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METHODOLOGY FOR DEVELOPING CHEMISTRY TEACHERS' FOREIGN LANGUAGE PROFESSIONAL COMMUNICATIVE COMPETENCIES

Abstract

This study's significance lies in its the need to develop foreign language professional communicative competence (FLPCC) of non-linguistic university students and the exploration of ways to achieve it. Developing FLPCC embodies not only speaking fluently in a foreign language in the professional field but also enhancing linguistic and communicative skills alongside subject knowledge. The purpose of this research is to identify effective methods and approaches for fostering fluent communication skills within the context of teaching chemistry in English. Analysis of the diverse methods of developing FLPCC enables us to reveal the components of this competence and create a set of exercises based on Kunanbaeva's modelling. To evaluate the effectiveness of this set of exercises used in class organization, diagnostic monitoring was conducted. The findings obtained from the final exam revealed that the students enhanced their professional communicative skills, expanded their vocabulary, and were motivated to further develop their linguistic skills. These research findings are beneficial for young scientists, teachers, and students conducting research in this field.

Keywords: competency, communicative competence, foreign languages, non-linguistic university, chemistry, language skills.

Basic provisions. In recent years, the requirements for foreign language proficiency have increased to expand opportunities for educational exchange in accordance with higher education standards. One of the key functions of modern pedagogical universities is to train professionals capable of communicating in a foreign language fluently in their professional field. However, there is often little focus on fostering communicative skills in the teaching

of chemistry and other natural subjects. Most teaching materials contain scientific data and uncomplicated assignments. To address these issues, this study is based on a communicative approach. The key idea of this research is to identify and assess the effectiveness of the lesson organization methodology for fostering fluent English communicative skills in the context of teaching chemistry.

Introduction. Multilingualism is one of the relevant issues not only in our country but worldwide, as comprehending multiple languages enables the expansion of international relations for any nation. In the rapidly advancing technological era, Kazakhstan's international relations with foreign countries are growing daily, raising the demand for specialists proficient in foreign languages.

Today, the key issue emphasized in the President's Address is the education and upbringing of competitive professionals who are proficient in three languages, meeting the needs of modern society. In his address titled "Unity of the People and Systemic Reforms are a Solid Foundation for the Nation's Prosperity", Kassym-Jomart Tokayev highlighted the significance of scientific research and education. Moreover, during an assembly council meeting, the Ministry of Science and Education was authorized to study the practice of multilingualism on each continent and integrate it into the local education system (Tokayev, 2021).

One of the main reasons for conducting this research is the lack of chemistry textbooks designed to develop foreign language professional communicative competence (FLPCC). Existing natural science textbooks and materials in foreign languages are described by general scientific texts. Modern textbooks should contain a sufficient number of exercises to develop several types of speech activities for students. Therefore, the paper focuses on the exploration of the effective methods for teaching chemistry in a foreign language at the university and to development of a set of exercises aimed at enhancing students' FLPCC and testing it in practice.

When analysing the findings of research methodologies, Oleynikova (2010) concluded that the main goal of teaching a foreign language in non-linguistic faculties is to promote the acquisition of FLPCC. This facilitates the implementation of intercultural professional communication by selecting effective communication methods. Moreover, the researcher identified empirical, linguistic, pragmatic, and traditional methods of grammar data selection. Among diverse criteria and principles, the idea of evaluating the communicative objectives of foreign language learning is particularly significant. Oleynikova (2010) highlights that specifics of the professional activities should be taken into account in the development of FLPCC of non-linguistic faculty students. In this context, future chemist training requires focusing on the intricacies of the chemical industry, technology, production, and laboratory work organization.

Pustovalova (2013) views the development of foreign language communicative competence (FLCC) among non-linguistic university students as the basis for using interdisciplinary communication within the framework of professionally oriented learning (POL). This approach provides that perspective specialists are capable of solving communicative tasks related to their future professional activity. The conceptual framework of students' FLCC under POL comprises groups of linguistic and linguistic professional competencies that determine the acquisition of both oral and written foreign languages. In other words, linguistic, speaking, and foreign language (FL) abilities include professional and intercultural skills. Pustovalova (2013) also identifies motivational, content, and activity indicators as criteria for developing FLCC under POL. Pustovalova (2013) defines the motivational indicator as the perspective specialist's readiness for self-improvement and enhancing the experience within their field. The content indicator includes mastering FL by state education standards and the ability to comprehend professionally oriented information. The activity indicator involves developing foreign language competence and the ability to apply it in the process of practice in a professional context (SNS, 2024; Sorayyaee et al., 2022). In addition,

the researcher considers the use of integrated technology, organizational methods, forms, and teaching tools in the teaching process as one of the sets of pedagogical conditions essential for fostering students' FLCC in non-linguistic universities.

Petrova (2010) describes the pedagogical conditions for developing FLPCC based on communicative-cognitive, competency-based, and activity-oriented approaches. Organizational pedagogical conditions are reflected in the choice of effective teaching methods; content-related pedagogical conditions can be achieved through the provision of the educational-methodical complex and the utilization of didactic material designed in compliance with the curriculum. The scholar describes the use of case studies, problem-based learning, project methods, and modular learning technology in the teaching process as an example. Motivating pedagogical conditions enables students to engage in independent research in the subject area (Bonilla López et al., 2021). Petrova (2010) identifies the FLPCC components as linguistic, sociolinguistic, verbal-cognitive, professional, and discursive criteria, as depicted in Figure 1.

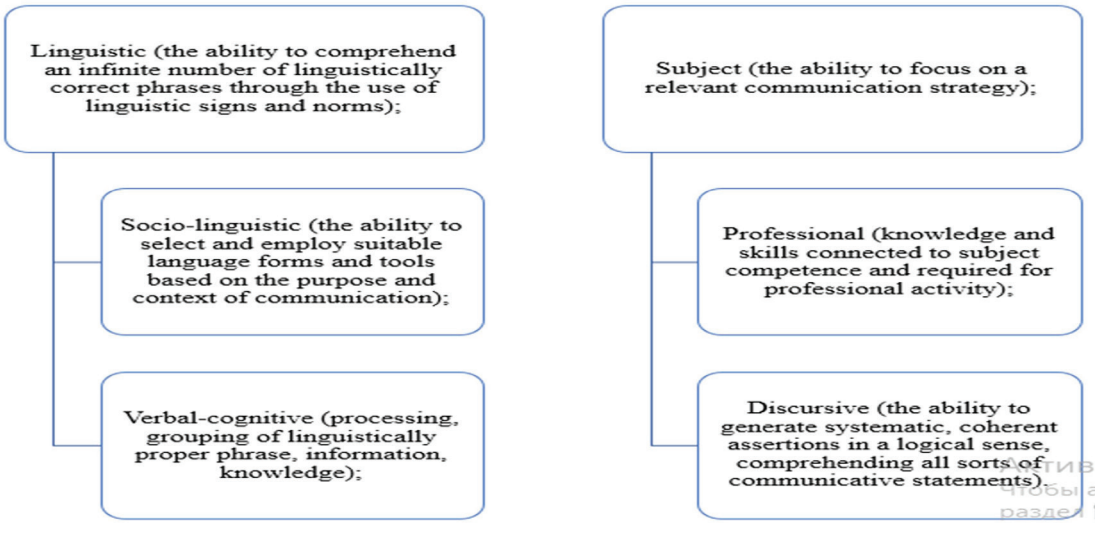


Figure 1: Components of FLPCC

The subsequent criteria for the development of FLPCC have been established in line with the proposed components: intellectual-cognitive, personality-motivational, reflective-evaluative, and activity-behavioural. According to research findings obtained by Shemshurenko et al., (2019), the communicative approach enables learners to enhance their cognitive abilities and become active participants in their learning process. Communicative pedagogy related to a foreign language suggests starting with exercises or hands-on activities. In a broader sense, practical activities in a structured learning process are essential to move from practice to theory, which proceeds with conceptualizing knowledge generated based on practical experience.

The scholars, Shemshurenko et al., (2019), believe that the FLPCC approach relies on active thinking processes and language creativity. Consequently, students create a unique linguistic environment and integrate the data acquired through analysis into their particular personality structure, which requires rules in real situations, passing from the individual to the general. Furthermore, the integrated information can be utilized for overcoming new linguistic or communication challenges at any moment. Self-learned knowledge lasts longer in students' memory and students can recall it on their own, even if it is forgotten or lost over time (Mohammed Idris et al., 2022; Shemshurenko et al., 2019). According to Cimermanova (2021), developing communication skills in a foreign language has been one of the key competencies of lifelong learning for centuries.

To summarize, in a communicative activity, students tackle communication challenges such

as denying something, proving, identifying, agreeing, and more. They figure out what to say, how to construct a phrase, and which lexical units and grammatical structures to apply.

A comparative review of psychological, pedagogical, and methodological literature shows that FLCC is defined as students' readiness and competence to successfully engage in professional communication in all types of FL conversation. Furthermore, FLPCC is primarily focused on the objective of teaching languages, which is to ensure students' capacity and genuine readiness to communicate in foreign languages and reach the necessary level for practical application in their subsequent professional activities. This competence is developed through all types of speaking activities, diverse forms of work, and carefully chosen methods and technology.

Materials and Methods. Analysis, deduction, induction, synthesis, comparison, generalization, and diagnosis of scientific-pedagogical literature were conducted to theoretically and empirically substantiate the development of foreign language professional communicative competence (FLPCC) among prospective chemistry teachers and effective methods of teaching a foreign language (FL) at a non-linguistic university.

The analysis of foreign study findings allowed us to highlight three major features of the search and application of new technologies to enhance the level of FLPCC among non-linguistic students:

- investigating the educational system's demands in updating foreign language curricula and programs;
- determining the efficiency of the used technologies through practical implementation;
- researching attitudes of both students and teachers towards the technologies being used.

Even though the issue of developing and using new technologies for enhancing FLPCC of non-linguistic major students is widely discussed in foreign sciences, it should be acknowledged that the solutions that have been suggested are currently unable to be fully applied in the conditions of domestic universities. Teachers frequently emphasize the development of reading and translation skills, as non-linguistic students primarily need foreign language proficiency to obtain professionally important information. Speaking skills are frequently neglected.

Due to the limited number of FL courses in non-linguistic universities, it is vital to constantly seek ways to improve the effectiveness of teaching and enhance FLPCC among students. For instance, English is taught in non-linguistic universities to facilitate the strengthening of students' FL communication skills. However, the proficiency level achieved by the majority of students is insufficient for employment.

As shown in Figure 2, the components of FLPCC for the development of English-speaking abilities in chemistry students at universities have been identified.

Galkina (2018) believes that the process of continuous enhancement of professional and communicative competence will be relevant in addition to the formation of knowledge, qualifications, and skills (competencies) in the development process. Among the methods, forms, procedures, and technologies used for the development of professional and communicative competence, the following are distinguished: professional development, aspects of problem-based learning, master classes, project methods, etc. The researcher suggests that professional-communicative competence can be realized through problem-solving and assignments. This strategy leads to the growth of mutual communication in the team and the improvement of international relations. One aspect of constructive student engagement is problem-based learning. During the lecture, students can be offered the following assignments: creating a list of key assignments, independently developing titles of the lecture topic, independently drawing conclusions based on the lecture materials, creating an information collage, organizing group work, discussing the solution to the problem, making recommendations and presenting the obtained outcomes in the form of charts or tables.

Kunanbaeva (2005) developed a model of the formation of intercultural communicative

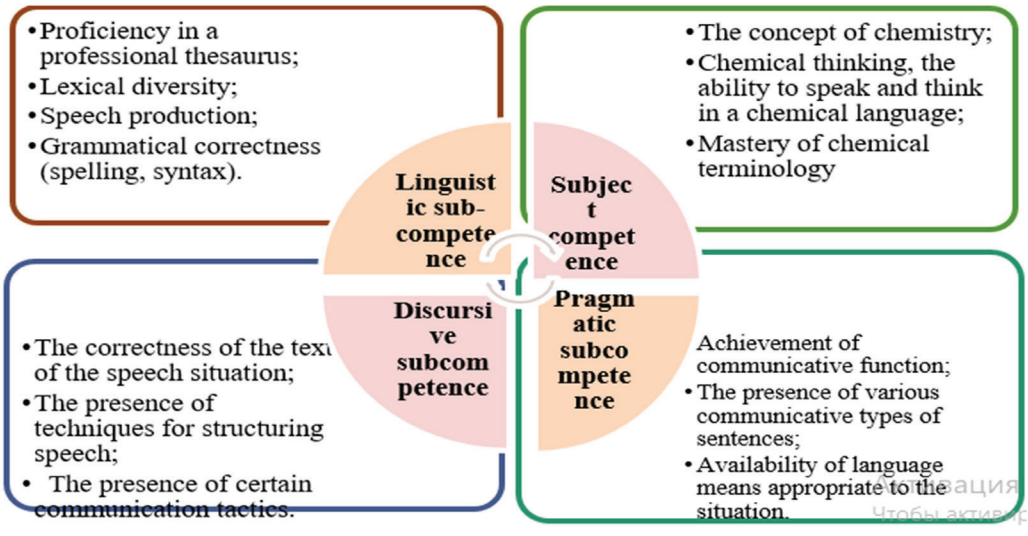


Figure 2: The components of FLPCC for chemistry students

competence (ICC) in her scientific work. She determined the organization of the learning procedure for the enhancement of communicative competence through context-oriented communication, modelling of typical communicative situations, and stages of intercultural communication.

Based on Kunanbayeva's model and the components of FLPCC illustrated in Figure 2, a set of exercises was developed for the "Organic Chemistry" course. As shown in Figure 3, students will acquire the following abilities through the completion of the entire set of exercises.

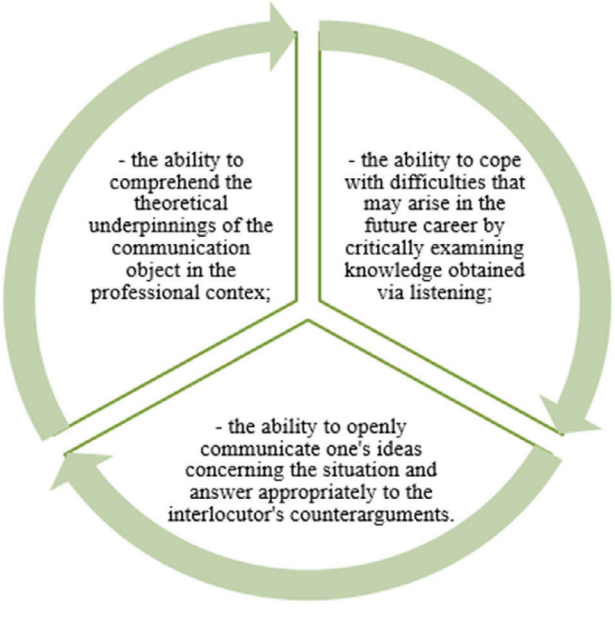


Figure 3: Student abilities are acquired through the completion of a set of exercises designed based on Kunanbayeva's Model

Taking into account the expert evaluations and the specifics of the conducted research, based on the examination of the theoretical rules, the criteria for assessing the level of chemistry students' FLPCC development according to the components illustrated in Figure 2 were identified (Figure 4).

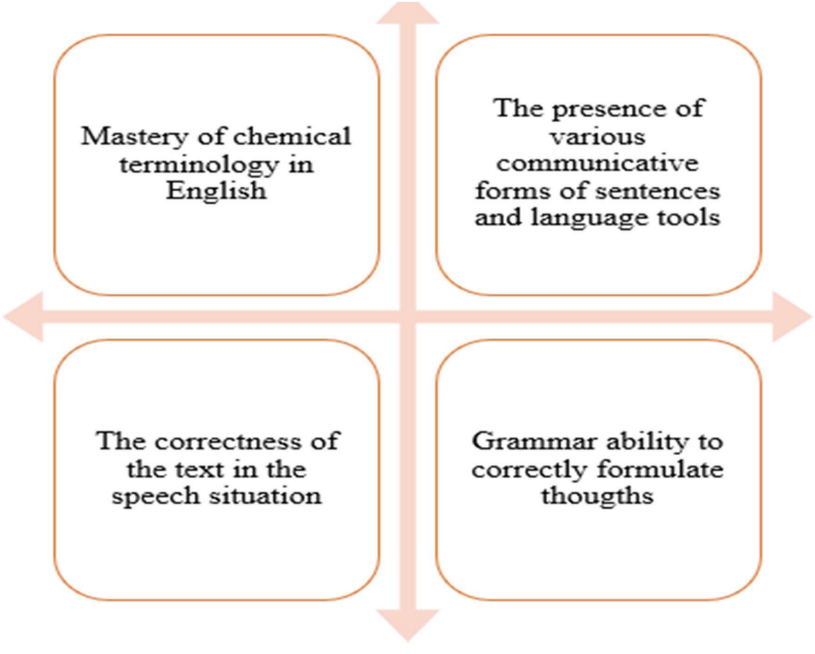


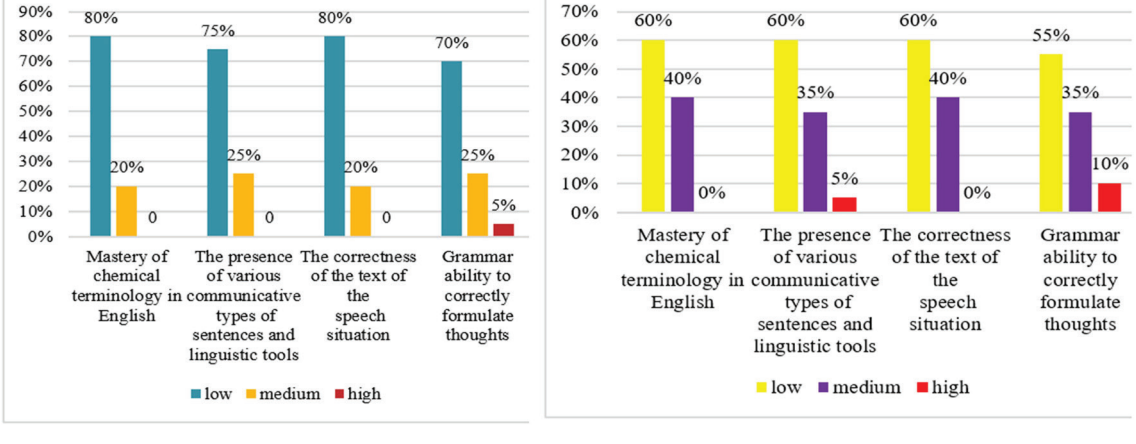
Figure 4: Criteria for assessing the level of FLPCC development in chemistry student

It was determined that the level of development of FLPCC of chemistry students is evaluated at high, medium, and low levels, taking into account the determined indicators of each criterion, depending on the above-mentioned components.

Results. The set of exercises has been tested for 3-year students from Ozbekali Zhanibekov South Kazakhstan Pedagogical University enrolled in the educational program 6B01504 Training of Chemistry Teachers. The number of experiment participants is 45.

The purpose of the experiment is to test the effectiveness of a set of exercises and to consider empirical research approaches that will enhance FLPCC for prospective chemists. The experiment was organized utilizing the principles and theories of scientists such as Biggam (2011) and Shashkov (2005).

The medium level of FLPCC development of the experimental group students indicates a high quality of required competence. Figure 5 shows the findings of pre- and post-experimental tests among control group students.



Before the experiment

After the experiment

Figure 5: The findings of the pre-and post-experimental tests of the control group students

The graph depicts the findings of the level of FLPCC development in the control group students before and after the experiment.

According to the level of mastering chemical terminology in English, 20% of low-level students enhanced their scores. Based on the third criterion, 20% of low-level participants moved to a medium level, while 5% of low-level learners reached a high level, demonstrating their ability to express their thoughts adequately.

Figure 6 illustrates the pre-and post-test findings of the experimental group of students.

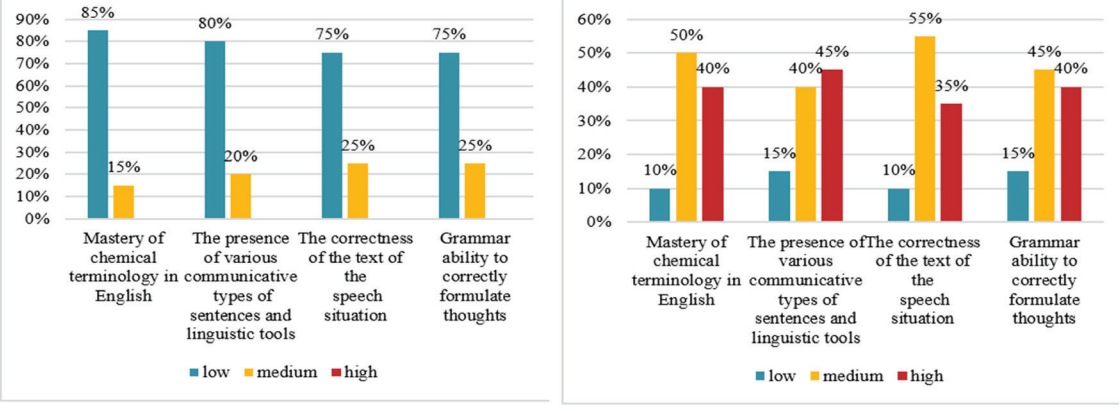


Figure 6: The findings of the pre-and post-experimental tests of the experimental group students

When assessing the participants in the experimental group based on all criteria, it was observed that their level was lower than expected, showing better performance during the experiment. In general, all criteria demonstrated notable improvement. The most significant changes were observed in the comprehension of chemical vocabulary in English.

According to the criterion "The presence of various communicative types of sentences and linguistic tools", the proportion of students with a high level increased from 0% to 45% during the test period, as shown in the graph. In addition, in terms of the correctness of the text of the speech situation, the percentage of participants at the low level decreased to 65%. Similarly, the number of high-level students increased to 40%, demonstrating their grammatical ability to correctly formulate their thoughts. These findings indicate positive results from the study.

Discussion. Jalal and Nawab (2022) explored the challenges of teaching chemistry In English to 7th-grade students in a private school in North Sindh, Pakistan. They assessed the current situation of both students and teachers, conducted the lesson, and during the experiment, demonstrated chemical concepts in English. They used group and pair work assignments to introduce students to content, communication, cognition, and culture. Initially, the students struggled to speak English despite the researcher's assistance. Although they knew some concepts, they could not comprehend them. Therefore, the researchers came to the conclusion that immediately immersing them in English is not an effective strategy. Further strategies and activities were needed to expand their vocabulary. However, due to limited attention to the content by both the researchers and the students, there was a fear of insufficient understanding of scientific concepts among students.

In our study, it was observed that the English proficiency level of the experiment participants was generally high, namely, students of the multilingual group. This is because the prepared set of exercises is intended for students studying chemistry in English. However, even if the level of English is intermediate or higher, it is necessary to master chemical terminology in English to speak a foreign language fluently within the content of the subject. Therefore, if we analyze the results of the experiment, we cannot state that insufficient time was spent on subject knowledge because all the assignments are related to the subject content text. On the contrary, we noticed that the knowledge of chemistry increased due

to performing exercises related to situational problems aimed at conducting independent research. Using video materials, we found out that information is remembered for a long time and can be remembered again in case of loss of consciousness. It can be seen from the results of the experiment that the step-by-step method of modelling in the lesson organization facilitates mastering the topic comprehensively. Compared to the research results mentioned above, we remarked that to achieve the goal of enhancing FLPCC, when using a set of exercises designed, it is essential to allocate at least 3-4 hours to cover one topic to get the expected outcomes.

In addition, if we conduct a comparative analysis, we can study the scientific work of Byrdina et al., (2020). The researchers proposed a model of FLPCC development based on integrated learning and evaluated it during the experiment. The research work assisted in improving the participants' FLPCC level and successfully mastering professional and communicative methods. It was effective in enhancing professional communication and FL skills. In addition, during the study, the researchers identified a lack of pedagogical and methodological materials by filling out a questionnaire of all teachers who conducted integrated learning classes (Byrdina et al., 2020). In our case, as a result of the research work, it was found that chemistry textbooks in English in Kazakhstan are not intended for communicative direction and there is a lack of educational tools in this direction.

Conclusion. Our country's global economic and academic sphere brought shifts through the processes of globalization, fostering a desire to live fairly and competitively in the social spheres. The ability to use FL in the professional field provides significant advantages in terms of expanding opportunities for international cooperation in the field of science and education, as well as full participation in international educational integration. One of the growing trends in the educational paradigm is the competency-based approach, which involves the development of a person's ability to use current knowledge and abilities to solve practical problems in the real world. The development of FLPCC is a prerequisite for the implementation of this methodology. In this direction, the nation is moving from the concepts of "ability" and "skill" to the concepts of "competence" and "competency". The demand for a competency-based approach stems from clarifying the purpose and outcomes of FL teaching in non-linguistic universities.

As a result, several objectives were performed during the research:

- the relevant issues of FLPCC development of non-linguistic university students have been described;
- FLPCC components and their indicators have been identified;
- a set of exercises has been developed based on the FLPCC components and Kunanbaeva's model;
- the evaluation criteria for the prepared set of exercises have been proposed;
- a set of exercises has been tested and analyzed.

The experience indicates that the prepared set of exercises enhanced the chemistry students' interest in learning, expanded their vocabulary, and developed professional speaking skills.

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