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THE ROLE OF TECHNOLOGY IN TEACHING INSTRUMENTAL PHONETICS

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Instrumental phonetics involves the use of technology to analyze and measure the physical properties of speech sounds, including articulation, acoustics, and auditory perception. With advancements in technology, teaching phonetics has evolved from traditional methods to more interactive and engaging techniques that leverage digital tools. These tools enable learners to analyze speech in real-time, visualizing sound waves, formants, and articulatory movements, making abstract concepts more concrete and easier to understand. This paper investigates the role of these technologies in phonetics education, analyzing how they enhance the learning experience and the challenges they introduce.

This study employed a mixed-method approach, combining qualitative and quantitative data collection techniques. Surveys were conducted among phonetics instructors to gauge their perspectives on the integration of technology in teaching. Additionally, a case study was carried out in which a group of students used phonetics software in a controlled classroom environment. Data were gathered through observations, student feedback, and performance assessments. The research focused on identifying how effectively technology enhanced students' understanding of key phonetic concepts, particularly in areas like articulation and acoustic analysis. The role of technology in the teaching of Instrumental phonetics is of great importance. In this area, modern technologies are used in the analysis, study and education of speech sounds using various tools. The following will consider the main roles of technology in this process:

1. Acoustic analysis tools:

Acoustic analysis tools are of great importance in the study and analysis of the characteristics of sound. With the help of modern technologies, it is possible to accurately and fully study the acoustic properties of sounds. For example, applications such as Praat are widely used for phonetic analysis. These tools can perform the following functions:

Phoneme measurement: the program measures and analyzes various elements of sound, including phonemes. It is one of the important possibilities used in the fields of linguistics and phonetics.

Spectrogram visualization: spectrograms display sound waves in a visual form, helping to track how sound frequency and amplitude change over time. It is used in the study of such properties of sound as volume, sound spectrum.

Sound Wave analysis: using acoustic tools, the effects of sound waves on how they arise, their changes and other sounds are studied.

Praat the program is widely used in linguistics, sound engineering and other scientific fields. However, it is also useful for improving sound quality, analyzing pronunciation, or studying music.

2. Speech synthesis and familiar programs:

Speech synthesis technologies, including text-to-speech (TTS) systems, can be very useful for students to practice pronunciation. With these technologies, students can develop their phonetic abilities by hearing the correct pronunciation and repeating it.

Speech Synthesis Technologies

Text to speech conversion (TTS): this technology automatically converts text to speech. TTS systems often sound natural and offer a variety of sound and accent options. For example, services like Google TTS and Amazon Polly.

Voice manuals: speech synthesis technologies are also used in applications such as voice assistants, such as Google Assistant or Amazon Alexa. These programs help users gain information through voice commands and communicate interactively.

Teaching programs: there are programs for students that are used alongside TTS for use in the development of pronunciation and language skills. For example, language learning apps like Duolingo and Rosetta Stone can help students learn the correct pronunciation.

Reading and writing manuals: speech synthesis technologies can be used to read texts to help students improve their reading skills. Hearing pronunciation in the reading process helps students learn how to pronounce words correctly.

Benefits

- Pronunciation Development: Students will be able to improve their pronunciation by hearing the correct pronunciation and repeating them.
- Simplify language learning: TTS technologies make the language learning process more interesting and interactive.
- Improving reading skills: students have the opportunity to correctly understand the text by hearing pronunciation during the reading process.

In general, speech synthesis technologies play an important role in education and help students develop their pronunciation and phonetic abilities.

3. Electronic dictionaries and pronunciation training programs:

Many online dictionaries and training platforms also have visual instructions along with the pronunciation of each word. This makes it easier for students to master the correct pronunciation.

Electronic dictionaries and pronunciation training programs are very useful tools in the educational process. These platforms often provide voice examples to listen to the pronunciation of each word, which helps students learn the correct pronunciation. On the other hand, visual cues, such as the writing of a word, presented through images and animations, help readers better understand the meanings of words.

With these technologies, students can be more effective at improving pronunciation, learning new words, and developing language skills. Since electronic dictionaries and pronunciation programs can be used anywhere and at any time, they allow students to learn with their own tempo. It also makes learning through interactive elements and games more fun and effective.

4. Machine learning and artificial intelligence:

Pronunciation errors can be detected and corrected using artificial intelligence. These technologies provide students with analytical information on how to identify shortcomings in their speech and how to correct them.

5. Visualization and real-time analysis:

The ability to visually see the phonetic aspects of speech in Real time can help students better understand pronunciation. Through this type of technology, the reader can compare sounds with his actual pronunciation and make immediate adjustments.

6. Virtual and augmented reality (VR/AR):

Teaching phonetics with VR and AR technologies becomes an interactive and lively experience. Through these technologies, students are more actively involved in the process of learning and pronouncing sounds.

In general, technology facilitates the study of instrumental phonetics, providing a more efficient and interactive educational process.

The findings suggest that technology plays a critical role in modern phonetics education, providing both instructors and students with powerful tools for analyzing speech. However, the successful implementation of these tools depends on proper

training and resources. Some educators reported difficulties in using the software, indicating the need for more comprehensive instructor training programs. Additionally, while technology enhances learning for most students, it may create barriers for those without access to digital devices or internet connections.

Conclusions

Technology has significantly improved the teaching of instrumental phonetics by making complex acoustic and articulatory processes more accessible to students. However, to fully harness its potential, educators must be adequately trained, and institutions should ensure equitable access to technological resources. Future studies should explore the long-term impact of technology on students' phonetic proficiency and investigate ways to integrate new advancements, such as artificial intelligence, into phonetic education. Moreover, educators should aim to strike a balance between traditional teaching methods and technological tools to cater to diverse learning preferences.

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