Computer Aided Education and Training Tool for Hearing Impaired Children: AURIS

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Abstract:

The computerized education system which is introduced in this paper is called AURIS. “AURIS”, is developed to improve verbal communication skills of hearing impaired children. AURIS, which is the software combining both visual and audio technology; has been designed as an elementary supplement to strengthen the learning system and in a way that would support the education of hearing impaired children. AURIS has been tested for hearing impaired preschool children, who are in the age group of 2 and 6 years with hearing aids or cochlear implant and children who are unimplantable. In this paper, impact of AURIS as a computer supported educational tool on preschool children with hearing loss and on their learning, hearing and speaking improvement has been investigated.
1 The Role of Computer in Preschool Education

As the number of computer aided education software is in a steady increase, the opportunity to evaluate the success of computer aided education is rising up. Using computer as a tool in order to improve language learning, computer environment for preschool children is also becoming increasingly popular and their role in child development is investigated [1]. Research results show that the computer aided education is more successful than the traditional education [2,3,4,5,6]. Furthermore, this kind of learning is more enjoyable and long-lasting.

2 Benefits of Computer Aided Education for Hearing Impaired Children

The function of any organ missing in our body is undertaken by other organs. As the auditory sensitivity of visually impaired person increases, the eyesight of hearing impaired person develops much more than individuals who can hear normally. People with bilateral profound hearing impaired, while do not hear the words, communicate through lipreading; in a way “they hear by seeing”. Since the computers provide a visual environment, it is an attractive and pleasant device for the hearing impaired. Computer assisted instruction offers interactive, customizable, and measurable training environment for disabled children at language learning [7,8]. The education of hearing impaired people, which is very difficult, can also be made much more easily through this aspect of computers.

2.1 The Difficulties in Education of the Hearing Impaired Children

Even early identified infants, at the age of 12 to 16 months old, with moderate to profound hearing loss exhibit delayed receptive and expressive language skills in oral and sign languages [9]. Considering that healthy babies start to hear in 5th month inside the mother’s womb, it is evident that the hearing impaired children are at least 2 years behind of their peers with normal hearing.

The difference in terms of language acquisition between hearing loss children and hearing coevals gets greater as time passes. Hearing impaired children typically exhibit extra literacy difficulties [10]. The reading skills of hearing impaired children have typically been delayed and this delay has been found to increase with age [11]. As the learning capacity decreases every passing day, the difference between him/her and his/her peers will increase and compensation will be impossible. “Cochlear implanted hearing impairment users were well integrated into the hearing world. .... However, their career perspectives are still not satisfying [12].”

Hearing impaired children, at about 2 and 3 years old, do not experience the same language acquisition phase as their normal peers even they have cochlear implant or use conventional hearing devices. Unless a verbal communication education is given they can not communicate orally. The first word they learn is named as the “key word” [13]. “Key word” opens the gate to the world of normal hearing people. All the words they will learn afterwards would be built on such a key word. Learning such key word takes months. This is a very tiring process for the educators in that they repeat the same word to teach persistently. Its difficulty is obvious
thinking of saying a ball for 92 times only in 5 minutes in one session [14]. This education is not only difficult but also time consuming for both children and educators.

In brief, the difficulties could be summarized as bellow:

- Difficulty in explaining abstract concepts, actions and time concepts,
- Inability to understand the word (concept) when used in a sentence,
- Situations where it is difficult to make materials available with respect to the subject to be explained,
- Forgetting what was taught quickly,
- Necessity to make so many repetitions,
- Rapid distraction of interest in the classical explanation because they do not hear properly

As a result, hearing impaired children need to be supported with special supplemental education continuously, especially during the pre-school period when the intelligence and language development is at its maximum.

2.2 The Role of Computer in Hearing Impaired Children’s Education

Computer is beneficial in all the fields we listed above as:

- Concepts that are difficult to be taught (actions, abstract concepts) can be presented easily
- Interest can be kept active all the time through animations and simulations
- Various options can be presented when repetition is needed and thus same information can be repeated without boring
- The opportunity for correcting the faults is provided by presenting visually through audio analysis graphics in remedying speech disorder (pronunciation)

3 The Role of AURIS in Hearing Impaired Children’s Education

AURIS is a computer aided instructional tool developed to improve the verbal communication skills of the hearing impaired children who usually have difficulties in language learning. And this tool is expected to be useful and enjoyable for both the child and the educator.

The hearing impaired children just start to perceive the voices at a stage when healthy babies learn to talk. This is a period when both the auditory and mental development process is ongoing for the hearing impaired children. Hearing impaired child starts to learn the concepts and to perceive the voice simultaneously. In this respect, the education of preschool hearing impaired children is a very complicated and difficult process in that they start to perceive voices through cochlear implant or hearing aids; the concept teaching and language acquisition are handled together; and this process should be continued by considering their mental development process compared to their peers.

AURIS is implemented based on the principle of teaching a concept (a key word) for preschool children who can not even talk. The design of AURIS based on a principle: while teaching a concept, teach also the language by hearing and seeing with the visual and audio support of computer (Figure 1, Figure2).
3.1 Practical Sessions

AURIS has been tested on 5 preschool hearing impaired children. The age range of these children was in 2-6 years. For each child, there were four sections which were recorded by video and microphone.

- Before this testing, every child was evaluated regarding their language levels using Preschool Language Scale-Version 4 (PLS-4). Receptive and Expressive communication level was evaluated and the results are presented in (Table 1).

- **Initial Evaluation Section:** Before we started the study, we also scored the perceptual and expressive language level of each child.
  - We tested whether the children knew the key words that were planned to be taught with AURIS
  - We tested their ability to pronounce the key words
  - We tested their ability to study with the computer

- **Training Sections 1, 2, 3, 4:** Each Section consisted of 20 minutes theoretical and 20 minutes practical sessions. In practical sessions, computer based education and training is applied with the AURIS.
Table 1: Properties of Hearing Impaired Children

<table>
<thead>
<tr>
<th>Number</th>
<th>Child</th>
<th>Age of Child</th>
<th>PLS</th>
<th>Degree of Hearing Loss</th>
<th>Year Implanted</th>
<th>Another Handicapped</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>S.Y.</td>
<td>3.4</td>
<td>6-8 months</td>
<td>6-8 months</td>
<td>Total</td>
<td>Total</td>
</tr>
<tr>
<td>2</td>
<td>İ.D.</td>
<td>3.5</td>
<td>1.6</td>
<td>1.5</td>
<td>Total</td>
<td>Total</td>
</tr>
<tr>
<td>3</td>
<td>B.O</td>
<td>4.5</td>
<td>3.6</td>
<td>2.5</td>
<td>Total</td>
<td>Total</td>
</tr>
<tr>
<td>4</td>
<td>Y.K</td>
<td>4.7</td>
<td>2.5</td>
<td>2</td>
<td>Total</td>
<td>Total</td>
</tr>
<tr>
<td>5</td>
<td>E.A</td>
<td>5.7</td>
<td>5.0</td>
<td>3.6</td>
<td>Total</td>
<td>Total</td>
</tr>
</tbody>
</table>

4 Result

The success of Auris software is examined under four categories in further detail:

- Teaching a Concept
- Correcting Pronunciation
- Teaching in a short Time, Easily and Enjoyable
- Retention

4.1 Teaching a Concept

At the beginning of the study, we tested the participants’ knowledge of the target concepts (key words). Three of them did not know the target concepts; and could not answer the question “What is this”. They learnt these concepts after two or three sessions. For example; Y.K., İ.K., S.Y were able to give us the ball when we asked “Give the ball” choosing the correct object out of three.

4.2 In a short Time, Easily and Enjoyable

The children reached the targets in a comparatively shorter period, achieved concepts more quickly with the help of moving images and visual effects compared to the theoretical lessons. We succeeded in teaching the key word to three hearing impaired children who can not communicate verbally (did not even make sounds as cooing). Teaching only one key word could take 6-12 months in classic education but in our study group children succeeded to learn at least one key word within only 4 sessions in 2 months without being tired and bored at all.

4.3 Improving Pronunciation

After they began to pronounce key words, we tried to improve their speaking and pronunciation problems with the help of AURIS voice analysis method. In the final session, they were able to pronounce the concepts correctly. When we asked the question again “What is this?” they were able to answer as “ball”, “car”, and “doll”.

4.4 Retention

Children do not forget the key words they have learnt in first sessions. In the further studies with AURIS, they also began to understand the meaning of the sentences including these key words. They were able to hear and distinguish the concept (key words) within the sentence, and also comprehend the meaning of it “Throw the ball” “Hold the ball” “Ali, throw the ball” “Throw the ball to your mother”. They could even comprehend three word sentences as well as able to make meaningful sentences. As a conclusion, teaching a concept with AURIS is proved to be effective.

5 Conclusion

In these days, children have more tendencies to play with computer and play computer games; thus children with hearing impaired are likely to accept this kind of education easily. With this software, AURIS, we aim to lessen the hardships and struggle that children and educators’ experience during education. With AURIS, they can learn concepts and actions quickly with the help of moving images and visual effects. Furthermore, this kind of learning is more enjoyable and long-lasting. Moving images help them to quickly learn the concepts without feeling bored and thus they do not forget the things they learn. We saw that they could even comprehend three word sentences and correct their speaking and pronunciation problems with the help of voice analysis method of AURIS.

References:


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