THE RECOGNITION OF FACIAL EXPRESSIONS AND EMOTIONS IN DEAF AND HARD OF HEARING CHILDREN

RAZUMIJEVANJE FACIJALNIH EKSPRESIJA I EMOCIJA U GLUHE I NAGLUHE DJECE

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ABSTRACT

The main goal of the paper is to examine comprehension of basic emotion and facial expression of children with hearing impairment. The research encompasses a sample of 66 respondents out of which 33 have non-damaged hearing and the remaining 33 respondents have hearing impairment. The age of respondents ranges, in chronological order, from 7 to 15 years. Recognition of emotions and facial expressions is being examined through 4 sets of tasks. The Emotion Recognition Test (ERT) is being used for evaluation, it has been adapted for the purpose of this paper and thereby adjusted for electronic usage via computer and internet. Through statistical processing of given data, following components have been calculated: minimal and maximum values, arithmetic mean, standard deviation, Wilcoxon Signed Ranks Test, Mann-Whitney U test, curvature test and flattening of distribution curve, t-test. Research results concluded that hearing impairment in children affects, with statistical significance, recognition and comprehension of facial expressions and emotions compared to their peers with no hearing impairment. The results were expected given the hearing condition and the consequences which hearing impairment creates. Children with hearing impairment possess poor vocabulary which affects comprehension of emotions. Statistically significant difference occurs among children with hearing impairments and recognition and comprehension of facial expression and emotions within situational context and isolated facial expressions.

Key words: deaf children, comprehension of emotions, emotions of the deaf, facial expressions, hearing impairments.

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SAŽETAK

Glavni cilj rada je ispitati razumijevanje osnovnih emocija i facijalnih ekspresija u djece oštećena sluha. Istraživanjem je obuhvaćeno 66 ispitanika od toga 33 sa urednim slušnim statusom i 33 sa oštećenjem sluha. Hronološka dob ispitanika je u rasponu od 7 do 15 godina. Prepoznavanje emocija i facijalnih ekspresija ispitano je kroz 4 seta zadataka. Za procjenu korišten je Test prepoznavanja emocija (The Emotion Recognition Test – ERT), adaptiran za potrebe ovoga rada, prilagođen za njegovu elektronsku primjenu, putem računara i interneta. Prilikom statističke obrade dobivenih podataka izračunate su: minimalna i maksimalna vrijednost, aritmetička sredina, standardna devijacija, Wilcoxon Signed Ranks Test, Mann-Whitney U test, test zakrivljenosti i spljoštenosti krive distribucije, t-test.

Rezultati istraživanja su pokazali da oštećenje sluha kod djece, utiče statistički značajno na prepoznavanje i razumijevanje facijalnih ekspresija i emocija, u odnosu na čujuće vršnjake, što je i očekivano s obzirom na stanje sluha i posljedice koje ono nosi sa sobom. Djeca oštećena sluha imaju i siromašan emocionalni vokabular koji utiče na razumijevanje emocija. Statistički značajna razlika se javlja u djece oštećena sluha i u prepoznavanju i razumijevanju facijalnih ekspresija i emocija datih u situacijskom kontekstu i izolovanih facijalnih ekspresija.

Ključne riječi: gluha djeca, razumijevanje emocija, emocije gluhih, facijalne ekspresije, oštećenje sluha.

INTRODUCTION

Emotion is defined as a sudden, involuntary, non-lasting agitation caused by acute experience of fear, surprise, joy, etc (Larousse Dictionary 1990, according to Cabanac, 2002). Emotion is the name for a person's reaction to an event. If it is a positive event, the emotion is positive, for example: happiness or surprise, and if the event is negative (if it is perceived as negative), negative emotions appear: sadness, fear, anger or disgust. An important factor in developing the ability to understand emotions is the skill of identifying emotions based on facial expressions. Expressing and understanding emotions are important parts of everyday lives. Inability to understand emotions or their inadequate expression can lead to miscommunication among people. Developing emotional comprehension is a process which starts in the first year of life, given that then children become aware of facial expression and vocal intonations. Recognition of basic emotions begins in the second year of life, while in third year children can talk about their and other people's emotions (Ziv et al., 2013). Recognition that emotions also depend on desires and beliefs is formed around the age of 5. Around that time children begin to understand that people have different desires and that those desires differ from their own (Ziv et al., 2013). The ability to recognize emotions and understand them enables behavior in accordance with a certain situation. Very soon after birth, children develop the ability to recognize basic emotions (Montague and Walker-Andrews, 2002, according to Avdić, 2015). Some studies have shown that the more information about that emotion the child will recognize and understand better (Barth and Bastiani 1997, according to Avdić 2015).

Development of emotional comprehension requires social interactions, since children's understanding of emotions is enhanced when interacting with brothers, sisters, and friends and when discussing emotional experiences with parents. Comprehension of emotions is of special interest in the field addressing the issues of deaf individuals. Terms like kindness, love, falling in love, hatred, and revenge, are some of the concepts which deaf individuals perceive differently than hearing individuals. Differences in comprehension lead to the question of whether deaf individuals understand what is assumed under these terms when used by hearing individuals. It is typical for deaf children to experience difficulties in understanding others' emotions, and it can be questioned whether they are capable of understanding and accepting occasionally unrecognizable emotions such as love, fear, kindness, surprise and whether these emotions appear to be confusing. Problems in understanding emotions, experienced by children and adults, are associated with psychopathology or poor social skills. When it comes to comprehension of emotions in deaf children it is assumed that their problems are fundamental given the postponed or impaired theory of mind (Rieffe and Terwogt, 2000).

MATERIAL AND METHODS
Sample of respondents

Sample consists of 33 participants with deaf impairment from Center for education and rehabilitation of hearing and speech (Tuzla, Sarajevo), age 7 to 15 years (from 2nd to 9th grade, encompassing both genders). The control group consists of 33 participants who are equal to experimental group in age, grade, and gender.

Method of conducting research

The research was conducted in Centers for education and hearing and speech rehabilitation of hearing and speech in Tuzla and Sarajevo and in elementary school. To all institutions in which research was conducted, an access request was sent, that is requested to interview the children. Technical requirements needed for research (computer access and Internet) were secured by researchers. Individual interviews were conducted due to the assumption that for some questions additional explanation will be required.

Measuring instruments

The Emotion Recognition Task – ERT, was constructed and adapted to assess the ability of recognizing and understanding facial expressions and emotions for the purposes of this research. The test was computerized for electronic use via computer and internet.
The first set of tasks consists of 6 individual basic emotions depicted on illustrated faces; each emotion (anger, happiness, sadness, surprise, disgust and fear) was represented with two illustrated faces (the set consists of 12 illustrations). Below each illustration answers choices were offered. The participant had a task of recognizing the illustrated emotions, selecting the correct answer via computer mouse, and then moving on to the next task/illustration.

The second set of tasks consists of 6 individual basic emotions shown through photographs of faces, each emotion was represented with two photographs of face (the set consists of 12 photographs). As in the first set of tasks, below each face photograph answer choices were offered. The participant had a task of recognizing emotion depicted on face photographs, select the correct answer via computer mouse and then move on to the next task/photograph.

Third set of tasks consists out of illustrated contextual situations which require from a child to recognize the emotions of the character on the illustration, for each emotion there were two illustrations (the set consists of 12 illustrated contextual situations). Below each illustration of contextual situation answer choices are given. The participant had a task to recognize the emotion, select the correct answer via computer mouse and then move on to the next task.

Fourth and final set of tasks consists of contextual situations shown through photographs, tasks require for a child to recognize the emotions of character from a photograph, for each emotion two photographs were given (the task consists out of 12 photographs). Below each photograph answer choices are given. The participant had a task to recognize emotion and select the correct answer via computer mouse.

Data processing methods

Data was analyzed using Statistical Package for the Social Sciences (SPSS 21,0) for Windows. Data was analyzed at 5% confidence level. Statistical analysis of data included parametric and nonparametric statistics (basic statistical parameters, measurement of central tendency, dispersion measurement, frequency and percentages, tabular and graphical representation of results). For testing differences between groups t test statistics and analysis of variance (ANOVA) were used.

RESULTS AND DISCUSSION

Table 1. Descriptive statistics of participants results on a test of recognizing facial expressions and emotions.

Variables	Number	Mean	Standard deviation
Children with Hearing Loss	33	32.90	5.50
Hearing Children	33	40.18	3.80
Total	66	36.54	5.95

Based on the results presented (Table 1) it is visible that there is a difference in the average number of correct answers on a test, the difference is in favor of hearing children (M=40.19) compared to children with hearing impairments (M=32.91), however it still does not indicate whether the differences are statistically significant. To discover whether the mentioned difference is statistically significant, ANOVA and Mann-Whitney U Test for independent samples were used, and these tests show statistically significant difference with 1% confidence level (p=0,001).

According to the results of the analysis, we can conclude that hearing impairment in children does statistically affect on recognition and understanding of facial expressions and emotions.

Table 2. ANOVA results of test on understanding facial expressions and emotions of hearing children and children with hearing loss

Source of variations		Sum of Squares	df	Mean Square	F	Sig.
Hearing children/ Children with Hearing Loss	Between groups	872.72	1	872.72	38.960	.000
	Within groups	1433.6	64	22.40		
	Total	2306.36	65			

Table 3. Results of Mann Withney U Test

	Total correct
Mann-Withney U	128.000
Wilcoxon W	698.000
Z	-5.359
P	.000

Dyck and Denver (2003) alse showed that deaf participants, who completed training in recognition and understanding of emotions, did not differ from control group participants on basic tasks of emotion understanding. In research conducted by Rodger, et al. (2021), it is indicated that both groups of participants show comparable accuracy and confusion in recognizing the six basic emotions. Jones et al. (2018) stated that deaf children have difficulties in recognizing emotions compared to their hearing peers in middle childhood (age 6 to 12). They concluded that deaf children achieve slightly lower results in recognition of static photographs when compared to control group. Similar results were obtained by Ziv et al. (2013). They found that children with severe hearing impairment could recognize and understand emotions in 85% and 95% cases. Somewhat different results were reached by Ludlow, et al. (2012), it was found that deaf children achieved lower results in most experimental cases, that is they identified fewer emotions while watching movie compared to hearing children. Sidera, et al. (2017) state that there is a deficit in recognition skills of specific emotions (i.e., fear, sadness, disgust) in children with hearing impairments. According to authors, results of this study were basis for their subsequent research, which was conducted in the same year, and results of this study show that linguistic development of participant affects understanding of emotions. Rieffe and Terwogt (2000), show that most deaf and hard of hearing children are able to correctly understand and predict other people's emotions, just like their hearing peers. In this study some deaf children didn't at first reach correct emotional predictions, however they were able to correct the mistakes once the researcher repeated the question.

Poorer results related to recognition and understanding of emotions can potentially be explained and linked to insufficient linguistic development of deaf children. Given the consequence of their hearing loss, deaf children have limited vocabulary of emotional language, hence the hearing population can recognize more emotions than people with hearing impairments.

The hearing population can also express different emotions through words, that is they have greater precision when describing emotions, while the population with hearing loss is lacking such verbal information.

Table 4 shows results of recognizing and understanding positive and negative emotions achieved by children with hearing impairments. Wilocoxon Signed Ranks Test was used to test statistical significance of differences. Results show that there is no statistically significant difference, which indicated that children with hearing impairments have equal success in recognizing and differentiating positive emotions from negative ones (table 5 and table 6). Children with hearing impairments show equal capabilities in recognizing and understanding positive and negative emotions like hearing children.

Table 4. Descriptive statistic of results of Children with Hearing Loss in recognizing and understanding positive and negative emotions

	Mean	Standard deviation
Positive emotions	69.13	18.15
Negative emotions	68.28	12.84

Table 5. Results of Wilcoxon Signed Ranks Test from Children with Hearing Loss in recognizing and understanding positive and negative emotions.

		N	Sum of ranks	Sum of ranks
Negative emotions-Positive emotions	Negative ranks	15	15.27	229.00
	Positive ranks	13	13.26	
	Relationship	5		
	Total	33		

b. negative emotions < positive emotions

c. negative emotions > positive emotions

d. negative emotions = positive emotions

Table 6. Results of Wilcoxon Signed Ranks Test from Children with Hearing Loss in recognizing and understanding positive and negative emotions

Negative emotions – positive emotions	
Z	-.593
P	.553

a. group = experimental

b. Wilcoxon Signed Ranks Test

c. based on positive ranges

Analysis of results on whether there is a difference in abilities of recognizing positive and negative emotions in children with hearing impairments and hearing children showed that there is no statistically significant difference, which concludes that children with hearing impairments will equally successfully recognize and differentiate positive from negative emotions compared to their peers. Similar results were obtained by Laugen, et al. (2016). They found the degree of understanding of negative and positive emotions didn't not differ among deaf and hearing children. Results of study conducted by Rieffe, et al. (2003) confirmed that deaf children, compared to their hearing peers, pay more attention to the outcome in negative situation and are related to recognition of emotions, in this case recognition of negative emotions such as anger, sadness and disgust. In addition, results of study by Rieffe and Terwgot (2006) have shown that deaf children have the tendency to recognize and express anger relatively openly, however they quickly forget about it. Further, Hosie, et al. (1998) noticed that deaf children were more accurate compared to hearing ones in a task which requests from them to recognize specific emotions (fear and disgust) shown on photographs. Their results also showed that deaf children were more accurate in recognizing anger, and fear, than hearing children. Sample of younger deaf and hearing children showed tendency to confuse negative expressions of anger, disgust, and fear with sadness. Results showed that, despite potential differences in early socialization, deaf and hearing children possess equal capabilities of understanding positive and negative emotions. Results of descriptive statistic, shown in table 7, show that children with hearing impairments demonstrate somewhat higher capabilities of recognizing facial expression presented via faces on photographs compared to those depicted on illustrated faces.

Table 7. Descriptive statistic of results of participants recognizing facial expressions and emotions shown on illustrated facial expression on a photograph in Children with Hearing Loss

	Number	Mean	Standard deviation
Ilustrated facial expression	33	7.64	1.69
Facial expression on a photograph	33	8.00	1.90

However, the difference in mean values does not indicate that the stated difference is statistically significant. To confirm that, we used parameter inferential test (t-test of mean differences). Based on the results related to children with hearing impairments (Table 8), it is visible that stated differences aren't statistically significant.

Table 8. Determining the differences of arithmetic means in the recognition of illustrated facial expressions and facial expressions in photographs

	Mean	Standard deviation	confidence level (95%)		t	df	p
			lower	Uper			
Ilustrated facial expression − Facial expression on a photograph	-.36	1.74	-.98	.25	-1.19	32	.241

Sidera, et al. (2017) state that deaf children can recognize certain facial expressions better than hearing children, because since they were little, they were using visual cues as a basis for their interpretation. Hopyan-Misakyan, et al. (2009) discovered that deaf children with cochlear implants (offspring of hearing parents) age 7 to 13 years were somewhat better than hearing peers in recognizing emotions conveyed through photographs. On the other hand, there are authors who reached the results that recognition of emotions and facial expressions is poorer in children with hearing impairments because of lack of hearing input and opportunity to be included (or hear) in conversation on emotions. Several research supports this perspective, i.e.,

Dyck, et al. (2004) who state that children with hearing impairments exhibit significant deviations when it comes to recognition of emotions through photographs. Additionally similar results, which are in favor of hearing children when it comes to emotions and their recognition and understanding were obtained by following authors: Gray, et al. (2001), Most and Michaelis (2012); Wang, et al., (2011). Results obtained by Dyck and Denver (2003) show that deaf children had poorer scores in recognizing illustrated pictures compared to hearing children, however there were no differences between the groups in recognizing emotions on photographs. On the other hand, there are authors whose results indicate that recognition of emotions and facial expressions is poorer in children with hearing impairments because of insufficient hearing input and capabilities to include (or hear) in conversation on emotions. Several studies support this view such as Dyck, et al (2004) which state that children with hearing impairments show significant deviations when it comes to recognition of emotions.

In contrast to previous mentioned studies, Tsou, et al (2021) found that deaf children are as capable as hearing children when it comes to recognizing emotions conveyed in photographs. Throughout their research they present potential explanations for absence of group differences in charge of early discovery of hearing loss and educational system in Taiwan. More than half of the children included in the study (n=33; 60%) were subjected to hearing screening as newborns (first day after birth).

Table 9. Determining the existence of differences in the recognition of illustrated situations and photo situations in Children with Hearing Loss

	Number	Mean	Standard deviation	min.	max.
illustrated situations	33	8.76	1.85	4	12
situations in the photo	33	8.48	1.75	4	11

When it comes to illustrated situations and situations on photographs, research analysis shows that children with hearing impairments show slightly higher average results in recognition and understanding of emotions conveyed through illustrated situations than those conveyed through situations on photographs (table 9), but that differences aren't statistically significant (table 10 and 11).

Table 10. Determining the significance of differences in the recognition of illustrated situations and photo situations in Children with Hearing Loss

		N	Rank M	Sum of ranks
situations in the photo - illustrated situations	Negative ranks	16[a]	13.31	213.00
	Positive ranks	10[b]	13.80	138.00
	connections	7[c]		
	Total	33		

a. photo situations < illustrated situations

b. photo situations > illustrated situations

c. situations in the photo = illustrated situations

Table 11. Determining the value of differences in the recognition of illustrated situations and photo situations in Children with Hearing Loss

	situations on phorography - illustrated situations
Z	-.981[b]
p	.326

a. Wilcoxon Signed Ranks Test

b. based on positive ranks

Children with hearing impairments achieve higher results in recognition and understanding of emotions conveyed in situational context than those conveyed through isolated facial expressions (Table 12).

Table 12. Descriptive statistics of results from recognition and understanding of emotions given in isolated and situational context in Children with Hearing Loss

	Number	Mean	Standard deviation
Isolated facial expressions	33	15.64	3.15
Situational context	33	17.24	3.24

However, the differences in the mean values alone do not mean that there is a difference. In order to examine the existence of statistical significance, we applied a parametric inferential test (t-test of the difference of arithmetic means), which showed that the stated difference is statistically significant.

Table 13. Determining the differences of arithmetic means in the recognition and understanding of emotions given in isolated and situational contexts

	M	SD	SE	confidence level (95%) lower	upper	t	df	p
Isolated facial expressions - Situational context	1.61	-3.26	.57	-2.762	-.451	-2.83	32	.008

According to the results, we conclude that there is a statistically significant difference in the recognition and understanding of facial expressions and emotions given in a situational context and isolated facial expressions, i.e. that hearing impaired people more successfully recognize and understand emotions if they are given in a situational context than isolated facial expressions and emotions.

Even though most new studies focus on examining recognition of emotions through static and dynamic (photography and video) display, their results are in favor of conducted research. Results of study conducted by Rodger, et al. (2019) showed that participants showed comparable accuracy and confusion in recognition of six basic emotions, which is like the results of conducted research. Furthermore, participants responded in a similar manner to both statis and dynamic display of stimulus. There was no clear effect of dynamic advantage in neither group, expect for the fact that the expression of surprise which control group recognized with greater precision when it was dynamically presented. Similar results were obtained by Wiefferink, et al. (2013) who had proven that children with hearing impairments rely more heavily on facial expressions compared to hearing children. Similar results were obtained by Sisk (2009) which showed that children with hearing impairments achieved better results in understanding emotions in given situations.

Jones, et al. (2018) reached conclusion that recognition of emotions in deaf children is better in dynamic rather than in static condition, while hearing children do not show differences in these two conditions. However, we should consider the fact that researchers had to repeat the questions to several deaf and hard of hearing children who did not accurately recognize emotions unlike their hearing peers. On the other hand, hearing children predicted more emotions compared to their peers with hearing impairments, which was expected given that hearing impairments itself and its consequences, while children without hearing impairments identify and recognize large number of emotions, among which are complex emotions, which children with hearing impairments have difficulty in understanding. For example, being in awe is a complex emotion which consists of numerous other emotions such as fear, discomfort, respect, and admiration. It is widely known that deaf children use more nonverbal than verbal communication, hence given the structure of complex emotions the issue occurs when those complex emotions must be explained in a nonverbal manner.

Children showed much better understanding of emotions conveyed through verbal manner, because a lot can be understood from the intonation of speaker's voice. Results also show the speed of recognition of emotion in which deaf children are better. The speed of recognition can be related to the fact that children with hearing impairments perceive negative facial expression, such as fear, as a danger, because unlike their hearing peers they cannot hear warning signs which will lead them to flight or leave the situation. A simple example would be the sound of branch breaking, children with hearing impairments cannot hear that sound, however they will react to the facial expression of other observers. Based on this it can be said that people with hearing impairments are more capable of recognizing and reacting to negative facial expressions of their hearing peers who can hear the danger sounds and thus they rely on their hearing abilities rather than on the faces of other speakers. From all this a well-known fact is derived: individuals with hearing impairments are visual types.

Also results of previous studies often showed that deaf children have impaired emotional competence, but they also tend to recognize negative emotions faster than their hearing pears, because negative facial expressions signal danger to deaf people which is related to the fact that they are visual types.

CONCLUSION

Recognition of other people's emotions is an important part of everyday communication and in social adaptation and personal development likewise. The ability to recognize emotions is an important component of nonverbal communication systems. Large number of studies which are related to recognition and understanding of emotions and facial expressions among deaf and hearing individuals, indicates that children with hearing impairments do not have significant issues in understanding emotions and in most cases do not deviate significantly from hearing population. When it comes to younger children it can be stated that understanding of emotions is affected by chronological age of child as well. With the increase of chronological age, mental age an languaeg develops as well and with-it emotional competence.

It is confirmed that there are segments in which deaf children perform better, such as speed of emotion recognition, and there are emotions to which deaf children react more expressively, which are typically emotions such as anger, fear, etc. Children with hearing impairments react more expressively in some situations, because, for example they consider a given task as an obligation which they must complete without discussion, and it can lead to a heightened reaction when the task is not compatible with their wishes and capabilities.

Deaf children are being raised in society which consists of mainly hearing individuals and their time and communication with other people is often limited, so they comprehend others' emotions through facial expressions regardless of the nature of that emotion. Inability to receive audio stimulus significantly affects understanding of emotions which are present in given situations. The association of deafness and delayed speech-language development portraits lack of understanding of emotions, which precedes other difficulties. Difficulties of emotional comprehension can be related to inadequate social competence. Given that children with hearing impairments are visual types, it is expected that if they see a person smiling, they will conclude that the person is happy, which is not necessarily always the truth.

It can result in confusion and even conflict. It is difficult for children who do not understand the emotions of those in their environment to fit in that same environment. Because of that it is important to work on raising awareness of the importance of emotional understanding in deaf children so that all existing difficulties could be minimized and eliminated.

LITERATURE

1. Avdić, A. (2015), Sposobnost prepoznavanja emocija kod djece oštećena sluha. Unapređenje kvalitete života djece i mladih, br. VI, 566-571.
2. Cabanac, M. (2002), What Is Emotion?.Behavioural Processes, Br 60, 69-84, https://www.researchgate.net/publication/11040893

3. Dyck M., Denver E. (2003). Can the Emotion Recognition Ability of Deaf Children be Enhanced? A Pilot Study. The Journal of Deaf Studies and Deaf Education, vol 8, br 3, 348–356, https://academic.oup.com/jdsde/article/8/3/348/364963

4. Dyck M., Farrugia, C., Shochet, I., Holmes-Brown M. (2004). Emotion recognition/understanding ability in hearing or vision-impaired children: do sounds, sights, or words make the difference? J Child Psychol Psychiatry. Vol.45, br.4. https://pubmed.ncbi.nlm.nih.gov/15056310

5. Gray, C., Hosie, J., Russell, P., Banks, J., Ormel, E. (2001). Emotional development in deaf children: Understanding facial expressions, display rules, and theory of mind. In: M. Marschark, D. Clark, & M. Karchmer (Eds.), Context, cognition, and deafness. Washington, DC: Gallaudet University Press

6. Hopyan-Misakyan, T., Gordon K.A., Dennis M., Papsin B.C. (2009). Recognition of affective speech prosody and facial affect in deaf children with unilateral right cochlear implants. Child Neuropsychol Vol.15, br.2. https://pubmed.ncbi.nlm.nih.gov/18828045

7. Hosie J., Gray D., Russell A., Scott C., Hunter N. (1998), The Matching of Facial Expressions by Deaf and Hearing Children and Their Production and Comprehension of Emotion Labels. Motivation and Emotion, vol 22, br 4, 293-313, https://link.springer.com/article/10.1023/A:1021352323157

8. Jones A., Gutierrez R., Ludlow A. (2018), The role of motion and intensity in deaf children's recognition of real human facial expressions of emotion. Cognition and Emotion, vol 32, br 1, 102-115, https://www.tandfonline.com/doi/pdf/10.1080/02699931.2017.1289894

9. Laugen N., Jacobsen K., Rieffe C., Wichstrøm L. (2016),Emotion Understanding in Preschool Children with Mild-to-Severe Hearing Loss. The Journal of Deaf Studies and Deaf Education, vol 22, br. 2, 155–163. https://academic.oup.com/jdsde/article/22/2/155/2547736

10. Ludlow A., Heaton P., Deruelle C. (2012), Decoding actions and emotions in deaf children: Evidence from a biological motion task. Journal of Cognition and Developmentvol 14, br 4. https://research.gold.ac.uk/19768/1/Ludlow%2C%20Heaton%20%26%20Deruelle%20%282012%29.pdf

11. Most T., Michaelis H. (2012), Auditory, visual, and auditory-visual perceptions of emotions by young children with hearing loss versus children with normal hearing. J Speech Lang Hear Res. Vol. 55, br. 4. https://pubmed.ncbi.nlm.nih.gov/22271872

12. Rieffe, C., Terwogt M. (2000), Deaf Children's Understanding of Emotions : Desires Take Precedence.Child Psychol. Psychiat. vol. 41, br. 5, 601-608 . https://pdfs.semanticscholar.org/4687/763fbfd6ab8caffcd6bf4053087bcd7a3f55.pdf

13. Rieffe C., Terwogt M., Smit C. (2003), Deaf children on the causes of emotions.Educational Psychology, vol 23, br 2, 159-168, https://www.researchgate.net/publication/240239357_Deaf_Children_on_the_Causes_of_Emotions

14. Rieffe, C., Terwgot M. (2006), Anger communication in deaf children. Cognition and Emotion, vol 20, br8, 1261-1273, https://www.researchgate.net/publication/247497298_Anger_communication_in_deaf_children

15. Rodger, H., Lao, J., Stoll, C., Richoz, A.R., Pascalis, O., Dye, M., Caldara. R (2021) . The recognition of facial expressions of emotion in deaf and hearing individuals. Heliyon, 7(5), e07018

16. Sidera F., Amadó A., Martínez L. (2017), Influences on Facial Emotion Recognition in Deaf Children.The Journal of Deaf Studies and Deaf Education,vol 22, broj 2, 164-177, https://www.ncbi.nlm.nih.gov/pubmed/27927685

17. Sisk S. (2009), Recognizing emotion in illustrations and photographs: Comparing responses of children who are deaf or hard of hearing with those of children with normal hearing, Magistarski rad, Washington:Washington University School of Medicine. https://digitalcommons.wustl.edu/cgi/viewcontent.cgi?referer=https://www.google.com/&httpsredir=1&article=1451&context=pacs_capstones

18. Stoll C., Rodger H., Lao J., Richoz A., Pascalis O., Dye M., Caldara R (2019), Quantifying Facial Expression Intensity and Signal Use in Deaf Signers. Journal of Deaf Studies and Deaf Education, Vol. 1, br. 10. http://perso.unifr.ch/roberto.caldara/pdfs/stoll_19.pdf

19. Tsou, Y., Li, B., Eichengrün, A., Frijns, J. H. M., Rieffe, C. J. (2021). Emotions in deaf and hard-of-hearing and typically hearing children. Journal Of Deaf Studies And Deaf Education, 26(4), 469-482. doi:10.1093/deafed/enab022

20. Wang Y., Su Y., Fang P., Zhou Q (2011)., Facial expression recognition: Can preschoolers with cochlear implants and hearing aids catch it? Research in Developmental Disabilities Vol 32, br.6. https://www.researchgate.net/publication/51538691_Facial_expression_recognition_Can_preschoolers_with_cochlear_implants_and_hearing_aids_catch_it

21. Wiefferink C., Rieffe C., Ketelaar L., De La Raeve, Frijns L. (2013), Emotion Understanding in Deaf Children with a Cochlear Implant. Deaf Studies and Deaf Education, br 18, https://www.researchgate.net/publication/233901260_Emotion_Understanding_in_Deaf_Children_with_a_Cochlear_Implant

22. Ziv M., Most T., Cohen S. (2013), Understanding of Emotions and False Beliefs Among Hearing Children versus Deaf Children. Deaf Studies and Deaf Education, vol 18, br 2, 161-174, https://academic.oup.com/jdsde/article/18/2/161/370774