Research on the development of smart application for e-learning as an assistive device for people with hearing impairment

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Abstract – Teachers of students with learning disabilities are well aware of the necessity of English teaching books suitable for their students. Additionally, they often support independent educational programs that focus on these students’ particular needs to better ensure student learning. Some IT companies have already begun developing English learning programs that can be provided on digital devices, but there are few programs being developed for students with hearing impairment. This is an obvious and immediate need. This study reviews the development of English learning application for hearing impaired students. By conducting a field survey and examining previous research, we were able to develop an application constructed to meet the needs of students with hearing impairment. The purpose of this work is to develop and secure resources for instruction of the hearing impaired, and to increase their self-esteem and social participation.

Keywords: e-Learning, Application development, Hearing impairment, English pronunciation, Unit system

1 Introduction

Teachers of disabled students see a great need to develop English textbooks for their hearing impaired students. Another identified need is for educational programs that meet specific individual needs. (Yoon, Sun-hwa, 2010) Therefore, textbooks should be constructed to work both as individual learning tools for students and as well as textbooks for teachers. While considering needs and necessities of users, many IT companies still struggled to develop learning tools from the different viewpoints.(Koh, Jin Bok, 2013) Since the development of universally designed smart devices, a variety of applications for learning English have been created. Those programs help students learn on their own, regardless of the user’s location or time of day. However, there has been a certain restraint on the use of applications already made before for students with hearing impaired due to limited instructional methods. Language teaching methods for them can be divided into three. First is a sign language using gesture and the second is oral method using vocalization and look of lips. And the third is the one using both above mentioned. These days, many schools employ sign language to communicate and focus on teaching letters. However, it is hard to perfectly express sentences in a sign language, and the limitation of sign language makes it difficult for hearing impaired students to both learn grammar and acquire knowledge. Students with hearing impairment may also have problems understanding others’ feelings and thought. To solve this problem schools use letters to educate them, but this medium is limited because of hearing impaired people’s limited understanding of sentences. (Moores, D. F, 2001) Although learning through an oral method is difficult, it has an advantage to help them to grammatically understand sentences and what speakers mean. Studies have compared students educated via a sign language with those educated by oral method in terms of how they complete sentences. Results indicated that students who are educated by an oral method attain higher achievements in making sentences. (Jeon, Gye-ja, 1988; Nah, Kwon-soo, 2003) Moreover, they also showed a higher rate of admission to colleges. Once they are educated well by oral method, they tend to be enthusiastic about learning and are more likely to consider going to college. On the other hand, students educated via a sign language tend to feel afraid of expressing their opinions, and going to college. According to the research on a special school, mostly teachers who don't have a specialized training about a sign language teach classes. But those who teach English already knew about the importance of oral method. Students with hearing impairment have difficulties learning a native language as non-disabled students do when learning a foreign language. Due to these reasons, necessity of oral method is increasing. However,
it was found that applications to systematically teach hearing-impaired students via an oral method have not been invented yet.

1.1 Current status of App development for training of English pronunciation

Developed applications for oral method programs are usually aimed at non-disabled people. As shown in Figure 2, most of the applications use 2D images. In these applications, it is hard to see the movement of the tongue and structure of mouth. In addition, since the explanations are quite vague and consist of technical terms, they are hard for users to understand. Furthermore, it causes hardships for teachers because things must be explained through sign language or other means. Therefore, to secure meaningful instruction for students with hearing impairment, the development of an English pronunciation training application is needed.

2 Body

2.1 Storyboard and development of design

2.1.1 Extraction of English words and categorization

First, we identified words in both Korean English textbooks and American ones and populated a vocabulary list with nouns, verbs, adjectives and adverbs suitable for sentence creation. Since target users are students who do not know English well, we set the level at the 4th grade of elementary school. Then, we extracted 85 words and divided them into seven groups, as seen in Figure 4. First, words are categorized alphabetically. Users can easily find the words they want in either capital or lower-case letters. This is because it was shown during our research that students with hearing impairment have problems distinguishing between lower-case and capital letters. Second, words are categorized according to their meanings in Korean. A given word can be searched for alphabetically in Korean. This is because most users are Korean and do not know the English alphabet. Third, words are categorized according to the order of Korean consonants and vowels. For instance, the initial sound of the word “gas” is similar to ‘ㄱ’ in Korean. Connecting two similar sounds in both Korean and English is aimed at helping users to memorize them more easily. Third, words are categorized according to look of lips and breathing. It shows whether they are vibrating or plosive sounds and explains the characteristics of each sound. This categorization helps users to discern characteristics of the words they speak and allows them to practice pronunciation easily and repeatedly. Lastly, words are categorized according to word class, which includes noun, pronoun, adjective, and verb. With this information, students can develop their syntactic abilities and make sentences.

2.1.2 Development of Application

The interface of the application includes distinct, individual buttons that can be clearly distinguished so users will not be confused. Some of the words that may be confusing are illustrated with pictures to make them easier to understand. Main categories are based on 7 standards mentioned earlier. In order to make structure of oral cavity clearly visible, 3D modeling technique was used to produce an authentic face model unlike previously developed applications which are in 2D. And using UNIT technique, each part of the face can be zoomed in and the exact place of a tongue and movement of lips and tooth can be observed on the whole.

2.2 Title Design and plan of the application

2.2.1 Interface

According to the importance of picture cards mentioned earlier, an interface was developed as in Figure 3. (Kim, Hee-
Young, 2009) This interface can provide visual and auditory effects simultaneously. Furthermore, this can make lower grades who can’t be focused easily feel more interested than when showing just letters in a simple way.

2.2.2 Category.

In this application, when touching the screen on the higher menu, the screen would change to a screen like that shown in Figure 4. Users can scroll through a list of words and select the one they want. Once users select a word, an explanation of the pronunciation, sound, and the meaning would be offered with pictures, vocalization sound, and 3D model in the next phase.

2.2.3 Unit

For this project, the application was developed in 3D using the UNIT technique. This application made the man in the picture of Figure 5 a three dimensional model, that students can rotate. With this function, users can closely look into the structure of the oral cavity. By doing so, 3D images offer a learners a better chance to understand how to pronounce specific words and phonemes.

2.2.4 Avoid using too many capital letters. All section headings including the subsection headings should be flushed left.

3 Conclusions

For this project, an English learning application as an assistive device for people with hearing impairment was developed, featuring the above mentioned elements. This application was developed as an assistive device for hearing-impaired students who are inclined to learn English. To the end, this application has the purpose of supporting learning in various places, including outside of school. In addition, this application provides help for students with hearing-impairment to learn and better understand English. We believe this application will play a positive role in learning English among the hearing impaired. This application can also be effective for other disabled people and non-disabled ones. Even though the number of words is limited to 85 due to the lack of funding, further research will help to expand constantly this project for the hearing impaired.

References


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