

Application of Intelligent Software in Language Rehabilitation Training for Hearing-impaired Children

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Received: 6 July 2024; Accepted: 31 July 2024; Published: 15 August 2024

Abstract:

Hearing impairment is a major health problem in the development of deaf children. “Hand for the mouth” to assist oral training, through wearing hearing aid equipment and “auditory mouth grammar” training to strengthen the impaired hearing, is the current common means to promote oral rehabilitation of deaf children. However, due to the poor popularity and high economic cost, its oral rehabilitation effect is not ideal. With the development and maturity of artificial intelligence technology, the state actively calls for and supports the application of various intelligent technology and equipment in the language rehabilitation training of hearing-impaired children. This paper summarizes the present situation of the language barriers, the cause of language rehabilitation training and hearing impaired children language advantage, at the same time compare the current characteristics of digital oral language training products, on this basis, gives the hearing impaired children oral language training intelligent product development strategy, in order to realize the barrier-free communication, power language rehabilitation training to provide theoretical basis.

Keywords:

Intelligent Software, Hearing-impaired Child, Oral Rehabilitation Training

1. Current Situation of Language Barriers in Hearing-impaired Children

Hearing impairment has become one of the major health problems worldwide. According to the survey, the number of deaf-mute people in China accounts for about 24.16% of the number of disabled people, with about 27.8 million. There are about 137,000 hearing disabled children under the age of 6, and there are about 23,000 newly born deaf children every year. The number of deaf children is huge and growing.

General Secretary Xi attaches great importance to the digital construction of special education, emphasizing that “information technology and special education should be further deeply integrated, develop digital teaching resources for special education, and

expand the coverage of high-quality resources.” In 2022, the Ministry of Education stressed in the Action Plan for the Development and Promotion of Special Education during the 14th Five-Year Plan period that education, health, civil affairs, disabled Persons' Federation and other departments and units should promote the integration of medical rehabilitation, information technology and special education. The project for the introduction of assistive devices into schools will be implemented, and priority will be given to providing scientific assistive device adaptation and services for disabled children in compulsory education.

The state encourages the digitalization of special education as one of the key contents of China's modern education transformation, and provides economic support for hearing-impaired children. For example, the cost of cochlear implants and hearing AIDS are included in the medical insurance, and language rehabilitation centers are set up to provide free language training services for hearing-impaired children and set up special schools. Although local governments have implemented a series of relief measures for hearing-impaired children to help them better integrate into society, such as opening special schools across the country, offering sign language courses, establishing oral rehabilitation centers, and support for hearing AIDS and cochlear implant equipment. However, due to the particularity of hearing impaired children, (1) deaf children have low cognition, short language memory time and weak comprehension ability; (2) although hearing impaired children can restore their hearing, hearing impaired children also need oral rehabilitation training in language development (0-6 years old) to strengthen their pronunciation organs and make up for the impaired hearing. However, due to hearing impairment, hearing-impaired children under the age of 6 can only recover some of their hearing even by wearing hearing AIDS, and need to strengthen their pronunciation organs. According to data from the Language and Training Department of the Hezhou Disabled Persons' Federation, the proportion of hearing impaired children aged 0-6 is about 70 percent, while most hearing impaired children with language rehabilitation return to ordinary schools to study. However, there are very few cases of normal spoken language communication.

Secondly, after the age of 6, hearing-impaired children will enter special schools to learn the language if the language rehabilitation effect is not good. Hearing-impaired children in special schools are usually characterized as “hand” to assist text learning, oral English is no longer their main learning goal, the main problems are: (1) understand the low penetration rate of “hand” sign language, chaotic language order expression, dialect deviation and so on; (2) economic lag and lack of teachers in education imbalance lead to the unsatisfactory language training effect of deaf education.

It can be seen that China attaches great importance to the deaf education relief work, but has been faced with many challenges and difficulties.

2. The Main Reason for the Impaired Language Rehabilitation in Hearing-impaired Children

2.1. Lack of family education

Under the age of 6 is the critical period of language rehabilitation, and the best means of rehabilitation is “home co-education”, because many families cannot hinder the path of language rehabilitation training.

2.2. Lack of teachers

At present, the supply and demand of language rehabilitation institutions is insufficient, there are only 841 rehabilitation institutions, but more than 35.46 million people; language rehabilitation teachers are scarce, less than 10,000, the social demand is as high as 30 million, and the price of private language rehabilitation institutions is about 3000 yuan a cycle, the cost is high.

2.3. There are few people using sign language, and the language expression and sentence patterns are confused

After the age of 6, hearing-impaired children will enter special schools to learn the language if their language rehabilitation effect is not good. Hearing-impaired children in special schools are usually represented as “hand for mouth” to assist text learning, and oral English is no longer their main learning goal. Moreover, few people know sign language; Hearing-impaired children use different words from ordinary sentences, and flashbacks. Therefore, whether it is sign language communication or text communication, it is very difficult or inconvenient for healthy listeners to understand the sign language or writing of people with hearing impairment.

On the whole, due to the poor popularity of sign language, the economy of lip learning, high time cost, family reasons, and the different personal situation of each hearing-impaired child, the oral rehabilitation effect is not ideal. For this reason, many parents attribute their children's hearing problems to “the misfortune of the previous life”. They are particularly eager to help children solve the problem of hearing impairment through the new technology, and achieve barrier-free communication with healthy listeners.

3. Language Characteristics of Hearing-impaired Children

3.1. Hearing-impaired children have strong visual and language advantages

The perceptual information processing of hearing-impaired children is incomplete. Hearing-impaired children have low cognition, slow mental development, short maintenance time of language memory, and weak understanding ability, but they have strong image thinking and are good at visual processing [1]. [2] Due to the defect of auditory stimulation, hearing-impaired children have incomplete perception of complex things and environment and lack auditory information processing. Therefore, their perceptual information is more dependent on vision, tactile perception and kinesthetics, which is not easy to form a comprehensive combination of audio-visual information. This leads to the vision of hearing-impaired children to naturally occupy a dominant position in the perceptual activities.

When hearing loss, hearing impaired children will use more vision to understand the world, and language understanding and communication. This phenomenon of “taking the eye instead of the ear” emphasizes the importance of vision in the life of hearing-impaired children, and emphasizes the advantages of visual compensation of hearing-impaired children.

3.2. The specific expression of visual language advantage

Hearing-impaired children have strong observation and imitation power. Hearing-impaired children visually show a strong observation and imitation power. They are able to clearly identify small things from distant things, more clearly than in normal

children. This advantage enables them to assist in understanding and imitation by observing visual information such as mouth shape and facial expression when learning language. It can be said that children have a strong advantage of reading through the images.

Hearing-impaired children have a strong visual memory ability. Due to the long-term dependence on vision for information acquisition and processing, the visual memory ability of hearing-impaired children has also been significantly developed. They are able to remember and recall what they learn through visual information, which is particularly important for language learning.

Through the close combination of vision and language, hearing-impaired children form a close connection between vision and language in the process of their language learning. They understand verbal meaning by observing visual information such as mouth shape and gestures, and learn pronunciation and expression by imitating these visual information. This combination makes the vision play an irreplaceable role in the language learning of hearing-impaired children.

In general, hearing-impaired children have strong visual language advantages. This advantage is fully reflected in terms of perception, learning and language development, and has had a positive impact on their growth and life. Therefore, we should fully realize and use this advantage to provide a better education and living environment for hearing-impaired children.

4. Digital Products Related to Oral English Training for Hearing-impaired Children

With the development of technology, auditory and oral grammar has gradually been replaced by the newly developed digital lip reading technology [3]. It captures a series of lip motion information, combines pattern recognition, speech processing, image classification, and natural language processing techniques, and deduces what the speaker says [4,5]. For example, the early data of “Lip and Lip Moving” is a real sign language teaching material developed by combining computer programming C language and real sign language video. Users need to cooperate with the computer client or insert a CD, and can also choose sign language videos according to the 26 pinyin used by the deaf and mute. According to the evaluation of users 'parents, real person teaching is boring, and it is difficult to attract deaf children's interest in learning.

“Dr. Qiying” - language correction instrument, is a large auxiliary equipment provided by the national classroom teaching for deaf children- pinyin training system, using an interesting way to carry out pinyin learning. It is composed of multiple devices and is mostly used in text learning in special schools. Its volume is huge, the price is more than 300,000. Hearing-impaired children are not convenient to use, and the initiative of machine practice is weak and lack of guidance.

In 2021, Guangdong Wuoula Company developed a deaf mute translator with high recognition and strong generalization ability - “Changing Hands” software. This software applies the deep learning method of audio-visual multi-modal fusion feature extraction to improve the matching recognition rate between database information. It mainly adopts an innovative program to automatically match the corresponding 3D characters, covering the speech shape and gesture movements of deaf and mute daily language. The reversible direction recognition between text-image and sound-image is

realized. Users can collect the voice of common sentences and their text input for real-time translation according to their needs. The software realizes image recognition through the motion capture device. However, the software database selects 1000 daily terms for deaf people, which not only has limited database information, but also requires people who understand the input method to use it. It is a translation software used by older deaf children, which is not suitable for oral training. Secondly, the software module is rich in design, but the 3D character design is simple enough to attract the attention of deaf children. The movements of oral language and sign language are not coherent enough, so it is not suitable for oral language training. At present, the relevant oral English training products are still an urgent breakthrough problem in the industry.

Chinese scholars have made a detailed research on the oral English training materials of hearing-impaired children. However, there are still some shortcomings: a. Rich policies and theories research on oral training of hearing impaired children, and the effect of oral training is not good. b. From the perspective of product development, the language training products or materials used by hearing-impaired children in the market are relatively limited, most of them are real sign language teaching and pinyin literacy, and the content is not interesting, and the database mostly covers daily language, so the oral training products for hearing-impaired children aged 0-6 are more limited. Based on the above deficiencies, in the future, based on the oral learning characteristics of deaf children, using gamification and interesting expression, combined with lip recognition digital technology and digital platform, to achieve the form of human-computer interaction training, to help deaf children quickly learn lip language.

5. Development Strategy for Intelligent Software

Based on the above problems, in the future, hearing-impaired children should be taken as the center, adopt emotional design methods to develop intelligent and interesting lip software, and create an immersive and interactive language rehabilitation training system, so as to extend the language learning time of hearing-impaired children and provide them with an interesting learning environment.

With hearing-impaired children as the object, using gamification, interesting expression, combined with computer programming technology to achieve the training mode of human-computer interaction. In the software design, local cultural content can be added for creative arrangement, integrate all the pronunciation and mouth forms of Mandarin and local dialects, and support the mouth and sign language input of customized sentences and local languages, which is easy to use. On the hardware, Based on the APP using LCD screen display, sensor technology, image rendering technology and other development of supporting smart handle, glasses and head display and other intelligent hardware devices, Combining computer programming, VR / AR and motion capture, Connect with mobile apps via Bluetooth or wireless, More accurate, concise simulation of lips and sign language immersive teaching, Innovative adoption of real-time input technology, By automatically matching the continuous mouth movements of a real human or a virtual person, Real-time capture of the user's voice, sign language, lip movements and other images, Provide a fast and efficient interactive experience, To help the hearing-impaired people to read the content of the healthy listener in real time, Realize barrier-free communication. These intelligent equipment and applications are helpful to better help the hearing-impaired children to better carry out oral rehabilitation training, fill the gap in the field of

barrier-free communication software for the hearing-impaired in China, and innovate the teaching method of lip recognition.

6. Significance of the Development of Intelligent Training Equipment for Hearing-impaired Children

6.1. Theoretical significance

Based on the design of deaf children speaking training product development research is deaf education problems in the field of design and computer professional deep extension, it to the modern deaf education system building “theory and practice” integration of ecological innovation, promote “interdisciplinary” “special education and science and technology integration” the transformation of the theoretical problems, has guiding significance.

6.2. Practical significance

Based on the design of deaf children oral training product development, in more digital, intelligent technology, with the expression of gaming, fun, lip recognition digital technology to achieve human-computer interaction training, can help deaf children fast learning lips, realize the real lip interaction, will fill the blank of deaf education in our country, change the way of oral learning.

Conflicts of Interest

The authors declare that there is no conflict of interest regarding the publication of this article.

Funding

This work was supported by Hezhou University 2024 National University Students Innovation and Entrepreneurship Training Program Project (Project Number: 202411838047).

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