



**ТЕОРІЯ І МЕТОДИКА ПРОФЕСІЙНОЇ ОСВІТИ**

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**Teaching Pronunciation to ESP Students  
and Assessing Their Phonological Competence**

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***Abstract.** The relevance of the study is determined by the need to develop engineering students' phonological competence as an essential component of professional communicative competence in ESP instruction. In academic and professional communication, pronunciation difficulties may reduce intelligibility, affect the perception of technical terminology, and create obstacles during presentations, discussions, teamwork, and international academic interaction. **The purpose of the study** is to explore effective approaches to teaching and assessing pronunciation in ESP courses for engineering students, with particular attention to intelligibility, phonemic awareness, prosody, terminology pronunciation, native language interference, and the pedagogical potential of AI-assisted learning tools. **The research methods** include the analysis of recent scientific literature, comparative analysis of pronunciation teaching approaches, synthesis and generalization of methodological findings, and classroom observations conducted*



during ESP teaching practice at a technical university. **The results** of the study demonstrate that pronunciation instruction should be integrated systematically into ESP learning rather than limited to occasional correction or listening activities. Effective pronunciation training may gradually progress from individual sounds and terminology practice to phrase-level activities, sentence production, and professional oral communication tasks. The article identifies typical pronunciation difficulties faced by engineering students, including the distinction between vowel sounds and diphthongs, stress placement, clear articulation of final consonants, and the production of sounds absent in the native language. The findings also indicate that phonetic transcription may support the development of phonemic awareness, while AI-assisted learning tools and speech recognition technologies may create additional opportunities for autonomous practice, immediate feedback, and self-assessment. **The conclusions** indicate that pronunciation assessment in ESP instruction should primarily take into account speech intelligibility, prosody, accuracy of terminology pronunciation, and effectiveness of professional communication rather than closeness to native-like pronunciation.

**Keywords:** pronunciation instruction; phonological competence; intelligibility; phonemic awareness; prosody; AI-assisted ESP learning.

## Навчання англійської вимови студентів ESP та оцінювання фонологічної компетентності

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**Анотація:** Актуальність дослідження зумовлена потребою в розвитку фонологічної компетентності студентів інженерних спеціальностей як важливого складника їхньої професійної комунікативної компетентності. В академічному й професійному спілкуванні недоліки вимови можуть ускладнювати розуміння усного мовлення, сприйняття технічної термінології та знижувати ефективність усних презентацій, фахових обговорень, командної роботи й міжнародної академічної взаємодії. **Метою дослідження** є вивчення ефективних підходів до навчання й оцінювання вимови під час навчання англійської мови професійного спрямування студентів інженерних спеціальностей. Особливу увагу приділено зрозумілості мовлення, фонематичній усвідомленості, просодії, вимові термінології, впливу рідної мови, а також освітньому потенціалу засобів навчання на основі штучного інтелекту. **Методи дослідження** включають аналіз сучасної наукової літератури, порівняльний аналіз підходів до навчання вимови, синтез і узагальнення методичних положень, а також аналіз спостережень, здійснених під час викладання англійської мови професійного спрямування в технічному університеті. **Результати дослідження** свідчать, що навчання вимови не повинно обмежуватися епізодичним виправленням помилок або лише аудіюванням, а має систематично інтегруватися в процес ESP-навчання. Формування навичок вимови має здійснюватися поступово: від опрацювання окремих звуків і термінології до фразового мовлення, продукування речень і професійно орієнтованих усних комунікативних завдань. У статті визначено типові труднощі вимови студентів інженерних спеціальностей, зокрема розрізнення голосних звуків і дифтонгів, постановку наголосу, чітку вимову кінцевих приголосних, а також артикуляцію звуків, відсутніх у рідній мові. Результати також засвідчують, що фонетична транскрипція може сприяти розвитку фонематичної усвідомленості, тоді як засоби навчання на основі штучного інтелекту й технології розпізнавання



мовлення створюють додаткові можливості для автономної практики, миттєвого зворотного зв'язку та самооцінювання. У висновках обґрунтовано, що під час оцінювання вимови в процесі навчання англійської мови професійного спрямування доцільно враховувати насамперед зрозумілість усного мовлення, просодію, точність вимови термінології та ефективність професійної комунікації, а не наближеність вимови до мовлення носія мови.

**Ключові слова:** навчання вимови; фонологічна компетентність; зрозумілість мовлення; фонематична усвідомленість; просодія; навчання ESP за допомогою ШІ.

**Introduction.** In modern ESP instruction, the development of students' communicative competence is considered one of the key objectives of foreign language teaching. However, despite the increasing emphasis on communication skills in professional contexts, pronunciation instruction has often remained underestimated in ESP courses for engineering and technical students. In many cases, greater attention is traditionally paid to the development of reading, grammar, and professional vocabulary skills, whereas phonological competence receives considerably less systematic practice.

At the same time, effective professional communication in international academic and workplace environments requires not only knowledge of technical terminology, but also sufficient speech intelligibility and comprehensibility. Incorrect pronunciation of professional terms may lead to misunderstanding, communication difficulties, and reduced effectiveness of professional interaction. However, phonological competence is not limited to the accurate pronunciation of individual words. It also includes word stress, sentence stress, rhythm, intonation, and prosodic patterns that help speakers organize meaning, emphasize key information, and make oral communication clearer. This issue becomes particularly



important in engineering fields, including chemical technology and engineering, where many professional terms may differ in particular phonemes, syllables, stress patterns, or word endings.

Furthermore, ESP students frequently encounter difficulties related to the pronunciation of unfamiliar terminology, distinction between long and short vowels, diphthongs, word stress, and prosodic features of speech. Native language interference also considerably influences pronunciation accuracy and may contribute to the gradual fossilization of incorrect pronunciation habits if pronunciation difficulties are not addressed at the early stages of language learning.

For this reason, pronunciation instruction should be integrated systematically into ESP courses and should include not only listening activities, but also guided pronunciation practice aimed at developing students' phonemic awareness, speech intelligibility, and confidence in oral professional communication. Pronunciation training may gradually progress from individual sounds and terminology pronunciation to sentence-level practice and short professional speech production with appropriate stress, rhythm, and intonation patterns.

In addition, modern digital technologies and artificial intelligence tools create new opportunities for pronunciation practice and self-assessment. AI-assisted learning tools may support students in developing pronunciation accuracy by providing immediate speech recognition feedback and opportunities for repeated autonomous practice outside the classroom environment.

The importance of pronunciation proficiency is also reflected in internationally recognized language assessment systems, including the Common European Framework of Reference for Languages (CEFR) and IELTS Speaking Band Descriptors, where intelligibility, stress, rhythm, intonation, and comprehensibility constitute important criteria for evaluating oral communication skills. Although pronunciation inaccuracies may still be present at the B2 level, they generally have little or no effect on intelligibility and successful interaction.



Therefore, there is a growing need for effective ESP pronunciation teaching materials, assessment criteria, and methodological approaches specifically adapted to the professional communication needs of engineering students.

**Literature Review.** Current research on pronunciation instruction demonstrates a gradual shift from the idea of native-like pronunciation towards intelligibility, comprehensibility, and successful communication. This tendency is especially important for ESP learners, whose oral communication is connected with academic and professional contexts. Earlier works emphasized the general pedagogical value of pronunciation instruction and the role of stress, rhythm, intonation, and prosody in spoken communication [1, 2]. Seyedabadi, Fatemi and Pishghadam (2015) also argue that pronunciation influences not only speaking, but also listening, reading, and writing skills, which confirms its importance as an integral component of language competence [3].

Guskaroska et al. (2024) provide a comprehensive overview of recent and earlier research on pronunciation teaching and emphasize that contemporary pronunciation pedagogy has shifted from the traditional goal of achieving native-like pronunciation towards intelligibility and communicative success. The authors stress that pronunciation inaccuracies, particularly those related to vowel and consonant production, stress placement and prosody, may significantly reduce speech intelligibility. They also argue that explicit and systematic pronunciation instruction is necessary, since pronunciation development does not always occur automatically through communicative practice alone [4].

A significant contribution to modern pronunciation pedagogy has been made by studies focused on intelligibility, comprehensibility, and accentedness. Levis (2022) emphasizes that pronunciation teaching should not aim primarily at eliminating a foreign accent, but should help learners become understandable in real communication [5]. This approach corresponds to the CEFR Companion Volume, where phonological competence is described through overall phonological control,



sound articulation, and prosody. The CEFR Companion Volume (Council of Europe, 2020) views phonological competence as an important component of communicative competence and includes not only the accurate production of sounds, but also stress placement, rhythm, intonation, prosody, and other suprasegmental features that contribute to intelligibility and phonetic expressiveness. According to the CEFR phonological control descriptors, B1–B2 learners may still demonstrate the influence of another language in their speech; however, at B2 level, pronunciation, stress, and intonation generally support clear and effective communication. These descriptors are particularly relevant for ESP students, whose professional communication requires intelligible pronunciation, appropriate prosody, and accurate pronunciation of professional terminology [6].

Several studies emphasize that pronunciation instruction should not be limited to individual sounds or word pronunciation, but should also include suprasegmental features such as sentence stress, rhythm, intonation, and prosody, since these elements contribute to coherent speech, intelligibility, and effective oral communication [1, 6, 7]. This is especially relevant for ESP learners, who need to produce not only accurately pronounced professional terminology, but also coherent oral explanations, presentations, discussions, and reports with appropriate sentence stress, rhythm, and intonation.

Another important aspect of contemporary pronunciation instruction concerns the use of phonetic symbols and phonetic transcription. Mompean and Fouz-González (2021) emphasize the pedagogical potential of phonetic notation for developing phonemic awareness, distinguishing sound contrasts, and understanding the relationship between spelling and pronunciation [8]. Trinh et al. (2022) demonstrates that explicit instruction in the International Phonetic Alphabet improved adult EFL learners' pronunciation performance and was positively evaluated by the participants [9]. A practical pronunciation-oriented approach is also reflected in Underhill's work on the phonemic chart, where phonetic symbols are



used as a visual tool for developing pronunciation awareness and sound production [10]. These ideas are relevant to ESP instruction, where students often work with unfamiliar professional terminology whose pronunciation cannot always be predicted from spelling.

Research also shows that pronunciation instruction remains relevant in ESP contexts. Quesada Vázquez and Romero (2020) describe a ten-week pronunciation module integrated into a university technical English course for engineering students and demonstrate that explicit pronunciation instruction may significantly improve learners' English prosody [7]. This is particularly important for ESP learners who need to use appropriate stress, rhythm, and intelligible pronunciation in academic and professional communication.

The problem of pronunciation fossilization has also received considerable attention in second language acquisition research, since pronunciation inaccuracies may gradually become stable and resistant to correction if they are not noticed or addressed systematically. The concept of fossilization was introduced by Selinker (1972) in his theory of interlanguage, where persistent language errors were described as a natural phenomenon of second language development [11]. Later, Han (2013) further developed the fossilization hypothesis and emphasized that fossilized pronunciation patterns may remain even at relatively advanced stages of language learning without focused instruction and corrective practice [12]. More recent pronunciation research demonstrates that fossilized segmental features may be improved through systematic perception and production training. For example, Fouz-González (2019) showed that podcast-based pronunciation practice involving perception, production, and peer evaluation tasks may contribute to improving learners' pronunciation of segmental features that tend to become fossilized in interlanguage [13]. Ukrainian researchers also emphasize the importance of phonetic and phonological competence in foreign language education. Stetsko and Nychko (2022) analyse the formation of the English phonetic aspect as a communicative-



linguistic subcompetence and emphasize the importance of systematic work with pronunciation difficulties and timely correction of already formed pronunciation habits [14]. Mochalova (2023) similarly stresses the importance of timely correction and systematic pronunciation practice in online phonetics instruction [15]. Halahan, Bezuhla and Leshchinska (2023) also examine phonological fossilization in the process of English language acquisition and highlight the role of systematic pronunciation work in preventing stable pronunciation inaccuracies. These findings are particularly relevant for ESP teaching, where students frequently encounter difficulties related to professional terminology, sound contrasts, word stress, prosody, native language interference, and insufficient phonemic awareness.

Recent studies also examine digital and AI-assisted pronunciation learning. Dennis (2024) shows that AI-powered speech recognition technology may support pronunciation and speaking practice [17], while Amrate and Tsai (2025) emphasize that computer-assisted pronunciation training should pay more attention to suprasegmental features and global measures such as intelligibility and comprehensibility [18]. Lao-un and Khampusaen (2025) demonstrate the relevance of AI-mediated pronunciation applications for ESP learners [19]. These studies indicate that technology-supported pronunciation practice may be useful when combined with communicative, intelligibility-oriented tasks.

**Previously Unaddressed Aspects of the Problem.** Although pronunciation instruction, phonological competence, intelligibility, and AI-assisted language learning have been widely discussed in previous research, several aspects of pronunciation teaching in ESP engineering contexts still require further methodological clarification and practical adaptation. In particular, limited attention has been devoted to the integration of pronunciation instruction into ESP courses for technical and engineering students, the systematic teaching of professional terminology pronunciation, the development of phonemic awareness and prosodic



skills in professional communication, and the adaptation of CEFR phonological control descriptors to the communicative needs of ESP learners.

**Objectives of the Study.** The aim of this study is to identify and systematize effective approaches to teaching and assessing pronunciation in ESP courses, with particular attention to phonological competence, intelligibility, professional terminology, phonemic awareness, prosody, and the potential of AI-assisted pronunciation practice. To achieve this aim, the study analyses recent research on ESP pronunciation instruction, identifies typical pronunciation difficulties faced by engineering students, examines the relevance of CEFR phonological control descriptors and IELTS pronunciation criteria for assessment, and outlines a gradual approach to pronunciation practice supported by phonetic transcription and AI-assisted tools.

**Research Findings and Discussion.** Pronunciation instruction in ESP courses should not be treated as an isolated aspect of language learning limited only to listening activities or occasional pronunciation correction. Instead, phonological competence should be developed systematically as an integral component of students' communicative competence and professional language training.

The analysis of recent research and practical teaching experience demonstrates that engineering students frequently experience pronunciation difficulties connected with unfamiliar terminology, sound articulation, stress placement, rhythm, intonation, and the distinction between similar phonemes. Such difficulties are often intensified by native language interference and insufficient phonemic awareness. In academic and professional contexts, pronunciation inaccuracies may negatively influence speech intelligibility and professional interaction, especially during presentations, project discussions, teamwork, workplace communication, and international academic cooperation.

Classroom observations in ESP courses at a technical university also demonstrate the practical value of phonetic transcription as a supplementary



teaching tool. Regular pronunciation practice shows that phonetic symbols may help learners notice pronunciation contrasts that they often fail to distinguish by ear. Visual representation of sounds may support students in differentiating vowel contrasts, understanding the difference between spelling and pronunciation, and pronouncing technical terminology more accurately. Therefore, phonetic transcription should be viewed not as an isolated theoretical component, but as a practical tool for developing phonemic awareness and supporting more accurate pronunciation production.

One of the most common groups of pronunciation inaccuracies involves difficulties in distinguishing long and short vowels, diphthongs, and similar vowel contrasts. Students may confuse words such as *hit* /hɪt/ and *heat* /hi:t/, *science* /'saɪəns/ and *since* /sɪns/, or experience difficulties with words containing diphthongs and complex vowel combinations, including *period* /'piəriəd/ and *series* /'sɪəri:z/. Such inaccuracies may negatively affect speech intelligibility and listening comprehension.

Another common tendency involves the transfer of native-language pronunciation patterns to English technical terminology. Students frequently rely on spelling-based pronunciation and apply familiar pronunciation rules to English scientific and engineering vocabulary. As a result, words such as *engineering* /,endʒɪ'nɪərɪŋ/, *chemical* /'kemɪkəl/, *hydrogen* /'haɪdrədʒən/, *ion* /'aɪən/, *ceramics* /sə'ræmɪks/, *vehicle* /'vi:əkl/, *circuit* /'sɜ:kɪt/, *height* /haɪt/, *hydraulic* /haɪ'drɔ:lɪk/, and *pneumatic* /ŋju:'mæɪtɪk/ are often pronounced inaccurately. Similar difficulties may also occur in meaning-sensitive pairs such as *wind* /wɪnd/ and *wind* /waɪnd/, *lead* /li:d/ and *lead* /led/, *minute* /'mɪnɪt/ and *minute* /maɪ'nju:t/.

Some pronunciation inaccuracies may lead to lexical misunderstanding in technical and laboratory contexts. For example, *beaker* /'bi:kə(r)/ may be confused with *baker* /'beɪkə(r)/, *goggles* /'gɒɡlz/ with *Google* /'gu:gl/, and *lead* /led/ as a chemical element with *lead* /li:d/ as a verb. Similar confusion may occur between



*acidic* /ə'sɪdɪk/ and *acetic* /ə'si:tɪk/, or *silicon* /'sɪlɪkən/ and *silicone* /'sɪlɪkəʊn/. These examples show that pronunciation instruction in ESP should also aim to prevent lexical misunderstanding in professional communication.

Special attention should also be paid to stress placement, since stress may influence both grammatical meaning and intelligibility. Students frequently experience difficulties distinguishing noun–verb pairs such as *increase* /'ɪnkri:s/ and *increase* /ɪn'kri:s/, *conduct* /'kɒndʌkt/ and *conduct* /kən'dʌkt/, *project* /'prɒdʒekt/ and *project* /prə'dʒekt/, *graduate* /'grædʒuət/ and *graduate* /'grædʒueɪt/, *precipitate* /pri'sɪpɪtət/ and *precipitate* /pri'sɪpɪteɪt/, or *compound* /'kɒmpaʊnd/ and *compound* /kəm'paʊnd/. Learners may also confuse words that differ in pronunciation and grammatical function, such as *advice* /əd'vaɪs/ and *advise* /əd'vaɪz/, or *practice* /'præktɪs/ and *practise* /'præktɪz/. Incorrect stress placement or sound substitution may reduce speech comprehensibility and create misunderstandings in oral communication.

Another important group of pronunciation inaccuracies concerns final consonants, suffixes, and endings in chemical terminology. In professional communication, incorrect pronunciation or insufficient perception of endings may completely change the meaning of a term. Students may confuse words such as *chlorine* /'klɔ:ri:n/ and *chloride* /'klɔ:raɪd/, *chloride* /'klɔ:raɪd/ and *chlorate* /'klɔ:reɪt/, or *bromide* /'brəʊmaɪd/ and *bromate* /'brəʊmeɪt/. Such examples demonstrate the importance of developing learners' ability to distinguish semantically significant sound contrasts and final syllables in scientific terminology.

Students may also experience difficulties pronouncing sounds absent in their native language, particularly dental fricatives /θ/ and /ð/. As a result, words such as *theory* /'θɪəri/, *thermal* /'θɜ:məl/, *theorem* /'θiərəm/, *thickness* /'θɪknəs/, *thin* /θɪn/, *thermodynamics* /θɜ:məʊdaɪ'næmɪks/, *thrust* /θrʌst/, *method* /'meθəd/, *synthesis* /'sɪnθəsis/, *though* /ðəʊ/, and *although* /ɔ:l'dəʊ/ may be pronounced inaccurately. These pronunciation patterns confirm the importance of systematic pronunciation



instruction aimed at improving intelligibility, pronunciation accuracy, and confidence in professional oral communication.

These examples demonstrate that pronunciation instruction in ESP courses should include systematic work not only on individual sounds, but also on terminology-related pronunciation, stress patterns, final syllables, and prosodic features that support intelligible professional communication. If such pronunciation inaccuracies are not noticed and corrected at early stages of language learning, they may gradually become fossilized and negatively influence students' intelligibility, confidence, and oral communication.

For this reason, pronunciation instruction in ESP courses should be organized systematically. The development of phonological competence may gradually progress from the perception and production of individual sounds and terminology pronunciation to phrase-level practice, sentence production, and short professional speech activities. Such progression allows students to develop pronunciation accuracy step by step while simultaneously improving speech intelligibility and communicative confidence.

At the initial stage, students may practise the pronunciation of individual sounds, minimal pairs, technical terminology, and commonly used engineering expressions. Particular attention should be paid to phonemes and pronunciation features that may cause difficulties due to native language interference. At this stage, listening discrimination exercises, repetition activities, guided articulation practice, and phonetic comparison tasks may be especially effective.

At later stages, pronunciation practice may gradually progress from individual sounds and terminology pronunciation to phrase-level, sentence-level, and communicative activities focused on stress placement, rhythm, connected speech, and prosody. Such activities may include technical explanations, discussions, mini-presentations, and professional communication tasks related to students' field of study.



At more advanced stages, pronunciation practice should be integrated into mini-presentations, short professional reports, discussions, and problem-solving activities. Such tasks help students apply pronunciation skills in more authentic communicative situations while developing fluency, intelligibility, and confidence in oral professional interaction.

An important role in pronunciation instruction may also be played by self-assessment and autonomous learning. Modern AI-assisted learning tools and speech recognition technologies create additional opportunities for repeated pronunciation practice and immediate feedback outside the classroom. Students may use such tools to check terminology pronunciation, compare speech models, identify pronunciation inaccuracies, and monitor their own pronunciation development. AI-supported pronunciation training may therefore contribute to greater learner autonomy and increased pronunciation awareness.

At the same time, pronunciation assessment in ESP teaching should primarily focus on intelligibility and successful communication rather than the achievement of native-like pronunciation. In accordance with CEFR phonological control descriptors and IELTS pronunciation criteria, pronunciation inaccuracies may still occur even at upper-intermediate levels, provided that they do not significantly interfere with intelligibility or successful communication. Therefore, pronunciation assessment in ESP courses should focus not on native-like pronunciation, but on intelligibility, stress placement, rhythm, intonation, terminology pronunciation, and the ability to maintain effective oral communication in professional contexts.

**Conclusions.** The conducted analysis demonstrates that pronunciation instruction is an essential component of ESP teaching and should be systematically integrated into foreign language training for engineering students. The study shows that students often experience pronunciation difficulties connected with terminology, sound articulation, stress placement, rhythm, intonation, and native language interference. If these difficulties are not addressed in time, they may



contribute to the fossilization of incorrect pronunciation habits and reduce intelligibility in professional communication.

The findings confirm that pronunciation teaching and assessment in ESP should focus on intelligibility, comprehensibility, and communicative effectiveness rather than native-like pronunciation. CEFR phonological control descriptors and IELTS pronunciation criteria may serve as a useful basis for assessing students' phonological competence. Gradual pronunciation training, supported by phonetic transcription, AI-assisted tools, and speech recognition technologies, may help develop phonemic awareness, communicative confidence, and professional oral interaction skills.

The practical value of the study lies in its methodological recommendations for pronunciation instruction and assessment in ESP courses for engineering students. Further research may focus on AI-assisted pronunciation training, empirical validation of assessment criteria, and profession-oriented pronunciation materials for technical specialities.

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