	98	4
syl-segment.	100	-	100	-	100	-	100	-
syllabication	96	6,8	91	11	98	6	93	9
syl.deletion	95	9	86	11	98	6	90	12
P. deletion	96	8	89	17	98	6	95	11
P. isolation	99,5	2	98	7	100	-	100	-
P. blending 1	97	7	80	19	98	6	88	15
P. blending 2	87	12	72	22	92	12	76	21
P. segment.	98	4	91	10	98	4	96	5
P. identific.	96	6	87,5	13	98	4	92	11
P. manip.	94	9	73	21	97	5	81	19

4. Conclusion

The present research results led us to the conclusion that the syllable awareness of Hungarian children develops spontaneously and the mental representation of the syllables gradually progresses towards the language-rule-based syllable forms. The spontaneous development of the syllables is enhanced by the rhythmic patterns of Hungarian nursery rhymes. Comparing the syllable awareness of Hungarian children to the results of English research (Libermann et al. 1974) we found that this level of the phonological awareness is more mature in young Hungarian children, similarly to their Italian peers (Cossu 1999).

The characteristics of the Hungarian language (its vocabulary, morphology and stress pattern) do not induce the early development of rhyme awareness. Spontaneous rhyming is connected only to the nursery rhymes. When children need to find rhyming words to the end of a nursery rhyme, then the “search-frame” in the mental lexicon is narrowed down to those words which are activated by meaning. When a child needs to find a rhyming word to a given word, the task is very difficult due to the nature of Hungarian children’s focus of auditory attention.

Mismatch Negativity examinations showed (Surányi et al. 2009) that they focus on the onset of the words rather than to the rime. Therefore, rhyming tasks become appropriate for them when the executive functions develop and make it possible to shift the attention to the rime while searching in the mental lexicon.

Some Hungarian children – especially the girls – may reach the phoneme level even before the onset of formal instruction on literacy and becomes able to isolate phonemes in initial, final then in middle position. The more complex operations at phoneme level are connected to the reading acquisition. The proper blending of non-words' phonemes is a more difficult task than that of a real word. In such cases, the activation of the mental lexicon does not help – rather, it leads to a dead end – if it is activated at all. Therefore, the workload on the working memory and on the executive functions is bigger. In the more complex manipulation tasks, the level of difficulty depends on the length of the word (the number of the given units) and on the number of units we need to manipulate on.

The present research confirmed the following previous research results:

1. The acquisition of grapheme-phoneme correspondence enhances the development of the phoneme level (Goswami 2003).
2. The explicit phoneme tasks develop the PA system rapidly.
3. The language environment which is rich in metalinguistic games influences the spontaneous development of phonological awareness but does not influence the working memory and the executive function in preschool. Therefore, the meta-phonological skills do not develop as a result of general cognitive development but separately (Wagnes et al. 1987,1999)
4. Children before the onset of formal literacy instructions can reach smaller grain size than syllables and rimes (Goswami – Ziegler, 2006, Caravolas).

The Phonological Awareness Test proved to be an adequate tool to screen children for written language disorders. Since it is not a standardized test, it needs further development. On the basis of the present research, we recommend the screening of all the areas of rhyme awareness and syllable awareness at age 5. Screening primary school children can also be useful at the beginning of grade 2 to understand the poor level of reading in a better way and to set the direction of intervention. This time, administering the phone subtests are crucial – with the exception of the phoneme isolation which showed ceiling effect with this age group.

The use of dynamic assessment may assist in differentiating between attention problems and language-based impairments. Its further benefit is that children rarely experience failure during testing.

5. The theses of the dissertation

1. In the early period of the development of Hungarian children's phonological awareness the syllable awareness develops spontaneously. Children segment the words according to the characteristics of the Hungarian syllable structure. Syllable segmentation becomes fully developed at about age 8 when children are able to perceive the temporal features of the speech sounds and the explicit learning confirms the rules. The early rhyme awareness development of Hungarian children is limited even in the presence of nursery rhymes and rich language experiences. The rhyme-based activation of the mental lexicon requires the development of the executive functions. The cognitive maturity influences the success of complex syllable and phoneme tasks, too. Preschool and kindergarten children have only limited access to the phoneme level. It develops rapidly under the influence of learning to read. Approximately, children need about 2–3 years in formal, explicit literacy instruction to acquire the written language. However the rich meta-linguistic environment supports the operation at the phoneme level even before schooling.
2. The development of phonological awareness of Hungarian children shows both universal and language specific characteristics. Its universal feature is that Hungarian children have access to the units according to their grain size: first to the bigger syllables then to the smaller phonemes. Its language-specific feature is the lack of spontaneous rhyming in the development that is connected to the fact that Hungarian children focus on the onset of the words due to the stress pattern of the language. During the phoneme development, the isolation of certain phonemes depends on their position and the articulation. In segmentation, the most difficult task is to segment consonant clusters which are blended or not pronounced due to co-articulation.
3. Blending becomes an easier operation in the case of a real word due to the activation of the mental lexicon. Manipulation is the most complex PA operation. Its level of complexity depends on the length of the words and the number and position of the

manipulated units. The most difficult position of the manipulated phoneme is inside the word.

4. The PA development of girls and boys shows similar level at the ages 4-5. Girls reach the phoneme level earlier when they precede the boys. However, due to the explicit learning to read, at the age of 9, their achievements become equalized again.
5. Children with dyslexia lag behind their typically developing peers in many areas of PA. In those tasks, in which the executive functions are deeply involved, they process even weaker. These areas for Hungarian children are the word-based rhyming, and the phoneme manipulation, in which the results show significant delay even above the age of 10.
6. Dynamic assessment provides important information about the child's working memory, the executive functions and perception. In the cases of dyslexic children, the response they give to the intervention and the intensity of the assistance they receive are factors that indicate language-based deficits.

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