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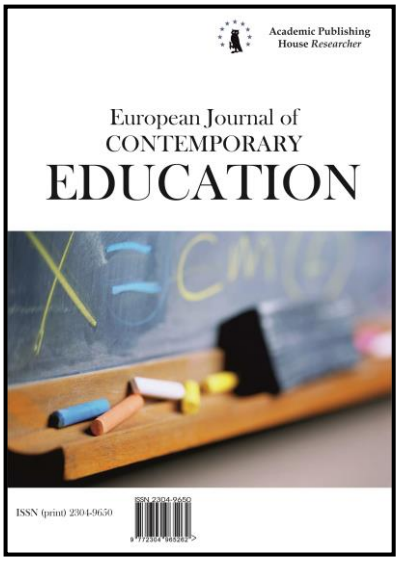

Phonematic Awareness and Chosen Cognitive Functions of a Child

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Abstract

The study presents research results in the level of phonemic awareness, particularly phonemic analysis and synthesis at children of preschool age in connection with the level of chosen cognitive functions. The study focuses more on the cognitive function of speech, namely active vocabulary and we identify whether the active vocabulary of a preschooler in Slovakia influences the level of phonemic awareness in the field of phonemic analysis and synthesis. From the results it is clear that there is a statistically significant relation between the level of phonemic awareness in the field of phonemic analysis (r = 0,510; p= <0,001) and also with the phonemic synthesis (r = 0,482; p= <0,001) and active vocabulary of children. The results show that the children, who achieved a higher level of active vocabulary, achieved also the higher level of perceptual analysis and synthesis. Thus, the findings showed that the children who achieved a higher level of active vocabulary, they also achieved a higher level of perceptual analysis and synthesis. Perceptual analysis and synthesis are the key factors of phonemic awareness that are according in a close relation with acquisition of reading and writing skills. That children entering schools with strong linguistic knowledge learn to read and write with an ease and less difficult than their peers who have lower level of vocabulary and language structures. Spoken expression is an important factor in development of a child not only in relation with actual developmental level but as a factor that can predict success of the child in school. The didactic level benefits from the research with the findings that systematic development of vocabulary of preschool children can play a significant role in development of phonemic skills of the children and furthermore, by phonemic awareness development it is possible to contribute towards developing reading and writing skills. Thus, the reading literacy can be supported.

Keywords: phonematic awareness, auditory analysis, auditory synthesis, active vocabulary, cognitive functions, reading literacy, strategies developing critical thinking.

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1. Introduction

Cognitive functions accompany humans during their whole lives. Through cognitive functions a person learns, remembers, recognizes and acquires the ability to adapt to the changing conditions of environment. They enable him processing information into mental representations and further on working with them. Speech, memory, thinking, perception, imatination and attention belong among cognitive functions. In our study we focus on the relation of the chosen cognitive functions and phonemic awareness that belong to the key predictors of acquiring reading and writing skills and literacy as it was proven by works of Bruce (1964), Liberman, Shankweiler, Fischer, Carter, (1974), Elkonin (1973). Studies of Bradley and Bryant (1978) unambiguously proved that the children with difficulties in reading reach a low level of phonemic awareness and that has been assessed as a cause of their problems in reading.

The relation of phonemic awareness and the level of the postponed reading and writing has been proven by following studies (Bryant et al., 1990; Cataldo, Ellis, 1988; Stuart, Coltheart, 1988). For example, Cataldo and Ellis (1988) searched the relation between reading, spelling and phonologic awareness in the first three years of schooling. The level of phonemic awareness was a predictor of the later development of reading and spelling in every phase of testing. These arguments attract the interest of experts in didactics for searching the effective development of phonemic awareness and also motivate to search for predictors influencing the level of phonemic awareness.

2. Theoretical background

Phonological awareness presents a metalinguistic ability to recognize and manipulate the sound structure of words without focusing on their meaning at a different level of language difficulty (Phillips et al., 2008). In the theoretical frame, Caroll (2001) describes phonemic awareness within two levels of understanding. The first becomes the theory by Goswami & Bryant (1990) based on a level of phonemic awareness of preschool children and the second one is by Gomert (1992) based on epilinguistic and metalinguistic awareness. Hearing perception is the base for phonemic awareness. Hearing perception of the speech which is directly connected with the development of the self-speech is particularly important in the preschool age. Through hearing perception a child acquires a mother tongue. The first elements of speech a child recognizes around their third month of age and at the end of the first year they are able to perceive the content of simple sentences.

A child does not create his own speech but repeats the speech after adults and thus acquires meaning of the words receiving them in a complete form. Pokorna (2010) states, that perceptual differentiation develops gradually after the basic skill of using the speech altogether with its grammar structures is completed. When a child is around 4–5, he or she starts to differentiate particular words in a sentence. Chanting with rhythmical patterns and sentences dividing it into small parts help towards the development of this skill. Around the age of five a child starts perceiving particular sounds in the words (which sound is at the beginning of a word, later on which is at the end). The most difficult is to determine a sound in the middle of the word. Further discrimination in speech perception is a perception of the sound length and differentiation of palatalized (soft) and non-palatalized (hard) consonants (6–7 years). The problems in auditive perception can lead into various difficulties, as for example inability to focus attention on one acoustic stimuli and differentiate it from other sounds, an inability to analyse similar sounds, phonemes, words, towards analysing a sentence by words, mixing voiced and voiceless consonants, towards the problems with perceptual analysis and synthesis (inability to divide a word into sounds) caused by merging particular phonemes, or insufficient auditive recognition of soft and hard sounds. The problems in auditory memory can appear in disability to remember the content or form of the heard content.

Listening connected with comprehension of the spoken speech does not have to be obvious. Many times teachers and parents assume that children do not understand them. The reason for this might be a decreased ability to perceive spoken words with focus and understand them. Children either do not perceive because they cannot focus on hearing stimuli or they hear correctly but they cannot recall the content of particular words, understand their meaning (Macajova et al., 2017).

Table 1. Orientation data on Development of Hearing Perception up to 6 years of Age (Duchovicova, Lazikova, 2008)

Skill		Age
Perceptual Differentiation	Localizes a sound	3
	Recognizes objects according to the sound	3.5
	Recognizes songs according to melodies	4
	Differentiates various words with visual stimuli	4
	Differentiates words without visual stimuli	5
	Differentiates words different in length	5
	Differentiates words different in softening	5.5
	Differentiates non-significant syllables	6
Auditory Memory	Repeats a three-word sentence	3
	Repeats three unrelated words	4
	Repeats four-word sentence	4
	Repeats four unrelated words	5
	Repeats a five-word sentence	5
	Repeats five non-related words	6
Perceptual analysis and Synthesis	Claps a word into syllables	4
	Determines a number of syllables	5
	Determines the first sound in a word	5
	Determines the last sound in a word	5.5
	Determines whether the word contains the given sound	6
	Forms a word from sounds	6
	Analyses a word into phonemes	6
Perception of Rhythm	Determines whether two rhythmical structures are the same	5
	Imitates the rhythm	5

Within the context of phonological abilities there is a term phonematic and phonological awareness. According to Jost (2011) phonological processing covers:

1. Phonological awareness,
2. Short-term phonological memory – an access to phonological information in the long-term memory,
3. A modulation factor that involves abilities to process melody, intonation and rhythm of a speech

Phonemic awareness covers:

1. An ability of analysis (awareness of rhymes, syllables, phonic awareness. Phonic awareness covers analysis of the first phoneme in a word, an analysis of the last phoneme in the word and analysis of the middle phoneme in a word).
2. An ability of synthesis

Phonemic hearing is also a part of phonemic awareness and it represents an ability to recognize phonemes by ear in the words that have meaningful function. According to Kutalkova (2005) phonemic hearing provides connecting sounds into words and division of the word into sounds, thus perceptual analysis and synthesis. Inadequately developed phonemic hearing is considered to be one of the main causes of dyslexia. Perceptual analysis represents an ability of a child to split a verbal expression into smaller segments (sentences, words, syllables and sounds). Perceptual synthesis is a reverse process. The basis is a cognitive activity that runs in unseparated unity of every cognitive process of perception, sense, imagination, thinking and certain cognitive operations (Macajova et al., 2017). Phonemes as abstract units of a language are reachable only by analysis. When a child acquires a language, he/she learns sound units (words) that are connected with notions. A phoneme is only a fraction of the unity and does not bear any notion (Jost, 2011). A maturity of a child can refer to premises of the correct perceptual analysis and synthesis,

achieving a necessary cognitive processes and systematic perception, quality of attention, good language handling, and well-fixed vocabulary (Macajova, 2011). In synthesis it is not just about composition of sentences from words, or words from sounds. There is a connection of two processes that is comprehension and verbal fluency. Verbal comprehension is tightly connected with receptive ability to understand spoken and written input of words, sentences, paragraphs and verbal fluency is an expressive ability to create a language output (Sternberg, 2009).

Metsala (1999) confirmed by research a mutual interconnection of phonologic abilities and speech development and the meaning is seen mainly in the scope of a preschool child vocabulary. The ability based on which the child recognizes bigger and gradually smaller speech units, is in the tight connection with the process of word acquisition. According to Byrne (1998) the meaning of vocabulary is not continuous for phonological abilities. He points at the period of a quick speech development, i.e. between 18 months to 3 years of a child. In connection with broadening vocabulary a child creates also a certain scope of phonologic awareness. The authors mentioned in the paper also note down that phonological awareness does not have to have essential influence on further vocabulary acquisition. The relation of vocabulary and phonemic awareness is described in the studies by Walley et al., 2003; Edwards et al., 2004; Munson et al., 2005.

A study by Muter, Hulme, Snowling (2004) shows that phonologic subsystem of a language influences primarily an initial development of literacy. The authors state that predictors of phonemic sensitivity, i.e. sound recognition, are cognitive functions, an ability to recognize words, active vocabulary and grammar skills. The research of preschool children literacy by the authors Pinto, Bigozzi, Vezzani and Tarchi (2017) reveals that it is obvious that a significant predictor for the process of reading is comprehension of the writing process. Phonemic awareness influences also reading from the reason that it is integrated in comprehension and knowledge necessary for a writing system. A significant finding is a fact that word segmentation into syllables and sound isolation bears “a significant rate of responsibility for the process of the early phases in reading skill development” (Majova, 2009). The meaning is accredited also to perceptual synthesis. This opinion is confirmed also by a longitudinal research by Wagner, Torgesen and Rashotte (1994). The authors label perceptual analysis and synthesis as a key skill influencing the ability to learn how to read. Within the last part of phonologic awareness according to Adams (1990) it is a demanding skill – manipulation with sounds that requires not only recognize the sounds from which the word consists but also omit the sounds, change them, etc. Individual differences in this ability to omit or change the sound in words are essential factors of literacy levels during the study at primary school (Majova, 2009). Similar findings are found in a study about Czech and English very young learners (Caravolas et al., 2005). This study followed the role of phonological awareness in development of reading and writing. The children with significantly linguistically and orthographically different languages in the age 7.5–11.5 years of age were tested for a predictive value of phonologic awareness for writing, speed in writing and reading comprehension. Phonological awareness was shown as a significant predictor of reading speed, correctness in writing and reading comprehension.

Based on the research findings we have created the following research intentions.

3. Research problem

The subjects of our research were partial cognitive functions and phonemic awareness of children. Phonemic awareness has been a subject of research since the 80´s of the 20th century in the direct interaction with the language research and literacy. It focuses on metalinguistic ability to recognize and manipulate with the sound structure of the words independently from their meaning on a different level of difficulty. The basic of phonemic awareness is a perceptual analysis and synthesis. Children in preschool age develop differentiation. If there are deficiencies in the field of hearing at preschool children, differentiations and analyses of speech sounds, then problems can occur in reading and writing development in their schooling age. based on new knowledge current focus of pre-primary pedagogy is to find various ways of how to support and stimulate phonemic awareness through educational programs and trainings as well as determinants that can stimulate or limit it.

The aim of our research was to find out whether the vocabulary of a child directly influences the level of perceptual analysis and synthesis. It focuses on searching the relation level of a chosen cognitive function – speech in the factor of **active vocabulary with the phonemic awareness**

of Slovak children at preschool age. Following this aim, the research problem is a relation of perceptual analysis and synthesis with the active vocabulary of children in preschool age. Based on the studied researches in the field of phonemic awareness and cognitive functions we expect a positive relation.

There are two research hypotheses formulated within a research problem:

Hypothesis 1: The children who reach a higher level of active vocabulary, reach a higher level in perceptual analysis.

Hypothesis 2: The children who reach a higher level of active vocabulary, reach a higher level in perceptual synthesis.

4. Research Methods

The choice of testing instruments that enabled us to identify the level of phonemic awareness children, was based on the analysis by Janeckova (2014) who collected the most commonly used diagnostic instruments of phonemic hearing by speech therapists. After the evaluation of measuring qualities of instruments and their availability, we chose the *Exam of perceptual analysis and synthesis (SAS) by Z. Matejček* for the testing instrument. The test consisted of two parts. Firstly, we carried out the perceptual analysis because it represents an easier part for children. In this part the children got the task to divide words into sounds. In the perceptual synthesis a reversed task is required. Particular sounds were read to children and after that they had a task to join the sounds correctly into the words. While taking this exam we always used the example to make it clear for the children.

We chose the *IQ test WISC III*, particularly a subtest 8 Slovník (Wechsler, 2006) for the level identification of cognitive functions, particularly the level of speech. Due to the fact that the instrument is standardized for the age group of 6 years of age, this factor further in the research influenced also the age of the tested children. Statistic processing of the data was realized through *Kolmogorov-Smirnovov Test* that confirmed the data normality, *Pearson correlation coefficient* that searched for mutual relations of variables.

The research was carried out in the pre-primary schools in Nitra region and this fact partially limits the generalization of the results, however, our findings are considered to be piloting for searching relations of the level of cognitive functions with phonemic awareness. The choice of preschools was based on availability and the choice of the children in the preschools was intentional as the sample consisted of the children who had reached 6 years of age. Overall, there was 52 children, of which 58 % of girls and 42 % of boys taking part in the research. Pucekova (2018) participated on data collection.

5. Analysis of results

The identified data were processed through mathematical and statistical methods. The data normality was found by Kolmogorov and Smirnov test, based on which we found out that the data were normally distributed (KS = 0,085, p = 0,200; KS = 0,114, p = 0,091; KS = 0,139, p = 0,013) and for other analyses we chose parametric tests.

Table 2. Normality of Data

Variables	Kolmogorov-Smirnov		
	Statistic	df	p
Active vocabulary	0.085	52	0.200
Perceptual analysis	0.114	52	0.091
Perceptual synthesis	0.139	52	0.013

Table 3. Minimal/maximum score, average and standard deviation at all the children in total

Total	N	Minimum	Maximum	M	SD
Active Vocabulary	52	6	32	17.83	6.573

Perceptual Analysis	52	0	20	6.19	4.366
Perceptual Synthesis	52	0	18	5.35	4.934

Verification of research hypotheses. Hypothesis 1 focused on the relation of active vocabulary with a level of perceptual analysis. We assumed that the children, who reach a higher level in active vocabulary, reach also a higher level of perceptual analysis. The findings are shown in Table 4.

Table 4. Relation of active vocabulary with perceptual analysis

Variables	**N**	**M**	**SD**	**r**	**p**
Active Vocabulary	52	17.83	6.573	0.510	**<0.001**
Perceptual Analysis	52	6.19	4.366		

**Comment: N – number; M – average; SD – standard deviation; r – Pearson correlation coeficient; p – significance level*

Thanks to Pearson correlation coeficient we found out that there is statistically very significant relation between active vocabulary with perceptual analysis (r = 0,510; p = < 0,001). That means that active vocabulary acquired by a child has a significant relation with the level of perceptual synthesis as a key part of phonemic awareness.

Our hypothesis assumed that the children who reach a higher level of active vocabulary, reach also a higher level of perceptual analysis. Based on the result of our research we consider this hypothesis to be confirmed.

Hypothesis 2 focused on the relation of a level in active vocabulary with a level of perceptual synthesis. We assumed that the children who reach a higher level of active vocabulary, reach also a higher level of perceptual synthesis. The findings are shown in Table 5.

Table 5. Relation of perceptual synthesis and active vocabulary

Variables	**N**	**M**	**SD**	**r**	**p**
Active vocabulary	52	17.83	6.573	0.482	**<0.001**
Perceptual Synthesis	52	5.35	4.934		

** Comment: N – number; M – average; SD – standard deviation; r – Pearson correlation coeficient; p – significance level*

The result in Table 4 present findings that there is a statistically significatn relation between active vocabulary and perceptual synthesis at children of preschol age (6-year olds), based on which we can state that the hypothesis was confirmed.

6. Conclusion

The aim of our research was to find out the relation of partial cognitive functions with phonemic awareness. In a research problem we focused on a relation of active vocabulary and perceptual analysis and synthesis at Slovak children in preschool age. We were searching how active vocabulary influences perceptual analysis. We found out that there is a statistically significant relation between the variables (r = 0,510; p = <0,001). In confirming the relation between active vocabulary and a level of perceptual synthesis we came to the same results (r = 0,482; p = <0,001). Thus, the findings showed that the children who achieved a higher level of active vocabulary, they also achieved a higher level of perceptual analysis and synthesis. Perceptual analysis and synthesis are the key factors of phonemic awareness that are according to the studies (Pinto et al., 2017; Elhassan et al., 2017; Moats, Tolman, 2009; Vaessen, Blomert, 2013; Ehri, 2005; Ehri, Roberts, 2006; Tucker et al., 2016; Muter et al., 2004) in a close relation with acquisition of reading and writing skills. Kasacova et al. (2017) state that children entering schools

with strong linguistic knowledge learn to read and write with an ease and less difficult than their peers who have lower level of vocabulary and language structures. Spoken expression is an important factor in development of a child not only in relation with actual developmental level but as a factor that can predict success of the child in school.

The didactic level benefits from the research with the findings that systematic development of vocabulary of preschool children can play a significant role in development of phonemic skills of the children and furthermore, by phonemic awareness development it is possible to contribute towards developing reading and writing skills. Thus, the reading literacy can be supported.

A teacher´s role in a preschool is to prepare a child for reading and writing, first of all through the support of comprehension of what types a writing culture consists of and how to use it regarding the different intentions of reading and writing (Zapotocna, Petrova, 2016). According to our findings, a child in preschool can be prepared for reading and writing by a systematic development of vocabulary. The development of vocabulary in early childhood should be done naturally and amusingly as a part of activities and task in preschool. Steward (2009) mentions techniques of stressing out new words that are a part of children tasks and daily activities from the environment of children and formation of new meanings of words by playing, authentic and natural use of new words in the conversations, or when talking about games. The words describing feelings and emotions play also significant roles. The words such as happy, sad, tired, lonely, cosy, uncomfortable, etc. should be covered by everyday talk.

A suggested technique is emphasizing the names of objects, switching the names of familiar and less familiar objects that are interesting for children and supporting conversation and also a frequent use of descriptive words (adjectives) expressing qualities of objects. An important strategy of developing vocabulary is emphasizing words when reading books and looking through pictures. A strategy can be an every day reading out loud, repeated reading of favourite books that can help children connect printed words and pictures of a story. When children hear a story, they draw connections of words that are heard when listening. Going through the pictures of the read books can also be supportive because a child already knows what the book is about and what words there are and probably tries to express them. An applicable technique is also integration of printed versions of words in environment that a child is surrounded by (in classroom, at home) and when a child shows an interest in one word, it is necessary to help a child identify and use it in everyday talks. Names of children should be a part of such words. Stanovich (1986), Bast, Reitsma (1997) describe so-called ´Matus effect´in the context of relation of vocabulary with learning to read and write that also confirms a significant meaning in stimulation of vocabulary at preschool age of children. In this relation there is a rule that the more words a child knows, the more they want to read. The more they read the more vocabulary they learn. More reading does not have the same effect for children starting their school with limited vocabulary, i.e. more reading does not cause bigger vocabulary. The wider methodological material of how to develop vocabulary is presented by the authors Beck, McKeown, Kucan (2002), and social factors that influence acquisition of vocabulary in early childhood is discussed by Dickinson, Cote, Smith (1993), Marvin, Beukelman, Bilyeu (1994) and others.

As vocabulary development of preschool children is not an isolated topic and falls into the wider context in the issue of communication competences development of children, within the topic we recommend also the works of national authors that processed the theoretical backgrounds and ideas for analyses and creation of curriculum of language education of preschool children (Zapotocna, Petrova, 2010); an issue of literacy from the view of its development and possibilities of didactic direction (Gavora, Zapotocna et al., 2003; Lipnicka, 2008), or studies on early literacy (Pupala, Zapotocna, 2003) and theoretical contexts of phonemic awareness as a precursor of literacy development (Macajova et al., 2017, 2019; Macajova, 2011). In order to develop communication competences Srnova (2014) recommends the teachers to create such conditions so that the children are stimulated to active speech production and acquisition of required communication skills. She emphasizes mainly the use of breathing, voice, articulation exercises into educational activities during a day by intentionally chosen games in order to develop phonemic awareness and phonemic differentiation of sounds, improve grammatical correctness in spoken expression and develop the awareness on grammatical structure of a language. Stimulative environment, professionality of teachers and their speaking model as well as the content and

organization layout of a day in a preschool creates optimal conditions for development of the correct speech at children according to the author.

There are lots of programs for preschools focused on literacy development, phonemic awareness and language development and it is up to teachers to stimulate vocabulary of children as an inseparable part of curriculum and apply it in their every day educational practice. The paper is an output from the research project VEGA no. 1/0637/16 titled Development of a Diagnostic Tool to Assess the Level of Phonemic Awareness of Children in Preschool Age.

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