COMPUTER-ASSISTED PROGRAMS OF ASSESSMENT AND STIMULATION OF VERBAL COMPREHENSION FOR STUDENTS WITH HEARING IMPAIRMENT

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ABSTRACT. The study investigates the effects of adapted computer program on training the verbal comprehension at students with hearing impairment. Participants: 10 students with different degrees of hearing impairment were pre-tested for verbal comprehension with an adapted vocabulary scale. The following 10 sessions of computer-assisted training offered an alternative method of learning. Final results revealed that further stimulating and developing of verbal comprehension for students with hearing impairment can be achieved by diversifying the topics approached in schools through alternative methods and materials.

Key words: verbal comprehension, auditory trening, computer programs, informatic means

ABSTRAKT. Bewertungsmöglichkeiten durch Informatik und stimulierende Sprachverständnis bei den Schülern mit Schwerhörigkeiten Die vorliegende Studie untersucht die Auswirkungen der Verwendung von einem computerisierten Programms angepasst für das Training des Sprachverständnisses bei Schülern mit Schwerhörigkeit. Die Teilnehmer sind 10 Schülern mit unterschiedlichem Maße von Hörschwierigkeiten, die anfänglich durch eine angepasste Probe evaluiert wurden um ihr Sprachverständnis bewerten zu können,. Es folgten 10 Trainingseinheiten durch Übungssammlungen auf dem Computer, die eine alternative Methode repräsentierten.
Die endgültigen Ergebnisse zeigten, dass anregen und entwickeln des Sprachverständnisses bei Kindern mit Schwerhörigkeit, kann durch die Diversifizierung der Themen in der Schule

Stichwörter: Sprachverständnis, Hörtraining, Computerprogramme, elektronische Möglichkeiten.

INTRODUCTION

There are over four thousand spoken languages around the world – and all use words and sentences in organizing ideas and thoughts. The human being has the capacity to organize sounds in words and sentences with meaning. The

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interpretation of this is, actually, a form of comprehension (Carrow-Woolfolk and Lynch, 1985).

In the case of children with hearing impairment, they have difficulties in understanding language, expressing ideas, forming sentences because of the disfunctions of the auditory analyzer.

The ear uses the acoustic informations for a better accommodation of the human being to the existential problems (Plack, 2005 after Darwin, 1859). In the case of children with hearing impairment, they have difficulties in understanding language, expressing own ideas, forming words and everything that means development of language (Anca, 2001). The ability of decoding the verbal information received through oral or written modality has to be designed, trained to ensure an appropriate efficiency. In a research made by Miller (2002) it is highlighted the role of the context (oral communication/gestural communication) in which the hearing impaired child was educated by marking differences in recognition of verbal structures. Since 1985, Kretschmer and Kretschmer defined comprehension on two levels: the first one implies the recognition of the lingvistic particularities and the second one, the understanding of the principles that the person can use in grammatical judgements. The understanding of the processes and factors involved in the comprehension of texts at children with hearing impairment is unprecise and fragmented and the comprehension of texts is dominated by the semantic and syntactic processing of the reader (Miller, 2000). Gormley and Frazen (Miller, 2000) sustain the fact that many hearing impaired readers have the tendency to recreate the final sense of the text by interpreting words through prior knowledge without giving attention to the syntactic structure. The comprehension difficulties, the low level of vocabulary can be observed in the reading tasks because of the fragmentary phonological knowledges (Miller, 2002). Another idea of this author is that the pattern of a concept reflect its properties. This way, the pattern is directly associated with the meaning of the word and can be quickly reactivated so that it can provide further easier processing. This way, the stimuli represented through pictures are processed faster than those represented in written form (Miller, 2004).

The educational computer programs, specialized on a domain can raise attention and interest of many students, also bringing a contribution to learning for students with different deficiences, implicitly, students with hearing impairment. The alternation of the traditional system of assesment and intervention with computer programs has positive effects in the development of verbal auditory function.

The present paper is part of a larger project being involved students from Special Education and from the Speech Therapy and Educational Audiology master. With this project we propose by using computer-assisted programs to improve the functionality of language and hearing at children and adults with hearing impairment.

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The study presented in this article consists in elaboration of a training program for students with hearing impairment with the aim of improving the comprehensive language.

Objectives:
1. *Elaboration of computer-assisted program for improving the comprehension capacity at students with hearing impairment after the model of Ecosse program.*
2. *Improving the capacity of verbal comprehension at children with hearing impairment from the fourth and fifth class with the use of a computer-assisted program elaborated after the Ecosse model.*

Hypothesis:
The use of the computer program for stimulation and assessment of the verbal comprehension at students with hearing impairment will improve the capacity of verbal comprehension

Participants:
The participants of this study were 10 students with hearing impairment, with the age between 9-14, attending the "School for Deaf Children" Cluj-Napoca. According to their medical paper, they all had congenital sensorineural hearing loss with different levels of severity, from moderate to profound.
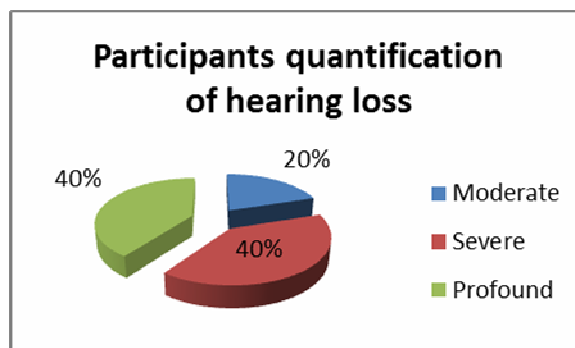
**Picture 1**. Participants quantification of hearing loss

Research
The research had four stages:
1. The initial stage- assessment of the development of the language at students with hearing impairment. There were investigated two major aspects of the development of the language:
   Lexical development – through the oral and/or sign language in the explanation of words
   Semantic development – through the capacity of recognizing and defining words.

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2. The elaboration of the adapted instrument for stimulating and assessing language comprehension (AISALC) at students with hearing impairment

AISALC has three sections: DATA, EDITOR and TEST.

The DATA section contains all the materials used in creating stimulation exercises and assessment of verbal comprehension at students with hearing impairment: pictures, audio records, exercises. It is important to mention that the audio recordings were made with a high quality microphone to avoid background noises.
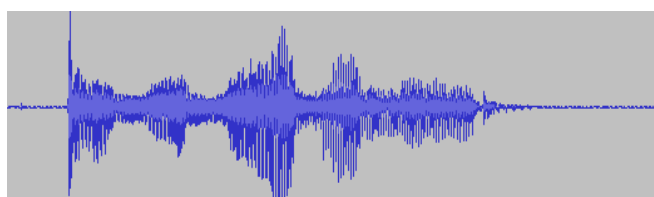
Picture 2. Record of sound with background noise
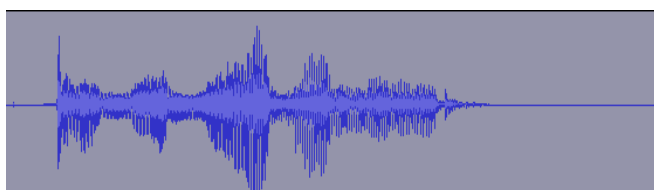
Picture 3. Record of sound without background noise

In picture 2 it is represented the visualisation of audio record that contains background noise. It can be noticed at the end of the record that the line has distorsion that means noise.

In picture 3 it is represented a sentence without background noises. It can be noticed that the final straight line is continuous comparing the first picture where the line is not straight because of the background noises.

The EDITOR section is addressed to the Special Education teacher who creates the set of training exercises. The content and number of the sentences for one set is selected taking into consideration the individual particularities of the participant. There can be three tasks:

➢ written sentence - the participant has the posibility to read the sentence and then select the appropriate picture response.
➢ audio sentence – the participant has the possibility to hear the sentence and then select the appropriate picture response.
➢ mixed sentence – the participant has the possibility to hear and read the sentence and then select the appropriate picture response.
The last section, TEST, represents the interface .

1. **Deployment of the training**
   Before starting the test, there are introduced the initials and age of the participant. The instructions are given to the student verbally accompanied by sign language:

➢ For written sentences: ”You will see a written sentence on the top of this page (I pointed the exact location). Please read it carefully and select the correct image”(I pointed to the four places where images will appear)

➢ For audio sentences: "You will hear a sentence in the headphones. Please listen to it carefully and select the correct image (I pointed to the four places where images will appear). If you want to hear it again press the Repeat button (I pointed to the repeat button to show its location on the screen)"

➢ For mixed sentences: "You will see a sentence on the screen and also hear it in the headphones. Please select the correct image (I pointed to the four places where images will appear). If you want to hear the sentence again, press the Repeat button (I pointed to the repeat button to show its location on the screen)"

The comprehension of these instructions was tested before starting the training.

Each correct answer was rewarded with a smiley face that appeared on the screen. For incorrect responses the feedback was a sad face. At the end of each set it appeared a princess with a magic stick flashed as a prize. Also, I gave them stickers for their good work.

I designed 10 training sets of 5 sentences based on the list of words designed for the assessment of the semantic aspect of the language at students with hearing impairment and grammatical structures after the Ecosse model, but taking into consideration the specific of the Romanian language. Each set was presented once a week to every participant in all three types – written, audio and mixed. Also, it was monitorized the progress of every participant.

2. **Final evaluation**
   The final evaluation contained a set of 22 items following the grammatical structures of the Ecosse model, but taking into consideration the specific of the Romanian language. The instruction for the final evaluation was: "This is the final evaluation. There will be more sentences than usual. Some sentences will be written, some audio and some mixed. Please pay attention and select the correct picture. You can click on the Repeat button if you need to hear the sentence again. You can return and change only one answer." The final evaluation was applied to every participant in one session.

The sets were scored using the following scale (both the exercise sets and the final evaluation):

➢ Each correct answer was awarded 2 points.

➢ If the audio record was repeated, only 1 point was awarded.

➢ No points were given for incorrect answers or if the audio record was repeated more than once.

RESULTS

After the analysis of the results at the verbal comprehension task adapted for hearing impaired, it was found that 48% of the words were identified and defined by participants. The words correctly explained by all participants were "carrot", "dress", "truck", "bed" and "morning". These words are part of the participant's active vocabulary. On the opposite pole, words that could not be recognized at all were: "patch", "harvest", "raw", "precipice", "fulfill", "perform", "victory", "echo".

The morphological characteristics generally identified by the participants were nouns, verbs, and then adjectives and adverbs. Prepositions and conjunctions are seldom present in their active vocabulary.

The sets of practice exercises had the purpose to stimulate and develop the language comprehension of hearing impaired children using AISALC. During the training process the mixed sentences scored the highest points. Sentences with pronouns recorded the greatest average while negative sentences or sentences with preposition scored the lowest average.
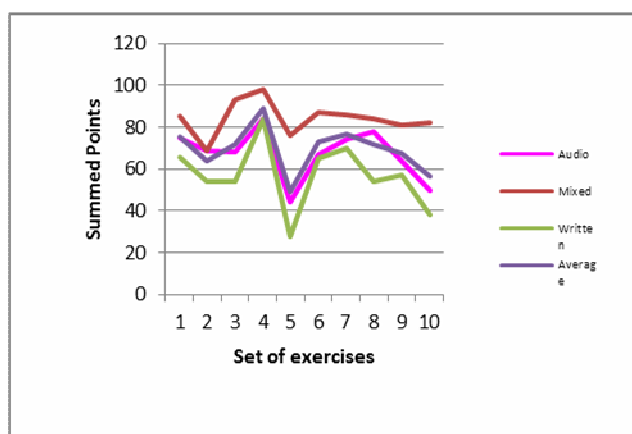
Picture 4. Participant's result at the practice exercises

For the final test an average score of 67% was recorded. The top scores were registered for nominal sentences, simple sentences with prepositions, direct/indirect speech sentence, and relative clauses. The lowest average was recorded for negative sentences which were presented in the audio form.

Conclusions

Students with hearing impairment have difficulties in remembering studied words, especially when are not integrated in a context. They operate with predominantly concrete and not abstract words, this fact being noticed in their telegraphic speech. The sign language predominates in communication, which creates confusion, because they use the same sign for different morphologic categories.

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The active vocabulary of children with hearing impairment contains nouns and verbs that are linked with daily activities (in class and/or at home). Another observation indicates that children with hearing impairment encounter difficulties in operating with the notion of gender For example, the items that contained the word "carrot" had a better score than words like "vegetables".

Using computer programs as a modality of stimulation and assessment, had a benefic effect on the development of the comprehensive side of language at students with hearing impairment. AISALC constituted a modality of training of verbal comprehension and a modality of developing the vocabulary of students with hearing impairment. All the participants manifested interes to collaborate, the program being seen by some of them as a game.

At the reading task, nine out of ten participants used the dactyl language as a source of self-control and self-appraise. When listening to audio exercises they faced difficulties: most of the incorrect answers were chosen by recognizing just one word from the entire sentence. Also, as a consequence of memorization, some of the wrong answers persisted to all next types of the sentence. The high number of audio repetitions proved to be necessary, because the participants' poor comprehension ability triggered by the hear impairment. For the mixed sentences, the majority of the participants gave their answers based on the written part of the sentence.

In conclusion, it is imposed the development of the verbal comprehension at students with hearing impairment by diversification of the topics approached in schools and using alternative material and method, including informatic means.

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Appendix 1
AISALC Sentences- Stimulating Exercises for Hearing Impaired Children

No. set	Grammatical Structure	Sentences	Words from Crichton Vocabulary Scale
1	Nominal sentences Singular adjectives	Dan is joyous. The ring has a blue diamond. The apple is red. Nicu has a small garden. The dress has black dotted print.	joyous, diamond, garden, small, dress
2	Simple sentences Simple negative sentences	In winter I skate on the ice. Inside the house is not cold. Santa Claus brought me a dog. The Snow Man melts at heat. Christmas is getting closer.	house, dog, melt, closer
3	No, only, sometimes Simple sentences with prepositions	The disobedient child doesn't receive gifts. The candle has yellow flame. Santa Clause does not reveal the gift list. Santa's bag has a white patch. Santa's sleigh vanishes in night.	receive, flame, reveal, gift, patch, vanish
4	No, only sometimes Sentences with personal pronouns	When there is a storm, sometimes there are strikes. She stirs in the pot. He answers the phone. He gets scared easily. Sometimes haste makes waste.	storm, strike, stir, answer, haste
5	But, no, neither Sentences with prepositions (in front, behind, inside, outside)	No carrots grew in the garden. No ships arrived in the harbor. There is a burglar behind the house. There is a mouse underneath the bed. Dad is reading in front of the television.	garden, carrot, ship, house, burglar, bed, television
6	Sentences with prepositions (above, underneath) Relative pronouns (that)	The song that she performs is boring. A frog rests above the water. An airplane flies above the clouds. The dictionary that I'm looking for is in front of me. The cat rests underneath the table.	perform, boring, rest, airplane, dictionary

7	Comparatives and superlatives , Passives	Costel is the most stubborn boy. The perfume smells like roses. The seaside vacation was more fun than ever. The wall was built by a worker. The kite was flown without effort.	stubborn, perfume, fun, fly
8	Reduced to relative pronouns, Reduced to the relative "than", Ambiguous pronoun	That who claps will be punished. That who has the courage can go in expedition. Salute politely raising the hand to the hat. Argue without a reason. The door that I'm locking is made of metal.	clap, punish, courage, expedition, argue, lock, metal
9	Ordinal adjectives, Relative pronouns	The third strawberry is smaller. The second passenger from the motorcycles is frightened. The apple that I chose was from the ground. The shoes that I bought had the strings tied. The cat that I was talking about catches mice from the pantry.	small, fear, choose, tie, catch
10	Active sentences	The battle that I'm writing about was with the Turkish soldiers. The elders said that this year we will have a rich harvest. Mom praises his hard work. They say that you can hear better the echo in precipice. I was telling the dream that I had this morning.	battle, write, say, harvest, praise, work, echo, precipice, dream, morning

Appendix 2
AISALC Sentences- Assessing Test for Hearing Impaired Children

NO.	Sentence	Type
1	The chick is obedient.	written
2	The mouse drives a car.	mixed
3	The teddy bear paints a flower.	audio
4	Cannot catch him.	mixed
5	I sometimes listen to music.	audio

6	Cristina is talking on the phone.	mixed
7	Mom said that the soup is hot.	mixed
8	She tries to catch the ball.	written
9	The cake that I told you about has two levels.	mixed
10	I do not like ice-cream but I will still eat one.	written
11	He looks tired.	audio
12	There are no swans on the lake.	audio
13	He is in front of the computer since morning.	mixed
14	Above the books there is a red apple.	audio
15	The ostrich is a bird that lays the largest eggs.	mixed
16	I like red lipstick best.	audio
17	The check was signed by me.	written
18	The one who will play the piano will be awarded.	mixed
19	The one who will try the red dress will look like a princess.	mixed
20	Gives injection to sick children.	audio
21	Twelve ants dance on a pie.	mixed
22	The table that I bought is oval.	written