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LIP-READING WITH DEAF AND HARD OF HEARING PRESCHOOL CHILDREN^a

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SUMMARY

Pedagogical and educational work with deaf and hard of hearing children is characterized by the application and teaching of lip-reading. Speech is acquired spontaneously by listening. In the absence of auditory stimuli, deaf and hard of hearing children follow carefully the movements of the lips of a person who speaks. Thus, visible images of the movements of speech organs which take part in the articulation are created. Visual perception of speech does not only involve recognition of each individual sound, but it is also important that a child should perceive the information as a whole and understand its meaning.

The aim of our research was to establish the level of success in lip-reading separate terms and sentences with deaf and hard of hearing preschool children.

We examined the success in lip-reading within the following areas: body parts, domestic and wild animals and clothes and shoes. Moreover, we examined the acquisition of first adjectives, verbs and pronouns which children at this age should have learnt as well as the success in lip-reading sentences (which related to the story “the Gigantic Turnip”), which we checked through pictures.

The sample comprised 15 preschool children who attend preschool groups at schools in Belgrade.

The results obtained show that the terms within the area of body parts are best lip-read, while the poorest results were achieved in lip-reading terms relating to clothes and shoes. The terms which are more frequent, which are used more and which the children have had some experience with are better lip-read although they are less legible by the structure of sounds. The significance of early knowledge of signs facilitates the acquisition of terms as well as lip-reading. A lot of children responded to the spoken term with an adequate sign and showed a higher level of understanding of what was spoken than the children who did not use a sign (a gesture). In lip-reading sentences, the children perceived the length of sentences and recognized individual terms, while they gave adequate responses from the context of pictures.

Key words: lip-reading, visibility (legibility) of sounds, deaf and hard of hearing children, preschool age

INTRODUCTION

The first symbols of oral – vocal speech pointed the audience to the mouth and face of their interlocutors. Today, as well, when speech reaches a high level of development,

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one often seeks, by watching the interlocutor's face and mouth, to get more information about the subject of conversation. This is particularly noticeable under the conditions of somewhat difficult communication (i.e. high environmental noise or when speech is faintly heard). We can say that speech reading is not unique to deaf people, but also to people who don't have a hearing problem, except that their percentage of participation of vision is considerably lower.

There are still different opinions on whether the child, in developing speech, relies more on optical images of a word, or just the acoustic symbols, and whether it's exactly these images that make it possible for the child to develop speech. What is mutual is agreeing about the fact that the child is carefully monitoring the movements of the lips of the person who speaks, and in that way it creates visible images in its mind.

A child who can hear, perceives speech and controls it through hearing, which is above the stimulus' speech threshold. Auditory control of speech does not stop in the chain of communication, not even when speech is adopted and automated. A child with a hearing impairment does not develop speech, and in an adult who has a hearing impairment, an impairment of speech ensues.

For children with impaired hearing, visual perception is crucial in formation of speech.

The bigger the hearing loss is, the more the person depends on good quality visual information in order to understand speech. We can say that everyone has, in part, the need to lip-read. Dimić (2002) states that understanding speech is improved when speech reading is combined with hearing. In working with older children and adults it is pointed to a strong link in using the remains of hearing together with lip-reading and / or sign language.

Lip-reading (Speech reading)

Deaf and hard of hearing children are instructed to use alternative forms of communication which require information to be processed in a different, and cognitively more demanding, way. Visual perception of speech does not only imply recognizing each individual voice, but it is important that the child perceives the information and understands its message. Because of their inability to learn by listening, they are directed to speech reading from the mouth and the face of the interlocutor. However, lip-reading is not the same as listening. Deaf and hard of hearing children can not control their pronunciation by watching, like normal hearing children do by listening. For this reason, hearing impaired children, in addition to the visual perception of movements of speech organs, have to use the help of the remained hearing, kinetic and tactile stimuli and, with their help, reorganize phonemic coupling.

We can say that lip-reading is a complex activity and it is a result of harmonious operation of various cortical structures and connections and not only connecting verbal symbols and adding up phonemes into words and sentences, but also understanding the thoughts and ideas. The nature of lip-reading, its quality, is determined by cognitive development as well as neurological conditionality.

The first definition of speech reading from the face and mouth was given by John Bulwer in the seventeenth century. It reads: Listening with the eyes is a very delicate

skill through which a keen and attentive eye can, depending on lip movements, "hear" what any person is saying (Dimić, 2002).

Speech reading from the mouth and face of the interlocutor is the ability to receive optical images of words, process them, understand them and confirm them in speech behavior and activity (Dimić, 2003).

Reading oral-vocal speech from the mouth and face of the interlocutor is part of a chain of speech communication that includes the speaker and the one who speech reads. However, speech reading can not be reduced just to visual perception of movements of speech organs, it includes the remaining auditory capabilities, as well as thought processing of the received data (Dimić, 2002).

Research on visual perception of speech without its accompanying auditory stimulus was carried out on a sample of two groups of patients. The first one consisted of the University of Maryland students (N=96), and the second one consisted of deaf adult subjects with severe and very severe hearing impairments who were students of Gallaudet University (N=72). Participants were aged 18 to 45. Video recordings of a male and a female speaker, recorded in such a way that their faces filled the screen, were used, the monitor was a color monitor, at a distance of two meters away from the respondents. Meaningless syllables and monosyllabic words and sentences were presented. Deaf examinees achieved statistically significantly higher mean values than the hearing examinees. The authors have concluded that most patients with early hearing loss, especially with congenital profound impairments, speechread from the lips more precisely due to the need to further understand speech through visual perception (Bernstein, Demorest & Tucker, 2000).

Visual perception of speech was tested in people with impaired hearing which occurred at an early age (N=112), and it was compared with that of 220 hearing examinees. The average age of examinees was 23. The instrument that was used is a speech reading test that includes 30 sentences, on video recordings (Bernstein & Eberhardt, 1986). The sentences were presented with the help of a computer that was located 0.5 m away. After they had read a sentence, the examinees typed what they thought the speaker had said. The achievements of examinees who lost their hearing early significantly exceed the achievements of hearing examinees. Deaf respondents are better at reproducing words in sentences. The ability to speech read is positively correlated with self-assessment of the skills of communication through spoken language. The conclusion is that experience has an important part in communication through speech (Auer & Bernstein, 2007).

People naturally move their heads when talking and in that rhythmic movement of the head transfers linguistic information. The obtained results point out that subjects identify a larger number of syllables correctly when natural movements of the head are present in the animation, than when they are distorted or eliminated. These results suggest that nonverbal gestures (such as head movements) play an important role in perception of speech (Munhall, Jones, Callan, Kurata & Vatikiotis-Bateson, 2004).

Goebel (2013) points out that conversation is the key to fostering and maintaining interpersonal relationships. When the auditory signal is degraded due to hearing loss, there are significant limitations and difficulties in communication. In that case, other communication strategies are used in order to understand the information. This study

examines the effects of using context when lip-reading while listening (context from test sentences and situational context). The obtained results show that the context is used more through the visual than through the auditory channel. Deaf and hard of hearing people should use the remaining auditory capabilities in order to fill in the context, and it is certainly necessary to rely on visual perception in order to understand what was said.

A group of authors investigated whether the ability to speech read from the mouth can be improved at the age of 7 to 14 and whether hearing loss affects the development of the ability to speech read. What kind of a relationship there is between individual differences in lip-reading and the other capabilities was also investigated. The sample included 40 hearing children and 24 deaf children. The results indicate that the ability to lip read in children is not fixed, but it improves with age. Experience plays an important role in the development of this ability, and deaf children are better lip-readers than hearing children (Tye-Murray, Hale, Spehar, Myerson & Sommers, 2014).

Speech reading is a skill that deaf children need in order to have access to the language used to communicate in the community. They describe development of a new instrument, Test of Child Speech reading (TOCs) specially designed for use with deaf and hearing children. It is computer-based and it measures children's speech reading on three psycholinguistic levels; a) words, b) sentences and c) short stories. The aim of the study was to standardize the Test and to investigate the influence of the hearing condition, age and linguistic complexity on the ability to speech read. The study included 86 children with severe and very severe pre-lingual hearing impairment, and 91 hearing children, aged 5 to 14. The obtained results point out that speech reading skills improve with age in both groups of children. There is no influence of the hearing condition on the ability to speech read (Kyle, Campbell, Mohammed, MacSweeney & Coleman, 2013).

Oliveira, Soares & Chiari (2014) are, in their study, trying to identify the factors that influence the ability to speech read and comparing the ability to speech read in deaf and hearing persons. The authors conclude that examinees with pre-lingual hearing loss and those who have undergone the treatment of speech reading, perform better in speech reading tests than normal hearing examinees. Gender and education showed no influence on the ability to speech read. It was found that the vocabulary, the time when hearing loss occurred and speech reading treatment affect the ability to speech read.

What successful lip-reading depends on

Successful and high-quality speech reading from the interlocutor's mouth and face is possible if the following conditions are provided: ... properly placed lighting; the person who is speaking must have a clear, clean and correct pronunciation; speech must be distinct, clear, at first a little slower, but without exaggeration, chanting or chopping sentences; sentence length should be three to five words; the way of pronouncing should be normal; the rhythm of speech should be natural; head position should be normal; the hearing impaired interlocutor's attention should, from the very beginning, be focused toward the person who is speaking; the family should be educated to assist in speech

reading; the time of beginning to speech read coincides with the communication that begins in the family since the early days (Dimić, 2002).

We can say that the ability to synthesize is the most important factor for successful lip-reading. This means that the person who lip read is prepared to receive limited information that he or she has seen on the face, to store and use it and to correctly identify the spoken message. Also, the amount of training contributes greatly to the improvement of speech reading. Jeffers & Barley point out that the biggest progress occurs after one to three years of training-depending on the individual (Dimić & Dimić, 2003).

Better knowledge of the language provides for better lip-reading. This means that knowledge of vocabulary, grammar, and everyday and idiomatic expressions, i.e. understanding the language, greatly facilitates the whole process. The ability to use context or rules of the language can be crucial for integration into the conversation being conducted. A good speech reader has to be motivated, confident, with a positive attitude towards speech reading.

We might expect people who have been deaf since birth to be better lip readers, because the use of the visual channel takes longer. However, better speech readers are those children who became deaf later on, especially if they had mastered their mother tongue. Also, hard of hearing people show better results in speech reading. We assume that this is because they have a better built structure of the language.

Flowers (2006) states that the ability to lip read improves with age, as well as with longer use of hearing aids. Hard of hearing children are exposed to the strategies of speech reading daily, if they are trained in an auditory – oral environment. In that way they are provided indirect speech reading training because teachers pay attention, to a great extent, to the position of the head and the shape and position of the mouth while speaking.

One more factor that affects successfulness in lip reading is visual ability. Visual discrimination and visual memory skills are part of the ability to synthesize and be flexible, because the visual model of speech has to be remembered in order for it to be able to be used.

Mohammed (2007) points out that for people with severe hearing impairments who use speech, speech reading is extremely important. These people use their hearing aids more to assist in speech reading than as a means to listen. People with moderate hearing loss rely, to a greater extent, on visual information.

Visibility of our language's phonemes

Our language's phonemes are very different in their visibility. We can hear more than 30 different phonemes, but a much smaller number can be distinguished visually.

The pronunciation of a phoneme is caused by various movements, position and contacts of speech organs. All parts of the face contribute to optical expression. The deaf person visually perceives the speech of the interlocutor at the same time activating his or her speech organs and in that way he or she forms motor habits for speech. So, the optical signals activate kinesthetic sensations on the basis of motor imitation, which supports understanding and development of voice speech. The phonemes of

our language, in their location, are more or less visible. Vowels (vocals) are better heard, clearly visible (a, o and u), and some are more difficult to distinguish (i and e in particular). Consonants are of great importance for the understanding of meaning. They can be divided into those which are better seen (which are formed in the front part of the mouth), those which are partially visible and those that are almost not visible (formed in the interior of the mouth).

Depending on the place of being pronounced and sonority, as well as the presence or absence of nasality, visibility of phonemes is different. Voiced and voiceless sounds are replaced, which influences the reception and understanding of the meaning of the message. In the same way, the visibility of phonemes depends on their position and the place in words, as well as the previous and subsequent phoneme. Non-verbal context, as well as the overall situation in which the child is are significant for understanding speech.

Ostojić (2004) points out that knowing the context of the message facilitates perception. Words are much more easily perceptible when they are within a context where our knowing of language can facilitate recognition. Understanding the context of a sentence implies earlier experience, i.e. already fixed and learned acoustic images.

As a result of many consonants looking like other consonants (homophones), many words look alike. The right words are recognized on the basis of whether they make sense in a sentence or conversation. Homophone words make speech reading difficult (Dimić & Dimić, 2003).

Through the analysis of research conducted in the field of speech reading from the mouth (in our country: Savić, 1969; Dimić, 2002; Dimić & Dimić 2003), it was determined that a phoneme that is at the beginning of a word has the highest informative importance, the phoneme at the end of a word is less readable, and the most unreadable one is the one in the middle of a word. It happens that children read the first or the last syllable, but not the middle one. That confirms that a word is read as a whole, and not element by element.

However, in addition to speech reading from the mouth, it is necessary to enable a child to use even the smallest remains of hearing that may serve as a supplement to vision.

The best results in lip-reading are realized with the use of a hearing aid. It is an important communication strategy in people with impaired hearing (Dell' Aringa & Dell' Aringa, 2007).

The best way of learning speech is dual sensory or audiovisual way. Therefore, in speech development of a child with a hearing impairment, it is necessary to use sound amplifiers, as well, so that all of the remaining hearing is used.

Lip-reading at preschool age

Educational contents for children with hearing impairments predict that they are enabled to follow the speech of people around them so that they are able to participate in everyday communication situations.

Exercises at preschool age should be done through games by learning individual words, phonemes and sentences. In so doing, one should take care of the order and

way of learning. Firstone needs to practice reading vowels, then visible consonants, then those less visible ones. Reading isolated phonemes should be avoided, unless they represent a separate word or sentence. The child should be trained to read an entire word, a sentence, to understand short commands needed in everyday life, to answer the questions. At the end of the preschool period, before starting school, it is necessary for the child to lip read all the words that have a higher frequency of use in everyday life, especially short commands. In further work they are trained to read more complex sentences with new messages (Isaković & Vujasinović, 2008).

In lip-reading training it is necessary to devote equal attention to all kinds of words. They are introduced in the order in which they are handled in normal speech – language development. It is certainly necessary to provide individual approach to every child and to monitor the capacity and capabilities of each individual. On the basis of this information, treatment is adjusted for each child, individually. Through games, at preschool age, every kind of learning is performed, and so is learning to speech read from the mouth and the face of the interlocutor. One always starts with objects, phenomena and events that are closest to the child, to which it is bound by positive emotions. After that, the contents are, according to age, extended to objects from farther environment, as well as the abstract notions that are always a bigger problem for deaf children. They are more difficult to acquire through the senses and evidence, therefore it is necessary to pay more attention to them.

In deaf and hearing impaired children of preschool age, through various spontaneous and directed activities, it is necessary to develop all the functions of verbal and non-verbal communication (Dimić, Kovačević, Isaković & Nestorov, 2010).

MATERIALS AND METHODS

The aim of our study was to determine the level of successfulness in lip-reading (words and sentences) in deaf and hard of hearing children of preschool age.

Sample

The sample consisted of 15 preschool children, 3-6 years old, who attend preschool groups at schools for deaf and hard of hearing in Belgrade.

The research was conducted individually, and the task was considered successful if the child repeated correctly or showed by sign (gesture) the word spoken by the examiner. When examining successfulness in lip-reading sentences the child was to show an adequate picture after the sentence had been said.

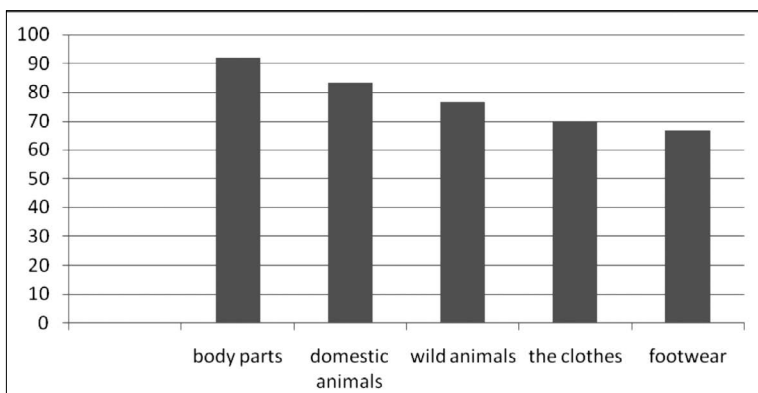
Instrument

We tested the successfulness in lip reading within different areas: body parts, domestic and wild animals, clothing and footwear, as well as lip reading the first adjectives, verbs and pronouns that appear at this age. We checked successfulness in lip-reading sentences which are related to the story "Gigantic turnip" through pictures.

Statistical methods

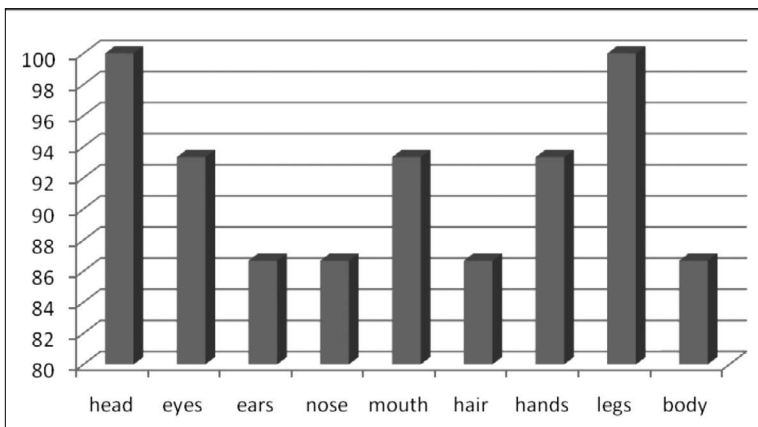
In the data analysis the following statistical methods and procedures were used: measures of descriptive statistics – percentages and frequency.

THE RESEARCH RESULTS WITH DISCUSSION



Graph 1 Success in lip-reading in different fields

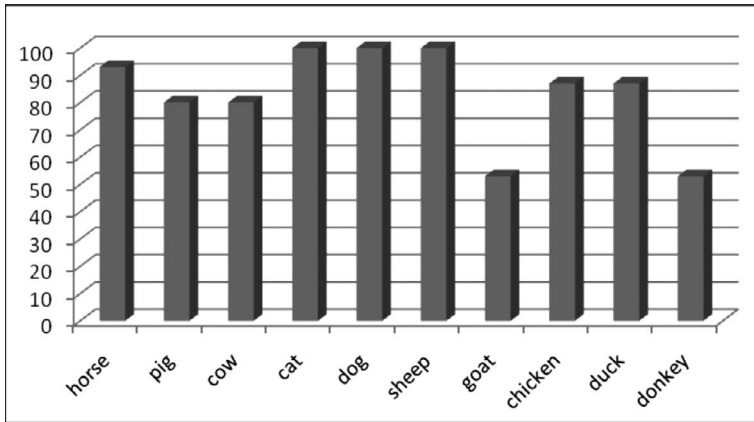
Graph 1 presents the results of lip reading in 5 tested fields. The following fields were lip read the best: *body parts*, and *domestic animals*. Terms from the field of *clothing and footwear* were lip read a bit less well.



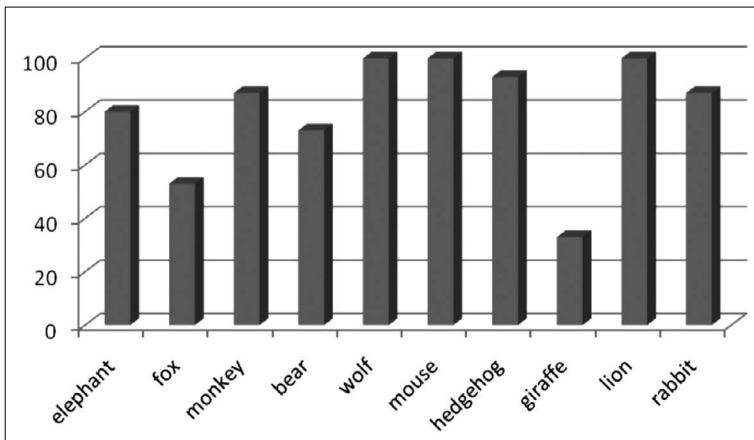
Graph 2 Success in lip-reading in the field of body parts

In Graph 2 the results of lip-reading the main parts of the body are presented. The best results were achieved in the perception of terms *head* and *legs*, and the weakest in lip-reading terms *ear*, *nose* and *hair*. Some of the mistakes in lip-reading lips are: uvo (ear) – ovo (this), kuvar (a cook), ovor; nos (nose) – mos, bos (barefoot); kosa (hair) – gosa, osa (wasp). Given that the achieved results are over 86%, for all parts of the body

we think that children are well integrated and have a sense of themselves and their bodies.



Graph 3 Success in lip-reading in the field of domestic animals



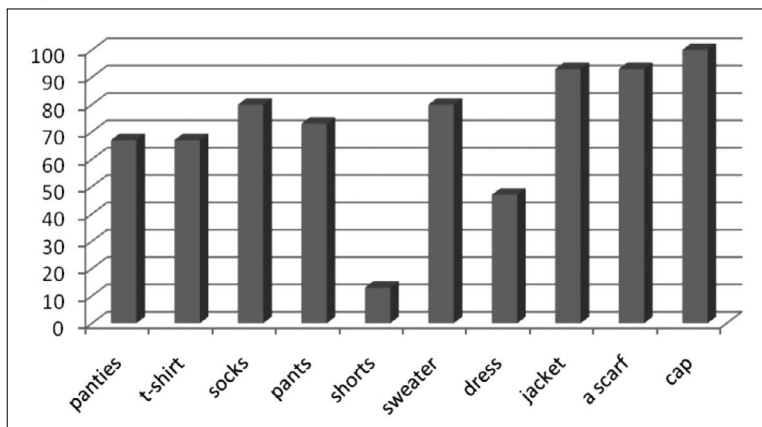
Graph 4 Success in lip-reading in the field of wild animals

In Graphs 3 and 4 students' results in the fields of domestic and wild animals are presented. Better results were achieved in lip-reading terms in the field of domestic animals (88.3%), while terms from the field of wild animals (76.4%) were lip read somewhat less well.

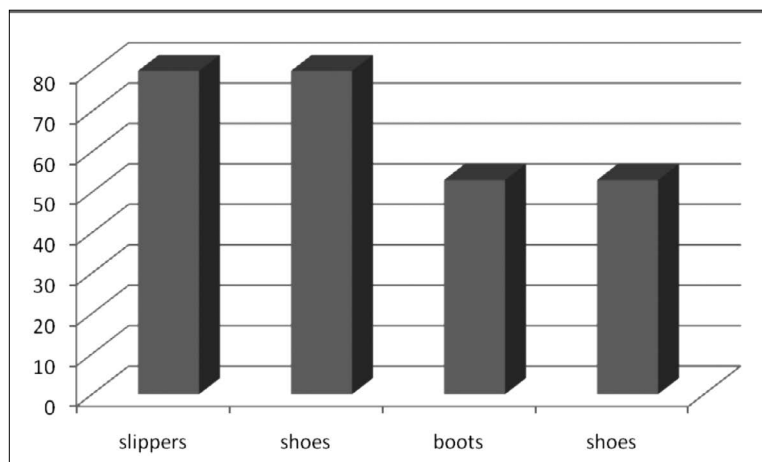
In the field of *domestic animals* the terms that were lip read best were *cat, dog and sheep* (100%), then the terms *horse, chicken and duck*. In teaching children one starts right from these terms, which are first adopted through onomatopoeia. The worst lip read terms were *goat and donkey*. The term *koza* (goat) was lip read as *osa* (wasp), *hosa, kosa* (hair), *rosa* (dew), *kosta, koska* (bone), *inosa*; and the term *magarac* (donkey) as *bagas, magac, magarasa*.

In the field of *wild animals* the best lip read terms were *wolf, mouse and lion* (100%), then *hedgehog, monkey and rabbit*. These are terms that children encounter in the

context of the first songs and fairy tales that are taught. The terms lip read in the worst way were *fox* and *giraffe* (which are not taught through onomatopoeia). The word *zec* (rabbit)–was lip read as *zek*, *ses*, *zet* (son-in-law), *zid* (wall), *šes*, *des*; *miš* (mouse) – *pš*, *piš*, *biš*, *muš*; *žirafa* (giraffe)– *žirava*, *čijava*, *sivara*, *širava*, *živa* (alive, mercury), *žiljava*, *šljiva* (plum), *šisa*.



Graph 5 Success in lip-reading in the field of clothing



Graph 6 Success in lip-reading in the field of footwear

In Graphs 5 and 6 the results of lip-reading in the fields of *clothing* and *footwear* are presented. Slightly better results were achieved in the field of *clothing* than in the field of *footwear*. Best read terms were *cap*, *jacket*, *scarf*, while the term *šorc* (shorts) was lip read in the worst way. It was lip read as *šors*, *šos*, *sors*, *sosa*; and the word *haljina* (dress) was lip read as *aljina*, *Galina*, *anina* (Anna's). In the field of *footwear*, terms *slippers* and *shoes* were lip read better than *boots* and *shoes*. The word *cipele* (shoes) was lipread as *ipele*, *smala*, *zmelje*, *čiper*, *sipete*, *cmela*, *tiple*, *sipedi*. Results obtained within this area suggest that names of clothes which are more frequently used are lip read better.

The first adjectives that appear at pre-school age are *sweet, salty, beautiful, ugly, clean, dirty, healthy, sick*. Adjective *beautiful* is lip read best, while the adjective *zdrav* (healthy) is lip read in the worst way (difficulty being represented by consonant set *zdr*, as well as insufficient frequency of use of the above adjective in children's communication).

The first verbs that appear at pre-school age are put on, take off, put on (shoes), take off (shoes), eat, drink, go, run, sit, sleep, drive, play, give (me), here you are. The verbs that are lip read best are *eat, drink, sleep, here you are* (which are also used most often), those lip read in a slightly worse way are the verbs *take off (shoes) and take off (clothes)*; lip readability of these words is bad, and they are not enough in use in everyday situations. The word *izuti* (take off – shoes) was lip read as *zuti, zati, iteti, isuti*; and *svući* (take off – clothes), *ašuci, scuci, vuci* (pull).

Pronouns *I, you, my* were successfully lip read by all the children, while they perceived the pronoun *your* slightly worse. The tested pronouns are short and used very frequently in everyday communication, and we believe that that's why lip-reading them was not a problem for the children.

When lip-reading sentences from the story "Gigantic turnip" it was observed that the first, the second and the third sentence are lip read better, and problems arise when reading the fourth sentence. The first and the second sentence (Grandpa is pulling the turnip. Grandma, brother and sister are helping grandpa.) were lip read successfully by all the children. The third sentence (Grandpa, Grandma, brother, sister, the dog, the cat and the mouse are pulling the turnip.) were lip read slightly worse, while the fourth sentence (They pulled out the turnip.) was lip read with a success rate of 40%. The problem in the perception of the shortest and the simplest of sentences was the pronoun, as well as the verb that are still not well consolidated at this age.

The results indicate that the point of the story was not actually adopted (the pronoun *they* and the verb *to pull out*). The other sentences were effectively perceived according to their length and the terms used in them are used very frequently in everyday communication.

CONCLUSIONS

Successfulness in lip-reading at preschool age is greatly affected by visibility (readability) of phonemes of our language, but also, to a large extent, by the degree of knowledge of terms in speech and sign language. Adequately adopted and stable terms are lip read well, even when the visibility of phonemes they are made up of is lesser. Poor visibility of fricatives (*s-z, š-ž, h*), affricates (*c, č-đ, č-dž*), and velar phonemes (*k and g*) in words makes it difficult to recognize the terms on the lips. However, we have noticed that well-established terms, as well as those that are frequently used and with which the children have had experience, even despite poor readability, present no problem when lip reading.

The importance of application of onomatopoeia in learning speech and adopting the first words has been observed. The terms that are mastered through onomatopoeia are lip read better (within the field of *animals*) than those for which there is no onomatopoeia. Also, we must emphasize the importance of the first songs, fairy tales

and fables which are taught at the earliest age (precisely the names of the characters from the first stories are recognized the best).

The importance of early knowledge of sign language facilitates the adoption of terms, as well as lip-reading. Many children have corresponded with an adequate sign to the spoken term and showed a higher level of understanding of the spoken words than children who didn't use signs (gestures). It was also observed that readability (recognition) is better for terms for which there is a sign – a gesture in sign language (that can be observed in the field of knowledge of the first adjectives and verbs), than where one character (gesture) signifies a number of similar terms. When lip reading sentence, the children perceived the length of sentence and recognized individual terms, while giving adequate answers from the contexts of images.

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