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THE PHONETICS LABORATORY: MODERN TECHNOLOGICAL RESOURCES FOR TEACHING AND RESEARCH

ANNOTATION

Today, the interest in learning a foreign language is increasing day by day, but due to the fact that the attention to teaching the pronunciation of a foreign language is relatively weak compared to the teaching of other skills of the language, the shortcomings and mistakes in the pronunciation of a foreign language can be observed in almost all language learners. This article is aimed at developing the phonological competence of students by creating automated phonetic laboratories based on the principles of instrumental and experimental phonetics at higher educational institutions specializing in foreign languages. The main reason for this is the biological, physiological, neurological and linguistic psychological factors in languages learning. On the basis of the mentioned factors, acquiring the skills of correct pronunciation in a foreign language leads to the formation of linguistic and psychological characteristics such as a sense of self-confidence, the ability to be an active listener, an active speaker, and an active speech carrier. And on the contrary, the fact that the ability to read, hear, speak and listen in a foreign language decreases in people who do not have the correct pronunciation in a foreign language determines the importance and relevance of the research. Taking into account these factors,

FONETIKA LABORATORIYASI: O‘QUV VA ILMIY TADQIQOTLAR UCHUN ZAMONAVIY TEXNOLOGIK RESURSLAR

ANNOTATSIYA

Chet tilini o‘rganishga bo‘lgan e’tibor va qiziqishning tobora ortib borayotgani ta’limda ijobiy burilish sifatida baholanmoqda. Bu jarayonda til o‘rganuvchilardan har qanday tilning to‘rtta ko‘nikmasini mukammal egallash talab etiladi. Xorijiy tildagi so‘zlarni to‘g‘ri talaffuz qilish me’yorlari va tartiblarini tilshunoslikning asosiy yo‘nalishlaridan biri hisoblangan fonetika fani kengroq o‘rgatadi.

Bugungi kunda xorijiy tillar bo‘yicha mutaxassislar tayyorlovchi oliy ta’lim muassasalarida instrumental va eksperimental fonetika tamoyillariga asoslangan avtomatlashtirilgan fonetik laboratoriyalarni yaratish orqali talabalarning fonologik kompetentsiyasini rivojlantirish masalalariga alohida e’tibor qaratilgan. Bunga asosiy sabab til o‘rganishdagi biologik, fiziologik, nevrologik va lingvopsixologik omillardir. Qayd etilganlar asosida chet tilida to‘g‘ri talaffuz qilish ko‘nikmalariga ega bo‘lish insonlarda o‘ziga ishonch hissi, faol tinglovchi, faol so‘zlovchi va faol nutq tashuvchisi bo‘la olish kabi lingvopsixologik xususiyatlarni shakllanib borishiga sabab bo‘ladi. Va aksincha, chet tilida to‘g‘ri talaffuzga ega bo‘lmagan shaxslarda biror bir tilda o‘qish, eshitish, gapirish va tinglash qobiliyatlarining susayishiga olib kelishi mumkin. Aynan mana shu omillarni hisobga olgan holda, talabalarning talaf-

the development of automated methodical support aimed at developing students' pronunciation will be a practical help to all language learners to correct their pronunciation deficiencies and will create ample opportunities for them to work as an active layer in the international arena and in the scientific, socio-economic and cultural life.

The main technology of the automated phonetic laboratory is cross-platform software integrated with phonetic equipment. This cross-platform program provides phonemes, syllables, accents, words, word combinations, phrases, and texts for different levels of a foreign language. Each given word, word combination and phrase, as well as the correctly pronounced form of texts, are entered, and students can check and improve their foreign language pronunciation skills through this cross-platform program. The cross-platform program serves as a useful resource not only for philological students and teachers but also for specialists in other fields.

Key words: phonetics, phonetics laboratory, experimental phonetics, electropalatography (EPG), linguagraph.

fuzlarini rivojlantirishga qaratilgan avtomatlashtirilgan metodik ta'minotning ishlab chiqilishi barcha til o'rganuvchilar talaffuzidagi kamchiliklarni bartaraf etishga amaliy ko'mak bo'ladi hamda ularning xalqaro maydonda va mamlakatimizning ilmiy, ijtimoiy-iqtisodiy va madaniy hayotida peshqadam qatlam sifatida faoliyat olib borishlariga keng imkoniyatlar yaratadi.

Avtomatlashtirilgan fonetik laboratoriyaning asosiy texnologiyasi fonetik uskunalarga biriktirilgan kross-platforma dasturi hisoblanadi. Mazkur kross-platforma dasturida xorijiy tilning turli darajalariga oid fonema, bo'g'in, urg'u, so'z, so'z birikmasi va ibora, matnlar beriladi. Har bir berilgan so'z, so'z birikmasi va ibora, gap hamda matnlarning to'g'ri talaffuz qilingan shakli kiritiladi va talabalar aynan shu kross-platforma dasturi orqali xorijiy til talaffuz ko'nikmalarini tekshirishlari va takomillashtirib borishlari mumkin bo'ladi. Kross-platforma dasturi nafaqat filologik yo'nalishdagi talabalar va o'qituvchilar, balki boshqa soha mutaxassislari uchun ham foydali manba bo'lib xizmat qiladi.

Kalit so'zlar: fonetika, fonetik laboratoriya, eksperimental fonetika, elektropalatografiya (EPG), elektroglotografiya (EGG), lingvograf.

INTRODUCTION

Through this skill, each of us, as individuals develops, creates and builds our reality to interrelate and establish psychological, social, cultural, and ideological bonds. Through language, humanity has built science, created myth and literature, and established harmonious societies. Our image as humans is partly given to us through the ability to communicate with each other through our own signs, essentially oral.

Linguistic orality has been the fundamental motivation for the scope and development of the phonetic sciences, the object of study which is the processes of production and perception of the human voice in the construction of articulated sound constitutes the great field of phonetics. Its vast field of study obliges those interested in the area to maintain active theoretical and practical relationships with innumerable scientific disciplines that it uses to explain its tasks; similarly, it has become a co-discipline and auxiliary science of various branches of knowledge, helping in the description and support of human sound phenomena. Its multidisciplinary character is undeniable.

One of the sciences that has benefited most from the phonetic area is, without a doubt, linguistics. In fact, it has become thanks to the method of analysis of studies on the phonic elements of languages that linguistics has reached the level that metrology demands of it during most of its history. Currently, instruments such as visualization systems for nervous phenomena, by magnetic resonance, for example, are revolutionizing linguistic studies. The pre-scientific philological schools, the Port Royal Grammar, the Historical Grammar, and the Comparative Grammar, developed their studies based on the phonic material of

the analyzed languages. The foregoing is briefly demonstrated with some studies from the end of the 19th century and the beginning of the 20th century, cataloged as precursors of a linguistic methodology, properly scientific, among which are the comparative works of the Polish Baudoin de Courtenay on the Indo-European and the Sanskrit, the studies on the phonetic modifications of Cellefroin's patois, carried out by the French Pierre de Rousselot, and the thesis of the Swiss Ferdinand de Saussure on the primitive system of vowels in Indo-European languages [Arleta A., 2001].

The incursion of phonetic studies in the field of natural sciences, through the use of acoustic physics instruments, in order to obtain quantifications on the physical characteristics of sound for studies in the therapeutic area, whose result was the advent of experimental phonetics at the end of the 19th century motivated some linguists to embark on the path of verifying hypotheses through acoustic and mathematical data on real speech sound samples. Thus, from the implementation of the visible speech method, in the middle of the 20th century, phonetics, as part of contemporary linguistic models, has become an auxiliary, necessary, and indispensable scientific branch in the study of any language and its areas of application.

The comprehensive understanding of the human phonic phenomenon, whether its physio-articulatory aspect or the acoustic bases that enable the understanding of the voice as a sound wave, will thus become the basic foundation for efficient pedagogical performance. The task of phonetics as a didactic instrument of the teaching exercise in linguistics, through audiovisual practice in the laboratory of experimental phonetics is almost obvious. However, despite the great technological advance and its increasingly easy paths of computerized accessibility, the laboratory of experimental phonetics is seen as a strange element within the departments of linguistics and those of modern languages of our university centers.

Perhaps this is due, in part, to the eternal split between the human sciences and the natural sciences, which leads to considering the former as theoretical sciences and the latter as experimental sciences. Since linguistic phonetics is a meeting point between them, linguists are inclined only to the formal and speculative parts, relegating the experimental character that linguistics can have at any level of analysis. The vast majority of linguistic studies in our environment lack a statistical treatment of the data and acoustic-type approaches, leaving the conclusions as impressionistic assessments of theoretical experts.

Similarly, in our environment, applied linguistics and language teaching have been far from acoustic work on speech and voice. Several years of experience seem to be required in the teaching-research area in the Laboratory of Experimental Phonetics.

If there were a linguistics and phonetics laboratory in each faculty of our university environment where languages are studied, perhaps the teaching and research quality in the linguistic area (including clinical linguistics) would exceed expectations of academic production and would result in better investigative and pedagogical exercise of national and foreign languages. The lack of training and permanent updating of the personnel in charge of the existing laboratories and the lack of economic resources for the design and achievement of the necessary infrastructure have diminished the interest in the subject and its practical application in the areas in question.

Work on this problem has already been carried out for the National University of Colombia. Not each of the tools mentioned will be described in detail. On the other hand, it is

about bringing the linguistics and languages teachers closer to knowing, implementing, and using modern analysis techniques in their explanations, which enables for supporting some aspects of speech in a more precise and verifiable way. At the same time, presenting some information on some of the uses of a phonetics laboratory in our faculties will enable us to give clues about the importance of having this tool for didactic, investigative, and service use.

LITERATURE REVIEW

Speech is the result of a highly complex and versatile system of coordinated muscular movements, and while perceptual assessment is useful, instrumental observation can provide significant benefits. Phonetic instruments are of great importance in observing speech as well as in treating and diagnosing speech disorders. In particular, the use of palatal support appliances in the management of hypernasal speech gave a result in speech therapy as seen in G.Manley, V. Johnson and V. Sharpe's research study [Manley G., Johnson V., Sharpe P., 2013]. They applied this research to a patient who was attending the Royal Hospital for Neurodisability, Putney, London, with a history of a stroke and was referred to the hospital dental department by Speech and Language Therapy. The young lady in question was 33 years old and had suffered a stroke one year before being admitted to the hospital. She had moderate generalized dysarthria with decreased speech clarity and volume. Snores system, palatal support appliance and acoustic recording microphones were used to measure airflow, provide a numerical score of perceived nasality and an assessment of speech intelligibility using automated speech recognition. A range of standard words was used, including some with predominantly oral components (e.g., cheese), which result in low nasal airflow, and others with a contrast of more plosive and nasal components (e.g., smoke), which result in higher nasal airflow. The results showed that 3 out of 10 words on the word list could be recognized without the palatal lift, and the average intelligibility rating was 27%. Word recognition increased to 8 out of 10 words and average intelligibility to 49% when the palatal lift was employed. With the palatal lift in place, the Nasality Microphone results likewise indicated a 54% decrease in perceived nasality.

Rosario Dominguez-Camara and W. Stephen discussed using the SNORES+ system for speech therapy and adding a new criterion for comprehending speech disorders [Dominguez-Camara R., Stephen W., 2002]. One of the main tools for speech therapy is multi-parametric assessment, which enables an objective assessment of the coordination and function of the main articulators used in speech production. Multiple speech evaluation methods are included in the SNORES+ unit's single program. With the use of hardware and software, clinicians and patients may easily measure five essential speech characteristics at once: respiration, larynx excitation, velo-pharyngeal closure, tongue-palate contact, and speech outcome. Clinically developed, user-friendly equipment called the SNORES+ system was created to measure the articulators as speech is being produced. The workstation enables the objective study of speech production, simultaneous multi-parameter assessment, and biofeedback from the articulators. With the ability to objectively measure the function and coordination of important articulators, SNORES+ has proven to be a highly

effective treatment unit in the assessment and therapy of many speech disorders. It offers visual feedback, which helps with therapy and is incredibly inspiring for both the therapist and the patient.

Steve Kelly, Alison Main, Graham Manley and Calum McLean [Kelly S., Main A., Manley G., McLean C., 2000] used Lingua-graph and electro-palotography in the treatment of speech disorders and acquired dysarthria. The electro-palatography therapy was considerably more effective in improving tongue/palate contact than other treatments, according to the objective measure (electropalatography), which was more sensitive to subtle alterations (related t-test: $t = 2.72$, $df = 23$, p 0.01). According to a survey on "attitudes toward communication", 79% of respondents said therapy had improved their confidence in their ability to communicate. In general, those who had electropalatography therapy first fared better than those who first received conventional therapy. Since electropalatography may detect even minute changes in performance, it offers biofeedback and unmistakable proof of progress. The majority of individuals regarded this to be very motivating, which may have had an impact on how they felt about therapy in general. Electro palatography amply demonstrates the complexity of speech and the need for precise articulation. Early treatment planning that used this knowledge may have made it simpler to work on the more generic components of speech and increased the total benefits. The enhanced articulatory patterns created by electropalatography therapy may offer a more solid foundation for further treatment. As a result, the benefits of electropalatography therapy may persist during the subsequent conventional therapy.

Shannon Mauszycki, Sandra Wright, Nicole Dingus and Julie Wambaugh [Mauszycki S., Wright S., Dingus N., Wambaugh L., 2016] conducted a study to investigate the effect of articulatory-kinematic treatment combined with electropalatography (EPG) visual biofeedback (VBFB) on articulation accuracy for acquired apraxia of speech. As a result of their study, participants showed improvements in articulatory accuracy for the majority of treated speech sounds. In addition, most trained speech sounds are generalized to untreated phrases. In both trained and untrained stimuli, two participants had better long-term maintenance of treated speech sounds.

Creating a phonetic laboratory: issues and solutions.

Today, the interest in learning a foreign language is growing, but due to the fact that the emphasis on learning a foreign language is much slower than teaching other language skills, the shortcomings and mistakes in the pronunciation of a foreign language are almost non-existent. At the same time, it is necessary to emphasize the possibility of developing students' phonological competence through the creation of automated phonetic laboratories based on the principles of instrumental and experimental phonetics at higher educational institutions specializing in foreign languages.

Admittedly, phonetic laboratories do not operate at higher educational institutions in Uzbekistan today. That is, students have no idea about instrumental and experimental phonetics. It is this internship that is an important aspect of a language

for students majoring in philology from the first days of the school day to the end. After all, the first indicator of a person speaking any foreign language is determined by its pronunciation. This problem needs to be addressed at the state level to improve the pronunciation of both national and foreign languages. Unfortunately, during the four years of study, students are not familiar with any phonetic instrument. That is why only one hundred percent of scientific researches is devoted to phonetics.

There is a need for a phonetic laboratory in the creation of cross-platform programs, including practical exercises for the development of pronunciation in Uzbek, English, German, French, and Spanish. The practical significance of the phonetic laboratory is that at all levels of knowledge of a foreign language, existing deficiencies in pronunciation and interference phenomena are eliminated through various practical exercises. The main reasons for this are biological, physiological, neurological, and lingo-psychological factors in language learning.

Taking into account these factors, the development of methodological support for the development of students' pronunciation will help all language learners to correct their pronunciation deficiencies and create opportunities for them to act as an active layer in the international arena and socio-economic and cultural life of our country.

The first Laboratory Phonology Conference was held in 1987 at Ohio State University, and the ninth conference was held at the University of Illinois, Urbana-Champaign, in the summer of 2004.The proceedings from the first seven meetings have been published, and the publication of those from the eighth is imminent [Kingston J., 2006; 295]**.**

In recent years, researchers' interest in the linguistic aspects of human speech has enabled them to strengthen the empirical basis of their research work using specific methods in areas such as phonetics, sociolinguistics, and psycholinguistics based on traditional research. This integrated and dynamic approach has led to effective collaboration between research areas. Much of modern research is done in phonetic laboratories using integrated methods. Today, phonetic laboratories operate in many developed countries around the world.

In particular, Harvard University's Phonetics Lab is equipped with the Kay Computer Speech Lab (CSL), which is used for textbook analysis and speech analysis in courses. Using CSL, it is possible to create pitch tracks, spectrograms, and spectra to test hypotheses and experiments. Students try to understand the monophthong and diphthong qualities of vowel sounds through special equipment. They analyze the acoustic aspects of the languages they are learning.

The department has portable digital audio for data collection, which is used through a noise-reducing microphone. There is also a Polaroid Macro 5 camera that deals with palatography and is specifically used by law enforcement and in the preparation of other legal and medical documents. The windows in the camera show the articulatory state of the tongue in the palate. Students use this camera to study similar sliders, as well as some phonemes in the language.

The phonetics lab has a variety of computer resources to help teach phonetics.

A database of world language sounds, as well as computer files from Ladefoged's Phonetics Course, will also serve all students. There are also several CD-ROMs with audio data showing phonetic differences and allophones.

The Oxford Phonetics Laboratory was established in 1980 as an independent department of the university. In 2008, the Laboratory became one of the departments of the Faculty of Linguistics, Philology, and Phonetics. The experimental field consists of two small recording studios, a physiology laboratory, and a speech processing laboratory. Laboratory resources are mainly used by students and researchers in the departments of linguistics, philology, and phonetics. Physiological research equipment includes electroglotography, labial electromyography, airflow measurement, and anatomical models.

The recording studio includes two small studios with high-quality microphones and digital recordings. In addition to creating excellent conditions for research in speech physiology and acoustics, the laboratory also has a computing infrastructure. Like Linux and Windows / Netveya computer networks, there are many programs that focus on speech analysis and synthesis.

The Phonetics Laboratory of Stockholm University is located in the Department of Linguistics. The phonetics laboratory has a lot of special equipment for phonetic experiments: Electromagnetic arthrography (EMA) is an electromagnetic tracking system that records articulatory movements. Electropalatography: shows the state of the tongue and hard palate during speech. Videotrack: A two-dimensional electromagnetic system specially designed by Stockholm University engineers to measure articulatory motion [Joseph P., Cohen M., Mario A., Melanie L., 1993; 3080].

Russia, Phonetics Laboratory of the Department of Linguistics and Translation of MDLU was established in 1985. The phonetics laboratory serves the teaching and research needs of undergraduates and graduates (master, candidate of philological sciences and doctoral). The main research areas of the laboratory include phonetics and typology of sounds, sound changes in Russian and phonetic features in the acquisition of a second language.

The phonetic laboratory focuses on the following scientific problems based on the phonetic competence specified in the qualification requirements for graduates of philology in the teaching of foreign languages:

■ to be able to clearly pronounce all the sounds of a foreign language, to put words and accents correctly, to distinguish intonation patterns in communicative situations;

■ to practice the use of language sounds in speech, along with the development of speaking skills; correct use of rhythm and intonation in communicative situations in accordance with the communicative types of speech (verb, interrogative, command sentence);

■ to work on clear pronunciation of words, and phrases; use of rhythm and intonation;

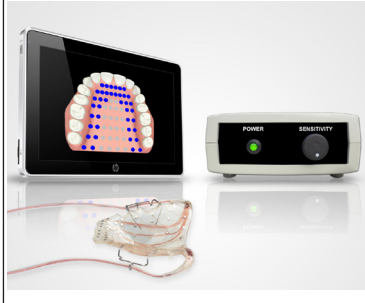
■ divide the sentence into meaningful parts; distinguish the main variants of a foreign language;

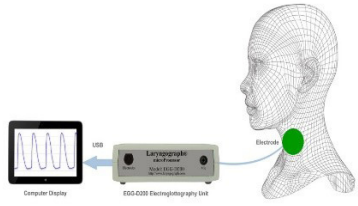
■ be able to use accents and intonation correctly.

The high demand and need for a phonetic laboratory can be determined based on the problems and shortcomings identified. This is because the laboratory, which will be put into practice in the future, can serve as a universal tool for all foreign languages and the Uzbek language learners.

The phonetic instruments which are used in the laboratory are shown and described in the following table (Figure 1).

Figure 1. *The phonetic instrumentations*

Electropalatography (EPG)		Electronic linguistic palatography The EPG system keeps track of when the tongue makes contact with the hard palate during speaking. Direct articulation can be studied or improved using electropalatography, which shows direct articulation. Using a specialized artificial palate with 62 electrodes put on the surface of the tongue, electropalatography can determine the relationship between the tongue and the palate. The user receives a little electrical signal that travels to the electrodes through the tongue. On the computer screen, examples of tongue and palate contact are consequently shown.
Kay computer speech lab (CSL)		Installed personal computer. It is used to analyze and teach speech in lessons and courses. With CSL, pitch tracks, spectrograms, and spectra can be generated to test hypotheses and conduct experiments. In this phonetics laboratory, students of Harvard University's phonetics courses regularly carry out projects describing the sound system of an unfamiliar language. Students also measure vowel patterns in their pronunciation. The tool is especially useful for understanding the monophthongal and diphthongal qualities of some vowels in English and other languages.
Polaroid Macro 5 Camera		Polaroid Macro 5 Camera. To document lingual articulation on the palate, the camera is utilized in conjunction with dental mirrors. Before speaking, the speaker coats his or her tongue with an emulsion of charcoal and olive oil to produce images.

Electroglottography (EGG)		By detecting the electrical conductivity between two electrodes positioned on the neck on either side of the thyroid gland, electroglottography (EGG) is a non-invasive method of measuring the vibration of the vocal folds. The portable electroglottography equipment EGG-D200 offers both qualitative and quantitative data regarding vocal fold vibrations. The electrical conductivity between two electrodes put on the neck is detected by the device.
PG20 and PG60 Portable system for measuring subglottal system		The energy required to produce the human voice during speech is provided by the air pressure in the lungs, also known as subglottal pressure. Understanding the laryngeal sound source's subglottal pressure is crucial to comprehend how the voice functions. The PG20 and PG60 are portable, battery-powered devices that estimate subglottal pressure in realtime as speech is being produced.
Oral/Nasal airflow		Measures oral airflow and detects apneas and hypopneas.

'Electroglottography' (EGG) and 'photoglottography' (PGG) are two other means of measuring the position of the folds and the state of the glottis. In EGG, two electrodes are placed on either side of the thyroid cartilage at the height of the glottis, and a weak current is passed between them. As the folds move apart or together, opening or closing the glottis, resistance to this current's flow increases or decreases. In PGG, a light source is placed above or below the glottis, and a phototransducer is placed on the other side. As the folds move apart or together, the amount of light passing through the glottis and falling on the transducer waxes and wanes [Kingston J., 2006; 279].

EGG and PGG only accurately depict the moments of fold contact and peak glottal opening. By permitting the folds' cross-section to be imaged, ultrasound laryngography

has shown how vibration propagates from the lower to the upper edge of the folds. The limitations of all these techniques apply only to the vocal folds in vivo. Larynges excised from dogs have been used extensively to study the nature of vocal fold movement during vibration [Moore and Berke, 1988; Perlman and Titze, 1988; Titze et al., 1997].

The 'X-ray microbeam' was built to replace cineradiography [Nadler et al., 1987]. This method uses gold pellets that have been adhered to the articulators as targets for a very narrow beam of extremely high-energy X-rays. As a result of the beam's narrowness and energy, the radiation dose received during a 10-minute recording session (48 mRad) is barely higher than the dose received during a standard full-mouth dental X-ray examination (10 to 30 mRad).

Ultrasound images are constructed from the time delay between the sound's emission and the return of its echo from a boundary, e.g., between the flesh and air at the tongue surface [Stone et al., 1988, 1992; Stone & Lundberg, 1996].

CONCLUSION

It must be acknowledged that none of the higher educational institutions, state educational agencies, or non-state educational organizations now employ methods for investigating the sound matter in their phonetic laboratories. Specialized subjects within one field are addressed in modern education, particularly Experimental Phonetics within Theoretical Phonetics. To what extent, however, students in the philology field may engage with instrumental and experimental phonetics highlights the significance of theoretical phonetics. After all, a person's pronunciation is the first clue that they are speaking a foreign language. This is the main reason why phonetics receives only 1% of all scientific research funding.

Based on the mentioned issues, it is possible to determine the high demand and necessity for phonetic laboratories, because the laboratory, which will likely be used in the future, can be a useful resource for all students of the Uzbek and foreign languages.

Note:

1. The essay written by Perry (1996). In this, its author exposes the problem of teaching and the applicability of phonetics in the human sciences, its current status in Colombia and justifies and proposes the outline of a Phonetics Laboratory. The theme presented summarizes the aspects discussed in a talk given to professors and students of the Linguistics Department of the National University of Colombia, in August 1995.

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