

Use of Information Technologies in Developing Foreign Language Competence for Professional Interaction of Undergraduate and Postgraduate Students Specializing in Mineral Resources

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Abstract—The article aims to investigate the available tools of current information technologies used in teaching under-graduate and postgraduate students at a foreign language department of a higher technical education institution of mineral resources line, to assess the experience of using those technologies by the authors of the article, to analyze the results achieved and to consider the ways of expanding the list of methodologies that apply the existing information technologies in teaching foreign languages in higher technical education institutions in mineral resource area. The article considers the following techniques: using the institution Internet portal to provide access to learning support materials, learning plans, assignments and tests, remote teacher consultations, organizing of and participation in outside webinars and video conferences, and incorporating training programs with speech recognition modules. Foreign language competence for professional interaction implies general basic knowledge of grammar and vocabulary, developing profession-related terminological vocabulary, and skills of face-to-face oral and written professional communication in the foreign language. The authors analyze the results based on surveying and feedback from undergraduate and postgraduate students and on long-term personal work experience in higher education. The results prove the effectiveness of using information technologies in the learning process. IT learning reduced the study time and provided convenient and effective tools to improve students' foreign language skills. The learners demonstrated increased confidence while communicating orally face-to-face with colleagues and teachers from other countries. As a mid-term objective, the authors have begun a quantitative analysis of the effect of IT learning based on experience of distant teaching during COVID pandemic.

Keywords—Professional communication, foreign-language, competence, technical, speech recognition, terminological vocabulary, mineral resource

1 Introduction

Present-day stage of development of information technology allows to enhance educational methods, including teaching foreign languages to undergraduate and postgraduate students of higher technical education institutions in mineral resource line. Easier access for learners to computers, tablets and smartphones which, in their turn, practically all the time provide access to the Internet, allows to use distance education techniques based on modern information technologies with little or no restriction. [1, 2, 3, 4]. In this respect investigating the effectiveness of applying such advanced methods in developing foreign language competence for professional interaction, also in the case of learners with disability [5], appears to be relevant. The relevance, on the one part, stems from the availability of information technologies to users, while on the other part the technologies can be effectively incorporated in today's dynamic pace of education. The results of the study can be used in developing foreign language curricula in higher education institutions as well as in developing the technical philosophy of equipping higher education institutions with advanced computer facilities and employing personnel with relevant qualifications. The relevance of using up-to-date distance learning techniques is confirmed by the situation of mass remote work of higher educational institutions during COVID pandemic.

2 Materials and Methods

The article examines the following teaching techniques based on the use of current information technologies and instrumental to develop and improve foreign language competence for professional interaction of undergraduate and postgraduate students:

1. Providing access on the institution Internet portal to online versions of teaching materials, learning plans, exercises and online tests in a foreign language both for general and profession-related purposes.
2. Using distance learning techniques and remote consultations to work with individual undergraduate and postgraduate students and groups (over Skype or similar software).
3. Tasking undergraduate and postgraduate students with Internet search for and translation and analysis of discipline-related information.
4. Arranging webinars in a foreign language (or participation in outside webinars).
5. Organizing video conferences (on professional topics related to training programmes offered by the institution) in cooperation with foreign partners of the institution.
6. Using designated training programmes incorporating speech recognition modules (which is an especially promising means of developing verbal communication skills involving the use of profession-related terminology).

2.1 Using the institution Internet portal

As a rule, access to the materials accessible at the portal is restricted, and is granted to teachers and undergraduate and postgraduate students after they have gone through the process of authorization and identity check, which allows to personalize all the user actions at the portal. The materials advisable to place at the institution portal are as follows:

- Teaching materials (foreign language for general and profession-related purposes).
- Learning plans for every training programme offered by the institution.
- Interactive exercises (tasks).
- Online tests.
- Knowledge base of Internet resources that are useful to study a foreign language (specialized dictionaries, tests, public libraries, etc).

In order to develop foreign language competence for professional interaction a number of specialized teaching aids is used [6, 7, 8]. Digitalization of teaching aids and placing them at the Internet portal allows undergraduate and postgraduate students to easily access them from any client device. Interactive tasks allow to instantly assess the knowledge gained and skills developed. Saving the information about how actively the students work with the teaching aids (statistics on pages opened and time spent on studying each page) and on the results of completing exercises helps the teacher to actually evaluate the work done by undergraduate and postgraduate students in real time [9, 10]. This approach is effective for independent study and develops the competences of understanding written vocabulary for general and profession-related purposes. Note should be made that it is masters and postgraduate students who spend a substantial part of their study time working independently with teaching materials and aids. The approach helps to develop and improve such aspects of foreign language competence for professional interaction as learning grammar and vocabulary and building up profession-related vocabulary.

2.2 Using distance learning techniques and remote consultations

Another approach used in distance teaching is teacher consultations via messaging applications (similar to Skype and others). These applications provide audio and video communication both between individual students and the teacher and in a group. In such joint activities the participants can transmit not only audio and video information with a camera or a microphone at their computer, but also any other files, diagrams and charts available on their personal computers. It should be emphasized that in this case the actual location of the participants does not matter; all that is necessary to participate in such consultations is a personal computer (or a tablet or smartphone) and Internet connection. The approach helps to develop and improve all the aspects of foreign language competence for professional interaction.

2.3 Web search and analysis of information in a foreign language

The novel nature of this approach is only in students using Internet resources instead of standard libraries to research the discipline-related information they need. To complete the task the learners are to find scientific materials on the given topics related to their field of study. Then they view all the material, do tasks related to the contents of the articles found, such as summary and literal translation and discuss the topics in the materials found with the teacher [11, 12]. The approach helps to develop and improve such aspects of foreign language competence for professional interaction as learning grammar and vocabulary and building up profession-related vocabulary [13].

2.4 Holding webinars in a foreign language

A webinar is an online workshop, a type of real time online conference, internet-based meeting or presentation. At the time of the event each of the participants is at his or her personal computer communicating over the web through an installed downloadable application or a web application.

In a webinar the feedback from the listener to the speaker is highly restricted: usually it is either an electronic voting system or an additional channel of communication run by a standalone application. The feedback practices are set for each specific webinar on a separate basis and vary from unavailability to a possibility to pose questions to the speaker and get answers. In the opinion of the author, in terms of teaching and learning the best form of a webinar is when the key speaker is a lecturer or researcher from a partner foreign educational institution, with the topic consistent with the area of study of the undergraduate or postgraduate students, and also of relevance. This form of education produces the desired effect, because it combines live professional speech in a foreign language and up-to-date topics. Webinars also provide a good opportunity to practice listening skills and discuss profession-related topics with colleagues in a foreign language. It should be noted that the technique involves restrictions, namely inadequate listener-to-speaker feedback and little opportunity to practice the listeners' foreign language professional communication skills. The technique helps to develop and improve all the aspects of foreign language competence for professional interaction.

2.5 Organizing video conferences

In a video conference every participant can see and hear the other participants and speak. The work can be arranged in a variety of ways, for example, participants taking turns to speak in combination with joint discussions. This organization pattern, from the perspective of gaining skills of professional communication in a foreign language, has practically no significant disadvantages except for the necessity to comply with a number of technical requirements to install a videoconferencing system in the institution. The technique helps to develop and improve all the aspects of foreign language competence for professional interaction, namely inadequate listener-to-

speaker feedback and little opportunity to practice the listeners' foreign language professional communication skills. The technique helps to develop and improve all the aspects of foreign language competence for professional interaction.

2.6 Using designated training programmes incorporating speech recognition modules

The techniques that involve computer-aided speech recognition also gain in effectiveness due to development of computer technologies. Following the technology upgrade the systems of speech analysis and recognition are becoming increasingly accessible for mass use. Today speech recognition systems have become sophisticated enough and can not only process single words, phrases, sentences or larger pieces of text but also control the correctness of pronouncing individual words and phrases. From this angle training computer courses with phonetic sections that allow for speech recording and recognition are becoming common tools accessible to teachers in organizing the teaching and learning process [8].

There are two basic approaches to architecting speech recognition systems:

- Voice track recognition
- Recognition of lexical elements of speech.

The first approach implies recognizing utterances using pre-generated samples and is also widely applied in learning systems. Likewise, comparing utterances with pre-generated samples is key to pronunciation analysis systems. The second approach is more complex, with the implementation necessitating to single individual elements, that is phonemes and allophones, out of flow of speech, to further combine them into syllables and morphemes. It allows to recognize spontaneous connected speech and develop automated speech translation systems.

Adding elements of speech recognition systems to automated learning systems allows to introduce the following kinds of exercises:

1. Filling text fields to enter answers in exercises using a microphone and speech recognition system instead of a keyboard. Since the list of possible answers is limited, application of this kind can be based on the voice track recognition principle.
2. Drilling the pronunciation of certain sounds and words. In this case the system compares the utterances with pre-generated samples. The system can evaluate the degree of similarity (likeness) of a learner's pronunciation to pre-saved samples on a percentage or grade scale, which serves as the assessment of task performance. In addition, today systems of this kind make allowance for voice pitch, dynamic range, and pace of speech.
3. Conversations with a computer. The learner holds a real-world conversation with a computer which, equipped with an up-to-date speech recognition system, can assess the correctness of his or her grammar as well as of pronunciation against a set of criteria.

From the perspective of teaching undergraduate and postgraduate students of higher technical education institutions in the area of mineral resources, the technique has certain restrictions which can later be removed, namely adding work-related vocabulary sections to training programmes. The author regards the solution to this technology-related problem as an opportunity to extend the scope of the technique to include building up profession-related glossaries as well as shaping and acquiring profession-related vocabulary in general (in particular for students specializing in mineral resources). The technique helps to develop and improve such aspects of foreign language competence for professional interaction as learning grammar and vocabulary and, to a certain degree, gaining skills of face-to face oral communication in a foreign language in a professional environment (in reference to conversations with a computer).

3 Outcomes and Discussion

The practical experience of the author in using the above-described techniques based on up-to-date information technologies is presented in the following table:

No	Teaching technique used	Effect on development and improvement of foreign language competence for professional interaction	Restrictions on the technique used	Performance evaluation of the techniques
	Providing access on the institution Internet portal to online versions of teaching materials, learning plans, exercises and online tests in a foreign language	<ul style="list-style-type: none"> - Helps to develop general basic knowledge of grammar and vocabulary due to enhanced accessibility of learning materials and exercises - Helps to build up profession-related terminological vocabulary owing to access to discipline-related teaching materials and exercises 	Ineffective for development of speaking skills (vocabulary for general and professional purposes)	According to survey of both undergraduate and postgraduate students, the technique provides a more convenient access to learning materials, reduces the time spent on search for learning aids and exercises as well as the number of face-to-face visits to teachers, which allows to achieve the desired learning outcomes within a shorter period of time
	Using distance learning techniques and remote consultations to work with individual undergraduate and postgraduate students and groups (over Skype or similar software)	<ul style="list-style-type: none"> - Helps to develop general basic knowledge of grammar and vocabulary owing to personal contact with the teacher - Helps to build up profession-related terminological vocabulary which is achieved through the programme of studies and related topics of the consultations - Helps to gain and develop skills of oral communication in a foreign language as a 	Does not imply written exercises, may only be used during the time allotted for consultations	According to survey of both undergraduate and postgraduate students, the technique allows more students to participate in consultations, which has a generally positive impact on the quality of the learning service

No	Teaching technique used	Effect on development and improvement of foreign language competence for professional interaction	Restrictions on the technique used	Performance evaluation of the techniques
		result of student-teacher interaction format		
	Tasking undergraduate and postgraduate students with Internet search for and translation and analysis of discipline-related information	<ul style="list-style-type: none"> - Helps to develop general basic knowledge of grammar and vocabulary through translation done as part of the assignment - Helps to build up profession-related terminological vocabulary, which is ensured by the subject matter of the translated texts (profession-related technical texts) 	Ineffective for development of speaking skills (vocabulary for general and professional purposes)	According to survey of both undergraduate and postgraduate students, the technique reduces the time usually spent on library research, with learners also gaining skills of working with academic and sci-tech online resources
	Arranging webinars in a foreign language (or participation in outside webinars)	<ul style="list-style-type: none"> - Helps to develop general basic knowledge of grammar and vocabulary through interaction with the speaker - Helps to build up profession-related terminological vocabulary, which is ensured by the topic of the webinar - Helps to gain and develop skills of oral communication in a foreign language owing to the form of interaction with the speaker 	Reduced possibility of feedback with no opportunity to speak on the topics of the webinar. Difficulty in organizing more than 1 or 2 events during one academic semester.	According to survey of both undergraduate and postgraduate students, the technique helps to gain better understanding of authentic profession-related speech; however, full-scale video conferences are said to be more effective
	Organizing video conferences (on professional topics related to training programmes offered by the institution) in cooperation with foreign partners of the institution	<ul style="list-style-type: none"> - Helps to develop general basic knowledge of grammar and vocabulary through interaction with the speaker - Helps to build up profession-related terminological vocabulary, which is ensured by the topic of the conference - Helps to gain and develop skills of oral communication in a foreign language due to the form of interaction with the speaker and other participants 	Difficulty in organizing more than 1 or 2 events during one academic semester.	According to survey of both undergraduate and postgraduate students, the technique proves the most effective for gaining the skills of understanding authentic profession-related speech and for oral profession-related communication in a foreign language
	Using designated training programmes incorporating speech recognition modules (which is a promising means, especially for developing verbal communication skills involving the use of work-related terminology)	<ul style="list-style-type: none"> - Helps to develop general basic knowledge of grammar and vocabulary through completing exercises - Helps to gain and develop skills of oral communication in a foreign language (with some restrictions) due to the capacity of the computer programme to assess the learner's pronunciation and 	As of today, challenges exist in adding to educational courses involving elements of speech recognition technologies of tasks containing professional vocabulary for mineral resource sector	According to survey of both undergraduate and postgraduate students, the technique appears to be promising as it is convenient for independent work with no necessity for a teacher to be present to control the correct pronunciation

No	Teaching technique used	Effect on development and improvement of foreign language competence for professional interaction	Restrictions on the technique used	Performance evaluation of the techniques
		on the learner's part, to the opportunity to work toward correct pronunciation		

The results show that in terms of quality the participants of academic process (teachers and learners) point out that the use of advanced information technologies in the learning process proves effective. The techniques reviewed reduce the study time and provide convenient and effective tools to improve foreign language skills; besides, the learners make mention of increased confidence while communicating orally face-to-face with colleagues and teachers from other countries. The outcomes may be used in developing study plans for foreign language courses in language departments as well as of technical philosophy of equipping higher education institutions with advanced computer facilities.

In this work the author only presents the qualitative evaluation of its outcomes; the following possible trend of development would be the quantitative evaluation of the effect of using up-to-date information technologies in teaching foreign languages to undergraduate and postgraduate students specializing in mineral resources, which is an area of academic interest. A yet further step in developing the work might be an endeavour to develop a comprehensive study course of profession-related English incorporating speech recognition technologies, designed for undergraduate and postgraduate students specializing in mineral resources area. Also, the authors are conducting a quantitative analysis of the effect of modern IT technologies use [14].

4 Conclusion

Summing up all the foregoing, from the perspective of the outcomes and the discussion, it would be appropriate to use advanced teaching techniques based on up-to-date information technologies to teach senior undergraduate students and postgraduate students in foreign language departments of higher technical education institutions, in particular for the purpose of developing and improving foreign language competence in professional interaction. This approach, first of all, provides access for undergraduate and postgraduate students to learning aids and to remote knowledge assessment system at the institution Internet portal. Second, this allows to webcast voice and images; alongside this, when technologically viable, there is an opportunity to organize and/or participate in outside webinars and video conferences. Third, the increased use of computer-aided distance English courses that allow to operate with speech recognition technologies makes it possible to distantly develop and monitor the success of mastering profession-related speech skills of undergraduate and postgraduate students. In addition, applying advanced learning technologies not only helps to develop and improve foreign language competence for professional interaction but also enhances the professional competence of senior undergraduate and of postgraduate students as it offers the opportunity to communicate with colleagues and teachers

from other countries. The ongoing quantitative study of the efficiency of the applied technologies will enable to measure their benefits. The 2020-distant learning during COVID pandemic has provided sufficient base for comparative analysis. Nowadays education has changed dramatically with the distinctive rise of e-learning. It is absolutely clear that the adoption of online learning will continue to persist during the post-pandemic period. That is why, careful studying of information technologies is becoming one of the most important issues now, which will provide high quality education in the future.

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