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Article

Developing Interactive English Communication for Science Students Through PBL Method

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Abstract: This article investigates the use of the Problem-Based Learning (PBL) method in enhancing interactive English communication skills among natural science students. The relevance of integrating PBL in language education is highlighted, as it not only improves student motivation but also actively involves them in the learning process. The study explores how PBL fosters the development of communicative competencies, particularly in scientific contexts, and enhances students' proficiency in professional vocabulary. The experimental study results confirm that PBL significantly contributes to both the improvement of language skills and the formation of critical thinking abilities. This article will be valuable for foreign language teachers, educators, and researchers interested in innovative and effective teaching methods. It provides insights into how interactive communication in English can be cultivated in students through PBL, bridging the gap between language learning and professional development in the field of natural sciences.

Keywords: problem-based learning (PBL), interactive communication, English language, natural science students.

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1. Introduction

Modern education requires the introduction of innovative methods aimed at developing not only professional knowledge, but also communicative competences in a foreign language in students. The development of interactive communication in English is especially important for students of natural sciences, since English is the universal language of science and technology. Problem-Based Learning (PBL) is recognized as an effective approach that allows integrating language learning with professional training and encourages students to actively participate in the learning process[1]. In the context of globalization, knowledge of English in the scientific community remains a prerequisite for building a successful career for young specialists in the field of natural sciences. However, traditional methods of teaching English often do not provide sufficient interactive communication, which limits the opportunities for students to communicate professionally. Problem-Based Learning (PBL) offers an alternative approach that combines the development of language skills with the active solving of professionally relevant tasks, which serves to deepen the mastery of the material and increase interest in the language being studied[2].

Problem-based learning is based on active problem-solving, helping to develop critical thinking and independence. In the context of language education, PBL serves to develop interpersonal skills and effective communication. The PBL methodology involves working in small groups, in which students jointly analyze problem situations, discuss possible solutions, and express reasoned opinions in English. This approach, along with improving language competence, also develops cognitive and sociocultural skills. PBL is based on the constructivist learning theory, according to which knowledge is formed in

the process of active activity and interaction[3]. In language education, this is manifested by involving students in discussions, presentations, and joint problem-solving processes, which develop not only language skills, but also cognitive skills. The uniqueness of PBL is its focus on real contexts, which is especially important for students of natural sciences, since they need to use English in specific professional situations.

Science students face the challenge of mastering specialized vocabulary and terminology, which requires a special approach to teaching English. Interactive communication in this field involves sharing knowledge, discussing scientific problems, and presenting research results. PBL creates a favorable environment for students to practice such communicative activities, which will allow them to use the language in real professional contexts and improve their general and specific English language skills[4]. Interactive communication includes oral and written forms, such as discussions, debates, joint reports, and presentations[5]. The ability to clearly and concisely express complex ideas and arguments, relying on scientific terminology, is essential for science students. PBL helps students develop these skills by deeply immersing them in problem situations that require collective discussion, exchange of ideas, and joint development of solutions in English.

Literature Review. Problem-Based Learning (PBL) was first proposed in medical education in the 1960s and has since been widely used in science and language education, among many other fields[6]. Research shows that PBL helps develop critical thinking, independence, and communication skills. In the study of English language learning among students in technical and natural sciences, PBL has been shown to enhance learning by integrating language and professional knowledge[7].

Recent research emphasizes the importance of interactive communication as a key component of language competence, which is essential for successful professional activity[8]. The use of the PBL method in language education creates a learning environment that actively engages students in dialogue, allows them to discuss and solve problems together. This serves to deepen the acquisition of vocabulary and improve oral and written communication skills[9].

At the same time, despite the positive results, there are difficulties in adapting the PBL method for natural science students due to the specificity of language teaching. In particular, it is necessary to develop methodological materials that consider the specificity of professional vocabulary and the characteristics of communication in the scientific environment[10].

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2. Materials and Methods

As part of the research, educational modules were developed based on the principles of PBL, which included thematic projects and problem situations related to the field of natural sciences. Students worked together in groups and solved tasks requiring the active use of English. Before and after the introduction of the PBL methodology, the effectiveness of students' language competencies was assessed using observation, questionnaires and tests. The learning process was organized based on the principles of active learning and a communicative approach. The modules included problem situations related to current scientific topics, which ensured the motivation and professional orientation of the tasks. During the sessions, students used various communicative strategies, including asking questions, clarifying information, argumentation and reflection[11]. Quantitative and qualitative methods were used to assess the dynamics of skill development, creating an opportunity to obtain an objective picture of the effectiveness of PBL.

3. Results and Discussion

To introduce PBL in English language teaching, thematic modules were developed that included problem situations that model real scientific situations. Each module consisted of several stages:

1. Problem identification - students familiarized themselves with the definition of the situation requiring a solution and formulated key questions in English.
2. Independent research — participants collected information using scientific sources and educational materials in English.
3. Group discussion — in small groups, students discussed the data found, developed hypotheses, and prepared a presentation of the solution.
4. Presentation and reflection — each group presented the results in English, and then the work done was discussed and analyzed[12].

Methods of observation, questionnaires, and comparison of the results of language tests at the beginning and end of the course were used to assess effectiveness. Attention was paid to the development of interactive communication skills — the ability to ask questions, argue, and maintain a dialogue was assessed.

Practical recommendations for implementing PBL. Based on the results of the study, the main recommendations for the successful use of PBL in teaching English to science students are as follows:

1. Integrate professional context: problems and situations should be close to the students' field, increase motivation and ensure the relevance of the material.
2. Develop communicative strategies: students should be taught methods of conducting discussions, argumentation and conflict resolution.
3. Flexibility in organizing group work: it is recommended to create groups of different levels to support less experienced students.
4. Use of digital resources: the introduction of online platforms and collaborative tools helps to organize communication more effectively and improve information exchange[13].

The results of our research confirm the main principles of constructivist and communicative learning theories, which form the basis of the problem-based learning (PBL) methodology. According to the constructivist approach, knowledge is formed in the process of active and collaborative work, which was clearly observed in students' group discussions and collaborative projects. The theory of language communication emphasizes the development of not only grammatical, but also sociolinguistic and strategic competencies, which is realized through the multi-component tasks of the PBL method.

The PBL method allowed natural science students to not only memorize lexical units, but also to apply them in real situations that model professional activity. This served to form the skills of scientific discussions, presentations, and collective problem-solving, which are the foundation of professional communication[14]. Despite the positive results, it should be noted that there are the following limitations that may affect the generalizability of the conclusions:

Limited sample size: the experiment was conducted in a small group of students from one university, which may not fully reflect the diversity of language levels and professional knowledge in other educational institutions.

Time limitation: since the course duration was only one and a half years, the long-term impact of the PBL method on language competence was not assessed.

The influence of the teacher factor: the successful application of the methodology largely depends on the qualifications and ability of teachers to organize the process, and requires additional training of teachers.

To overcome these limitations, it is necessary to conduct more extensive and long-term research with the participation of various educational institutions and teachers.

Further research can be focused on the following areas:

1. Development of adapted methodological materials and digital platforms that consider the characteristics of PBL in language education in the natural sciences.
2. Studying the impact of long-term use of the PBL method on written and oral communicative skills, as well as on the professional development of students.

3. Intercultural aspects of interactive communication and their integration into PBL courses are relevant, especially for students interested in international activities.
4. To assess teachers who are preparing to use the PBL method and identify best practices for improving the quality of teaching[15].

The problem-based learning method is a promising tool for the comprehensive development of language and professional competencies for students of natural sciences. It helps to develop not only linguistic skills, but also critical thinking, teamwork skills, and effective communication skills in English in a professional environment. Integrating PBL into educational programs requires a systematic approach, in which the training of teachers, adaptation of teaching materials, and the use of modern technologies play an important role.

In conclusion, the integration of the problem-based learning method in the process of learning English among students of natural sciences creates new opportunities for the formation of key communicative competencies. This approach not only increases language competence, but also develops professional and social skills necessary for successful academic and professional activities. It is desirable to continue to adapt and research the PBL method for different disciplines and levels of preparation to maximize its educational potential.

4. Conclusion

In conclusion, the Problem-Based Learning (PBL) method has proven to be highly effective in developing interactive English communication skills among natural science students. By integrating real-world problem-solving with language learning, PBL not only enhances students' language proficiency but also fosters critical thinking, teamwork, and professional communication. The method actively engages students, encouraging them to use English in scientific contexts, which boosts their confidence and competence in using professional terminology.

The study results confirm that PBL significantly improves students' motivation and interest in learning, leading to a deeper understanding of both the subject matter and language. It enables students to master specialized vocabulary, which is crucial for their academic and professional development. By creating an interactive learning environment, PBL helps students develop the communicative skills necessary for effective participation in professional settings.

However, some challenges persist in adapting PBL for natural science students, particularly with regard to integrating scientific language and communication skills. Future research should focus on addressing these challenges, developing more tailored methodologies, and utilizing digital tools to further enhance the PBL experience in language education.

Overall, PBL offers a promising approach to language education, helping students not only improve their English proficiency but also develop the essential skills needed for their careers in the natural sciences. By combining language learning with problem-solving, PBL prepares students for success in both academic and professional environments.

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