**ORIGINAL PAPER**

# Design and Implementation of a Software for Teaching Health Related Topics to Deaf Students: the First Experience in Iran

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**ABSTRACT**
**Introduction**: Deaf are not able to communicate with other community members due to hearing impaired . Providing health care for deaf is more complex because of their communication problems. Multimedia tools can provide multiple tangible concepts (movie, subtitles, and sign language) for the deaf and hard of hearing. In this study, identify the priority health needs of deaf students in primary schools and health education software has been created. **Method**: Priority health needs and software requirements were identified through interviews with teachers in primary schools in Tehran. After training videos recorded, videos edited and the required software has been created in stages. **Results**: As a result, health care needs, including: health, dental, ear, nails, and hair care aids, washing hands and face, the corners of the bathroom. Expected Features of the software was including the use of sign language, lip reading, pictures, animations and simple and short subtitles. **Discussion**: Based on the results of interviews and interest of educators and students to using of educational software for deaf health problems, we can use this software to help Teachers and student's families to education and promotion the health of deaf students for learn effectively.
**Key words: Deaf Students, software for Teaching Health Related Topics, Iran.**

## 1. INTRODUCTION

During the recent years, technology and computer advances have affected various aspects of human life (1). Development of information technology has influenced all aspects of society including education; in this line, electronic learning through computer, internet and multimedia software programs has been developed very much. Providing these technologies for all groups of society has been internationally supported by organized policies and activities (2-4).

Impaired hearing is one of the most common sensory failures affecting one in 1000 children (5). Impaired hearing is attributed to a condition in which the affected person needs special education and since children with hearing impairment more than 15db need special education, any type of hearing failure more than 15db can be called hearing impairment (6). According to WHO statistics, there are approximately 250 million individuals with hearing problems around the world of whom, 30 millions are deaf. Less than one percent of deaf, hard hearing and both deaf and blind children in developing countries have access to any type of education (7). Based on the statistics of World Federation of the Deaf (WFD), 80% of the deaf are illiterate or low educated (8).

Deaf people have problem in learning health recommendations (9). Limited knowledge of deaf people, due to their communication problems, makes their health care more complicated (10). According to a study on oral health status of male 12-15 year old students of Tehran deaf education centers, the rate of dental carries is higher in deaf students compared to blind students. This shows that blind people, due to benefiting from hearing sense, can receive health education better than deaf students (9). Moreover, studies of England Mental Health Institute have shown a direct relationship between psychological disorders and hearing loss; that is, the rate of psychological problems of deaf children is approximately as twice as other children (40% vs. 25%). According to the studies in different countries, psychological disorders are clearly more prevalent in deaf people (11). The percent of deaf receiving mental health care, even in the United States, is not more than 5% and in most poor countries, there is no mental health care for the deaf(12) .

The deaf population has some obstacles in attaining health information (13). Hearing impairment in the ages of language learning or before that injures language and speech potentials of the child severely and leads to failure in communicative capabilities followed by unsociability, depression and several psychological, emotional and social abnormalities (14). Due to different reasons including not identifying deaf people who live in rural areas, welfare organization cannot provide services for them and only 40% of people with hearing disorder benefit from rehabilitation and medical services of this organization (15). To solve this problem, designing educational programs with suitable format and language based on

the needs of deaf individuals is required (13). Social privation of the deaf causes some problems for them to attain higher and professional education. The deaf individuals and their families need information and education for improving general knowledge toward their condition (16). Without designing specific education for the deaf, there is a need for sign language translator that is expensive. It is possible to design electronic learning specific for the deaf and applicable on all computers (17). With access to learning tools such as electronic learning, the student can learn all topics at any time and place like home, work place and library (18). One of the educational elements for the deaf and hard hearing people is using educational technologies including computers and distance learning (7). Multimedia distance information and communication services can be used as the standard electronic platform for continuous teaching of the deaf (19).

During the recent years, opportunities for using information technology have been provided for the deaf; for example, access to e-mail and some web sites has been a help for the deaf to have contacts with each other and other people (12). In many developed countries, children with various disabilities are taught to use computers in their daily activities such as education, work, home appliances' control (turning lights, radio, TV…), communication and entertainment (20). Multimedia tools and environments can provide multiple presentations of concepts (film, subtitles and sign language) that are more tangible for the deaf and hard hearing people (21). Advanced video technologies have a significant role in electronic learning and have great potentials for providing distance communication for the deaf who use sign language as their first language (2).

Our experiences show that in spite of several experiences in developed countries in relation to the efficacy of new technologies in education of the deaf, there has been already not much measure in this regard in Iran. The present study was aimed at designing and implementing a virtual computer educational program for the deaf students in Tehran/ Iran.

Considering health problems of the deaf and the expenses imposed on them, their family and the society and also the importance of electronic education as an up-to-date technology used for more efficient education, this paper first explains the health needs of deaf primary school children and implementation of an educational software for health issues and then describes the stages of designing and implementing the virtual educational program.

The main question of this research was whether implementation of virtual educational program for the deaf is practically possible in our country or not?

## 2. METHOD

This study was a descriptive study in which a software program including sign language clips accompanied with voice and subtitle was prepared. For some clips that needed more information, images and animation were also used.

### 2.1. Health needs priorities

The study was performed on deaf and hard hearing children of 7 primary schools in Tehran/ Iran. The number of hygiene instructors considered for interview was in accordance to the study population. A questionnaire containing six open questions was used for interviewing hygiene instructors. The

questions were about the educational method used by the instructors (sign language or lip reading), the rate of using electronic educational tools in teaching deaf students and in the case of using them, their advantages and disadvantages. With the aim of applying the experiences of previous systems in this project, the questions were asked from hygiene instructors in order to identify health problems of deaf students, the educational level for each educational need based on instructors' recognition of awareness level of students and the rate of their learning as well as the characteristics of software needed by applicants. Since interview recording was forbidden, the answers were recorded on paper.

In order to analyze data obtained from interviewing hygiene instructors, first data related to each question, in accordance to the considered variables of that question, were extracted and for better use of data, using descriptive statistics, for each variable separate tables consisting frequency, percent and column graphs were prepared. Those variables with more than 50% frequency were considered as health needs priorities. Since the same CD had been prepared for both girls and boys, due to cultural issues, clip related to the menstrual health was omitted.

### 2.2. Software preparation
### Film preparation

Based on the results of interviews, 12 topics were considered for clip preparation. For each clip, the required items were gathered and after being confirmed by hygiene instructors, avoiding linking verbs and using simple words, they were organized in short simplified sentences to be understood more easily. Videos were presented by a deaf instructor who was expert in sign language and whenever there was no equivalent for the words in sign language, sign alphabet was used by the deaf instructor. Manual Panasonic camera was used for recording educational videos and since the videos were indoor recorded, a projector was used to supply the required light.

#### Video edit

Video editing was performed in four stages including cut and attaching voice, subtitles and images through Adobe Premiere Pro CS3 software; that is, first, the primary video was cut to short videos and then each video was voice attached. In order to add subtitles in Adobe Premiere software, Leo-Moon Persian software was used. Guiding images were put at top corner of video windows using Premiere software. Clips were saved with intended quality (resolution, frame format, file format). For better understanding of videos by students, animation was used too.

#### Software preparation

The software program was prepared in CD frame based on Scorm standard. For this, 12 prepared videos were classified in 5 major topics in a way that by clicking each, the sub-topics were shown. Under each sub-topic, too, the related videos were placed. Most videos and clips were related to the topic of oral health. In order to facilitate the distribution of software among students, it was prepared in CD form.

## 3. RESULTS

One of the goals of the present study was to identify the health needs of students and to determine their priority. The results of interviews showed that all hygiene instructors used both lip reading and sign language in teaching deaf students.

| Frequency/Priority | Number | Percent |
|---|---|---|
| Hands & face washing | 5 | 71.43 |
| Oral & dental hygiene | 7 | 100 |
| Unsociability | 5 | 71.43 |
| Correct and on-time medicine taking | 1 | 14.29 |
| Ear-trumpet keeping | 7 | 100 |
| Ear-hygiene | 7 | 100 |
| Toes hygiene | 5 | 71.43 |
| Hair hygiene | 4 | 57.14 |
| Hyperactivity | 1 | 14.29 |
| Consumed foods | 1 | 14.29 |
| Menstrual hygiene | 4 | 57.14 |
| Bathing | 5 | 71.43 |

Table 2. *Classification of clips based on topics and sub-topics*

| Major topics | Sub-topics | | Features |
|---|---|---|---|
| Body hygiene | Bathing | Bathing | A clip about the importance of bathing, number of bathing in week and teaching bathing, duration: 1´,24´´ |
| | Hands & face | Hands& face washing | A clip about the importance and correct way of hand washing, duration: 2´.39´´ |
| Ear hygiene | Points about ear hygiene | Ear hygiene | A clip with images about ears' protection, duration: 1´,10´´ |
| | | Internal ear-trumpet | A clip with images for keeping internal ear-trumpet, duration: 1´,7´´ |
| | | External ear-trumpet | A clip with images for keeping external ear-trumpet, duration: 1´,12´´ |
| Oral & dental hygiene | Teeth brushing | Correct teeth-brushing | A clip about correct way of teeth brushing (64) , duration: 3´,40´´ |
| | | Teeth hygiene | A clip for teaching oral hygiene with images, duration: 2´,20´´ |
| | | Brushing clip | An animation about correct way of teeth brushing (64) , duration: 58´´ |
| | Teeth flossing | Correct teeth flossing | A clip about correct way of using tooth floss (64) , duration: 2´,15´´ |
| | | Teeth flossing clip | An animation about using tooth floss, duration: 47´´ |
| Psychological health | Psychological health | Psychological health | A clip about maintaining psychological health, duration: 1´,19´´ |
| Personal items' hygiene | Personal items | Personal items | A clip about the importance and correct way of using personal items, duration: 1´,23´´ |

Table 1. *The frequency of Health priorities based on the opinions of interviewed hygiene instructors*

Moreover, only 2 schools used electronic learning of which, one school knew this method of learning useless. According to most instructors, washing hands and face, students' unsociability, toes health and correct way of bathing were health needs of deaf students. All instructors mentioned oral hygiene, ear-trumpet keeping and ear hygiene as health needs of deaf students. Approximately half of the instructors mentioned hair hygiene and menstrual hygiene as health needs. According to one of the interviewed instructors, hyperactivity and consumed foods were health needs of deaf students (Table 1).

Based on the results of study on teaching concepts, all instructors emphasized on teaching basic concepts by using short, simple and understandable sentences and believed that understanding long sentences are difficult for deaf students.

In relation to the characteristics of health education software, all instructors emphasized on the necessity of videos enriched with subtitles, sign language, animation and images. In addition, 5 instructors emphasized on slow talking of the presenter and using short simple sentences in the videos.

Manual Panasonic camera was used for recording educational videos and since the videos were indoor recorded, a projector was used to supply the required light. Videos were presented by a deaf instructor who was expert in sign language and whenever there was no equivalent for the words in sign language, sign alphabet was used by the deaf instructor.

After recording videos, using Adobe Premiere Pro CS3 software, cutting and attaching voice and subtitles were done; that is, first, in order to separate clips, films were cut. Since the film presenter was hard hearing and had difficulty in speaking, voice was attached to each clip in the second step. Meanwhile, since this software is used by hard hearings, voice helps them to understand the concepts.

After attaching voice, in order to improve students' reading skill, subtitles were added using Leo Moon Persian software. It was tried to use simple short sentences for subtitles and to consider the following qualitative features:

• Resolution: 704★ 576

• Frame format: CIF
• File format: MPEG

Based on the results of interviews, 12 clips with oral and dental health topics including dental care, correct way of tooth brushing and tooth flossing, ear hygiene including ear care and internal/external ear-trumpet care, bathing, hair and toes hygiene, personal devices, hand and face washing and correct way of hand washing were prepared in 5 major topics (Table 2).

In order to prepare the software, the software frame specific for production of Persian educational content was used.



Figure 1. *Frame has been prepared with Delphi program (using Scorm standard)*

Figure 2. *Image related to the topic–top right corner*



Figure 3. *Tooth brushing and flossing – animation*

The frame has been prepared with Delphi program and using Scorm standard (Figure 1).

In some clips that needed images for better understanding, images related to the topic were placed at top right corner of the film window using Adobe Premiere Pro CS3 software.

Tooth brushing and flossing, due to their importance, were presented by using animation too (Figure 3).

The software output could be in CD, DVD or executable file format and since the prepared software should be given to experts and users for evaluation, it was prepared on CD.

## 4. DISCUSSION

Based on our review of the literature and interview with hygiene instructors of our studied students about health and educational problems of deaf students, lack of deaf-specific educational tools, success of electronic education programs for deaf students but lack of any software for teaching specific health issues to deaf students, designing a software for teaching health issues to deaf primary school children was selected as the main aim of this study.

In order to achieve this goal, the first question of the research in relation to health educational needs of deaf primary school children was propounded. The results showed that this group, due to problem in communication and lack of up-to-date educational facilities, has many health problems. According to Zonoobi, most deaf students are weak in speaking and writing. They know each word with its first meaning and are unaware of metaphoric meanings. They have very simple and primary understanding of the words and phrases in a way that the maximum rate of writing for a case is not more than one page. They use verbs without inflecting for person and time and have no interest in spelling (22).

According to all hygiene instructors, caring about ear health and ear-trumpet is a health priority of deaf students.

The high frequency of this priority can be attributed to the special importance of it for deaf, since otherwise they face problems like ear infection or ear-trumpet impairment. Previous studies on oral and dental health show that deaf students have more problems in this regard. For example, a study on oral and dental health status of 192 deaf students aged 12-16 years in Tehran/ Iran has showed higher number of missed teeth in deaf group (23). In another study on oral and dental health status of male deaf students of Tehran Deaf Educational Center, the rate of dental carries was higher among deaf students compared to blind students. This can show that blind students, due to benefiting from hearing sense, receive health educational issues better (9).

Selection of deaf primary school children as the target group in the present study was due to the importance of health education in early ages, the problem of deaf students in communication and their weakness in speaking and writing skills. Education of hearing impaired children has been always faced controversial beliefs in regard to the suitable educational method (24). In the present study, hygiene instructors used both sign language and lip reading as their communicative strategy in teaching their students; even though, they had problem in complete transfer of issues and concepts to their students. The reason might be that, as Gholamhosseynzadeh reported, deaf students have no problem in recognizing alphabets but they have mostly problem in reading comprehension. They have also problem in understanding speech. While, they mostly focus on names and verbs, understanding prepositions, demonstrative pronouns and connectives is difficult for them and generally their grammar is weak (25). Therefore, as the results of this study showed, simple short sentences should be used in teaching these students. Meanwhile, using videos, animations and images beside educational subject-matters can help them to have a concrete understanding of the educational issues. The results of electronic education system project for deaf and hearing-impaired individuals in Australia have also showed that for adopting the system with applicants' needs the shortest text with simple sentences should be used (17).

The second question of the present study was related to the designing health education software for deaf primary school children. This software is among computer-based educational software programs in the field of electronic education. Although the beneficial effect of electronic education is clear, there has been no specific educational software for the deaf so far. The principles of World Federation of the Deaf (WFD) confirm the role of communication and information technology as a powerful channel for establishing and modifying information as well as developing equal access to social opportunities, education and new chances for the deaf people (26). There have been so far several studies in this relation; for example, a study on 3000 students in deaf schools by Stanford University Mathematical Studies in Social Sciences Organization has reported a direct relationship between the deaf students' scores and the number of received computer- aid courses (27). A study on designing a web-based distance learning environment for deaf people in electronic commerce sector using electronic learning tools by Drigas et al (28), educational project for women entitled 'my body: my responsibility" in a CD format by Rochester University Medical Center (29), a study on the effect of multimedia pro-

grams of reading comprehension for deaf people in Louisiana and Texas states by Gentry et al (27) and many other projects emphasize on the efficacy of using electronic education especially multimedia education in the education of deaf people.

In the present study, in order to prepare clips of multimedia software, sign language, lip reading, subtitle, animation and in some clips images were used. Educational images or animations help students in the education process. Due to attention of deaf and hearing impaired students to the hands and lips movements in the videos, the clarity of hands and lips movements in videos prepared with sign language is very important. Therefore, it was tried to prepare high-quality videos and since the software had an educational nature, in order to prevent primary school children from becoming tired, videos were prepared in a short format.

Along with the development of web-based technology, some performed studies have used Internet as a communication channel. Among them, Drigas et al study on distance learning for deaf in electronic commerce sector (28) or Liu et al project on improving math education by classes facilitated with wireless technology (30)can be mentioned. It is clear that using Internet has several advantages and provides the potential of creating interactional classes for increasing communication among deaf. Since all our subjects did not have access to high-speed Internet, for fair distribution of educational matters, they were placed on CD.

## 5. CONCLUSION

Based on the present study, attention to the problems of deaf, especially in relation to physical and psychological health, and their education is an undeniable necessity. In this line, benefiting from technology, for example electronic learning can be a useful method for relieving deaf problems. Multimedia software programs including educational videos enriched with sign language, guiding images and subtitles with simple short sentences as well as deaf-specific designed animations are suitable tools in deaf education. Any study in relation to developing multimedia software through completing educational content and improving its quality is valuable.

**CONFLICT OF INTEREST: NONE DECLARED.**

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