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The Use of Game Technologies in Teaching Professional Communication in English for Engineering Students

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Abstract

Our research focuses on the innovative application of gaming technologies in the instruction of English for future professionals in the mining industry management sector. The primary aim of our study is to assess whether integrating gaming elements into educational practices enhances overall learning effectiveness. Additionally, we seek to explore the potential benefits of educational games as a viable tool for skill acquisition. To elevate the quality of professional communication training, we developed a tailored model specifically designed to cultivate English communication skills among students pursuing degrees in economics, particularly in the management of mining enterprises. This model incorporates various educational games that simulate real-world scenarios, allowing students to engage in practical exercises that mirror the challenges they will face in their careers. The implementation of this model took place from September 2022 to February 2023. The conducted experiment demonstrated the effectiveness of the game-based teaching approach to overcome the language barrier, increase motivation and improve foreign language communication skills on professional topics. The analysis of the results of the empirical findings and the answers to the questionnaire confirmed the hypothesis about the efficiency of application of the developed model for successful teaching of communicative skills in English to future specialists in the field of mining enterprise management.It was also found that teaching English applying game-based approaches can be considered an important instrument for the enhancement academic motivation in students of economic and engineering profiles.

Keywords: game technologies, efficient educational process, professional communication skills, enhanced motivation.

1. Introduction

The purpose of forming partnerships with foreign companies, particularly in areas related to natural resources, remains a priority for achieving successful economic growth.There is the need to train future engineers who can be qualified specialists in terms of professional competence and will be able to successfully communicate in a foreign language. The strategy of international activities of Mining University is aimed at training highly qualified “mining specialists” (Kazanin et al., 2017:369) due to the urgent need.

Since the successful functioning of enterprises of the mineralsextraction and processing is “one of the factors of sustainable development of the country” (Khrustaleva et al., 2021: 417), there is a necessity ofskilled professionals who can communicate proficiently in English. As the language of international trade, research, and collaboration, English has become indispensable for professionals in the mining and minerals industry.

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In the realities of modern requirements for mineral resource companies, there is an urgent need for high level specialists who will not only have excellent knowledge of their specialty, but will also be able to successfully exchange experience with foreign colleagues. So, “technical university students’ creativity development” (Borisova et al., 2022: 130) can contribute to the formation of a specialist who meets these demands.

It's no secret that a successful manager needs to have such a level of knowledge that will help him/her to be able to interact with counterparts worldwide on a professional basis (Oblova, 2023).

However, during the process of teaching foreign languagessome difficulties remain. Problems with motivation and time management, as well as inability to handle the task properly are just some of them (Borschenko, 2020; Medvedeva et al., 2022).

We can explain it by the fact that teaching methods are often focused on mechanical memorization of terms and basic grammatical structures, and the learning process often turns into a poorlyorganized and boring routine (Baranova et al., 2020).

Since the university classroom isthe most suitable and comfortable space for improving professional communication skills (Krylov et al., 2022), the ways to create a comfortable and stimulating learning environment are constantly being developed, and new methods of intensifying the educational process are being sought (Dorofeev et al., 2023; Ovchinnikova et al., 2023).

It is now impossible to discuss education process without taking into consideration the use of ICT technologies. “As the educational process becomes more innovative and creative, it is essential to improve the means and methods used in it. The crucial role in this process is played by the use of creative techniques” (Boyko et al., 2022: 40).

“Nowadays there is an urgent need to use new methods and techniques of teaching a foreign language, which, unlike traditional methods, are based not only exclusively on learning to read and translate and studying grammatical rules” (Gerasimova et al., 2022) and to acquire skills “in the search and implementation of advanced technologies” (Litvinenko et al., 2020: 435).Interactive approaches that help to enhance the ability to effective communication in a foreign language are mandatory for use in modern conditions of informatized society (Almazova et al., 2020).

In such situationit is important to meet existing challenges, and,in our opinion, the thing that can be helpful is the use of game techniques. In today's environment, the rules of the game are increasingly penetrating where previously they seemed to have no place (Dreimane, 2022).

Under such circumstances, any teacher is required to have additional special skills aimed at organizing educational process taking into consideration the laws of games. “Gamification” is a method that uses the rules of a game to achieve real-world goals. In other words, it makes boring tasks interesting, undesirable things desirable and difficult tasks simple.Nowadays learning process is already partially “gamified”. If a student does an exercise correctly in class, he or she gets a good grade. If the students make a few mistakes, they get a bad grade. At the end of each university year, students move up to the next grade level.

In this study, the authors analyze the application of the specially designed model of the use of educational games for the development of professionally significant qualities in future managers of mining enterprises.

The authors considered the methods of using different types of communicative games to develop communication skills in various situations, including interpersonal, daily and household interactions, as well as situation-based games to improve professional communication abilities.The use of role-playing games in the formation of skills for effective management of a mineral complex is also of great significance.The analysis emphasizes the effectiveness of the implemented model and contributes to the methodology for teaching foreign languages to future engineers and managers at mining industry through the use of gaming technologies. The relevance of this research lies in its potential to enhance the quality of the educational experience for students and contribute to the training of future specialists.

Theoretical background

Teachers at Saint Petersburg Mining University are trying to investigate the questions connected with use of unconventional technologies in foreign languages teaching. “Artificial intelligence tools in teaching a foreign language” are studied by E.N.Nikonova (Nikonova et al., 2023). “Enhanced terminology acquisition” is explored by E.R. Skornyakova (Skornyakova,Vinogradova, 2021: 240). O.Yu. Kharlamova examined “vocational oriented foreign language reading to future oil field specialists” (Kharlamova et al., 2023).

Taking into account above mentioned challenges, the aim of our research is to analyze the formation of communicative skills on professional topics of future managers of mining enterprises through various games in English.

The methodological basis of our research is the works of L.S. Vygotsky (Vygotsky, 1956), the papers of A.A. Leontiev (Leontiev, 2000) and I.A. Zimnya (Zimnya, 1999); as well as the studies of A.A. Verbitsky (Verbitsky, 1991) and D.B. Elkonin (Elkonin, 1978).

The theoretical basis consists of E.I. Passov's methods of teaching successful communication in a foreign language (Passov, 1989), as well as I.L. Bim's "principles of foreign language teaching theory and methodology" (Bim, 1988), leading among which are the following – communicativeness, professional orientation and activity.

The principles and concept of game were defined by C. Salen and E. Zimmerman (Salen, Zimmerman, 2003); five categories of games were classified, and the term gamification was specified by Deterding et al. (Deterding et al., 2011); various terms for description of game-based learning or teaching practices have been investigated by Y. Gao and E. Gee (Gao, Gee, 2023).

The use of the games for overcoming psychological problems, the application of game activity to explain the world around us, and, in addition, the use of them for recreation and as a means of competitiveness were considered in a number of works (Klimova, 2015; Kovalenko, Skvortsova, 2022).

We can find the authorswriting about "the use of game technology for developing lexical skills" (Thiagarajah et al., 2022) and for improving "teamwork, critical thinking and self-learning" (Kapp, 2012). The research of Waluo and Lealwas devoted to the "impact of gamified vocabulary learning" (Waluo, Leal, 2021). Chen analyzed "the necessity to use games for enhancing students' self-organization and personal responsibility for learning outcomes" (Chen, 2018).

It can be concluded that many researchers consider the game as a complex skill inherent in humans since ancient times. Games help to develop intellectual level, improve psychological and personal characteristics, and accordingly are an integral part of the educational process, including foreign language learning.

2.Materials and methods

Our study was conducted from September 2022 to February 2023. The research platform was Saint Petersburg Mining University.This study aimed to compare the effectiveness of a game-based learning approach with a traditional methodology in teaching English to economic students. Two groups, each comprised of 30 students aged 17 to 19 years old with B1 level English proficiency, were selected for this research. The experimental group, consisting of first and second-year economic students of both genders, engaged in an educational program that incorporated communicative, situational, and role-playing games. These games were specifically designed to enhance interpersonal and professional communication skills, as well as to develop managerial competencies relevant to the mineral and raw materials sector. This approach aimed to create a more engaging and interactive learning environment, fostering active participation and collaborative learning. The control group, also consisting of first and second-year economic students with the same characteristics, followed a traditional educational process with minimal use of games. This group served as a baseline for comparison, allowing us to isolate the impact of game-based learning on language acquisition and skill development.

A comprehensive research methodology was employed to gather and analyze data. This included a thorough review of existing literature on the use of creative teaching methods in education, particularly focusing on game-based learning and its implementation in foreign language classes at non-linguistic universities.

The study further analyzed existing classifications of games and explored effective methods and techniques for incorporating game-based learning into the educational process. The study involved close monitoring of both experimental and control groups, including experimental training sessions where the effectiveness of the game-based approach was actively observed and assessed. A questionnaire survey was conducted to gather feedback from participants on their experience and to evaluate the success of the experimental program. Data collected through these methods was processed and analyzed using statistical software such as SPSS 17.0 (IBM) and Microsoft Office Excel 2017.

This enabled us to generate graphs and other visual representations to illustrate the results of the study and draw meaningful conclusions about the relative effectiveness of game-based learning compared to traditional methods. By comparing the outcomes of the experimental and control

groups, this research aimed to provide empirical evidence on the benefits and drawbacks of game-based learning in the context of English language teaching for economic students. The findings could contribute valuable insights for educators and curriculum developers seeking to enhance the learning experience and promote deeper understanding in foreign language classrooms.

To improve the quality of foreign language instruction, we developed a pedagogical model aimed at fostering professional communication skills in a foreign language among students at the Mining University. This initiative was implemented at the Foreign Languages Department of St. Petersburg Mining University, with the collaboration of three faculty members from the department and a representative from Peter the Great St. Petersburg Polytechnic University. The participants included first-year and later second-year students who were pursuing an economic profile. The implementation spanned a year and a half, from September 2022 to February 2023.

The primary goal of introducing this model into the educational framework was to assess whether the integration of game-based learning technologies could significantly enhance the effectiveness of the language acquisition process. We aimed to analyze not only the practicality of using educational games in foreign language instruction but also their impact on student engagement and motivation.

During the pedagogical experiment, various educational games were employed, ranging from role-playing scenarios to interactive language quizzes. These games were designed to simulate real-life professional situations, encouraging students to practice their language skills in a contextual and engaging manner. Furthermore, we incorporated feedback mechanisms to gauge student responses and adapt the games to better suit their learning needs.

Our findings indicated a marked improvement in students' communication abilities and overall language proficiency. The interactive nature of the games fostered a collaborative learning environment, allowing students to build confidence in their language skills. This model not only demonstrated the potential of educational games in enhancing language learning but also opened avenues for further research into innovative teaching methodologies that could be applied across various disciplines.

Table 1. Model of formation of professional communication skills in a foreign language among students of St. Petersburg Mining University with the use of educational games

Modeling of communicative activity in a foreign language	*Purpose and content of professional-communicative training*	*Types of educational games*
The formation of skills to conduct household discussions in a foreign language	Formation of communicative skills of discussions in a foreign language (interpersonal communication at the household level)	Communicative games
The formation of skills to conduct professional discussions in a foreign language	Formation of skills of communicative activity in English for interpersonal communication at the professional level.	Communicative games; situational games
The formation of skills necessary for successful management of mining and mineral raw materials processing enterprises	Formation of skills for managingactivity of an enterprise of the mineral complex with the help of means and methods of a foreign language	Role-playing games

Source: compiled by the authors

The primary aim of implementing this educational model was to assess how the incorporation of games affects the engagement and activation of the learning process among students. We sought to explore whether this playful approach enhances both motivation and the

eagerness to communicate in a foreign language. Additionally, it was crucial to identify which specific types of games could be effectively integrated into textbooks for practical classes, particularly in relation to preparing students for their future careers that require proficiency in a foreign language. In the study, we established a control group that followed a traditional teaching method, utilizing the same lexical and grammatical content as the experimental group. However, the key distinction was the absence of game elements in the control group's tasks. This allowed us to draw clear comparisons between the two groups. Our findings revealed that interactive games not only fostered a more dynamic learning environment but also significantly increased students' willingness to participate and practice their language skills. Furthermore, we discovered that incorporating various game formats – such as role-playing, quizzes, and collaborative challenges – can greatly enhance language retention and practical application, making learning both effective and enjoyable.

Communicative games

Communicative games included tasks such as filling in information gaps, searching for information, guessing sentences, or answering questions. They also had quizzes and questionnaires to test knowledge and understanding. These activities encouraged students to actively participate and motivate them to learn more about unfamiliar topics and events. They also encouraged students to share their knowledge by asking and answering questions and finding missing information.During communicative games, discussions arose due to differences in how information was presented. These differences were based on the significance of the information. In these discussions, participants explained or argued their individual, paired, or group positions.

"Agree or Disagree" activities, which encouraged students to express their opinions using all available language skills, were also a great example of communicative learning.

Situational Games

The use of situational and game-based methods in teaching a foreign language allowed the teachers to engage the students and stimulated their interest in mastering the material. This approach also enabled the teachers to find innovative methods for accessing necessary information, which could generate additional motivation among students, something that they often lacked.

There were various types of scenarios available, including advanced scenarios that provided a brief description and required the students to develop the situation, and complex scenarios that presented a problem that students had to identify and propose solutions for.

When using situational games, participants interacted in an environment that closely resembled real-life communication, with its distinctive features such as emotional engagement and purposeful linguistic structures.

Role-playing games

Using role-play, students enacted fictional scenarios in the form of dialogue or debate. This provided a valuable opportunity for students to enhance their vocabulary and grammatical skills in a range of settings, both in everyday life and in professional contexts such as business meetings and job interviews. A successful role-play scenario required a well-structured plot that served a specific communication goal, as well as a configuration of characters and interactions between the participants. These characters and their interactions could often be complex and contradictory. When students selected a role, they could portray a character or represent themselves in a given scenario.

3. Discussion

The findings of the study revealed a notable enhancement in vocational vocabulary among participants after they engaged in gamified exercises. This aligns with previous research that has demonstrated improvements in lexical skills resulting from the incorporation of gaming techniques into educational settings.

Notably, earlier studies primarily focused on general vocabulary acquisition and utilized gamification tools either in traditional classroom environments (Thiagarajah, 2022) or through specific applications used at home (Waluyo, Leal, 2021). In contrast, the current study employed communicative, situational, and role-playing games, which suggests that varying types of games and learning contexts can significantly contribute to the vocabulary development of engineering students.

An essential aspect highlighted during the experiment was the increase in motivation to learn a language. This finding resonates with other research indicating that games can have a positive influence on student motivation (Kovalenko, Skvortsova, 2022). When students are engaged in an enjoyable and interactive learning experience, they are more likely to participate actively and invest

effort into mastering the material. This motivational boost is particularly crucial in language learning, where consistent practice and engagement are key to achieving proficiency.

Another noteworthy outcome of this study was the increase in the rate of speech among engineering students, a factor that has often been overlooked in previous research on gamification in language education. This innovative approach underscores the potential of gamified learning environments to not only enhance vocabulary but also improve fluency and communication skills. The emphasis on communicative games is particularly important in developing professional skills in English, as effective communication is a vital competency in the engineering field and many other professions.

Furthermore, the study supports the effectiveness of situational and role-playing games in cultivating language skills within authentic contexts. By simulating real-life scenarios, these types of games allow students to practice language use in a manner that mirrors actual professional interactions. This experiential learning aligns with the situational approach to teaching, which emphasizes the relevance of context in language acquisition.

Despite the significant results, the study did have some limitations. The relatively small sample size of 30 students in both the experimental and control groups may have impacted the generalizability and validity of the conclusions drawn. Future research could benefit from larger sample sizes and a more diverse participant pool to further validate the findings.

Additionally, exploring the long-term effects of gamified learning on language retention and application in professional settings could provide deeper insights into its effectiveness. In conclusion, this study contributes to the growing body of evidence supporting the use of gamification in language learning, particularly for vocational contexts such as engineering. By demonstrating improvements in vocabulary, motivation, and speech fluency, it highlights the multifaceted benefits of incorporating games into educational practices. As educators continue to seek innovative ways to engage students, the integration of communicative and role-playing games may prove to be a valuable strategy in fostering language proficiency and professional readiness among students.

4. Results

Our educational experiment at St. Petersburg Mining University showcased the effectiveness of a new pedagogical model that focuses on enhancing students' professionally oriented foreign language communication skills through the use of educational games. The study specifically targeted students preparing for careers in the mineral industry, aiming to improve their English communication abilities.

To evaluate the impact of game-based learning on these students, we conducted a thorough post-experimental assessment comparing the performance of students in both experimental and control groups. Additionally, a questionnaire survey was administered to students in the experimental group to gather their feedback and insights. Throughout our research, we delved into various key indicators that reflect speech skills, such as speech rate, the accurate use of fundamental grammatical structures, and the seamless integration of industry-specific vocabulary.

To process and visualize the gathered information, we utilized computer programs like Microsoft Excel 2017 and SPSS 17.0 (IBM). The data analysis process involved a thorough examination of the distribution of various features, with a focus on key statistical indicators such as asymmetry and kurtosis. These metrics help us understand the overall shape of the distribution curve, providing insights into the data's characteristics.

To present our findings clearly and consistently, we utilized a standardized format that displays values as $M \pm SD$, where M stands for the sample mean and SD represents the sample standard deviation. This format enhances the clarity of our results, making it easier for readers to grasp the central tendency and variability of the data.

To compare averages and evaluate the statistical significance of our findings, we employed several statistical tools. The Student's T-test was particularly useful for analyzing normally distributed data with equal variances, allowing us to draw meaningful comparisons between groups. Additionally, we utilized the paired Student's T-test for related samples, which is essential when assessing the same subjects under different conditions. To further ensure the robustness of our results, we applied Fischer's F-test to examine the equality of variances across groups. Our analysis uncovered statistically significant differences at a significance level of $p < 0.05$, indicating that there is a less than 5 % probability of making a Type I error when rejecting the null hypothesis.

We maintained a consistent application of two-sided tests throughout all analyses, which is crucial for a comprehensive evaluation of the data. This rigorous methodology enabled us to draw strong conclusions about the effectiveness of game-based learning in enhancing professional communication skills among future professionals in the mineral industry.

Moreover, incorporating additional factors such as the type of game-based learning used, the duration of the intervention, and participant demographics could provide deeper insights into the nuances of our findings. Future research could explore these variables to further understand how different approaches to game-based learning impact communication skills development in various contexts.

The statistical analysis of the data gathered during the study revealed that the speech rate in the experimental group was 19 % higher than that of the control group, with a significance level of $P < 0.001$. This notable difference underscores the effectiveness of employing game-based techniques in educational settings, which resulted in nearly a twofold increase in speech rate compared to traditional teaching methods.

Importantly, as the rate of speech improved, there was a corresponding decrease in the number of unnecessary pauses during speech, indicating a smoother and more fluid communication style. When examining grammatical correctness, the experimental group did not show a statistically significant difference from the control group, although there was a noticeable trend favoring the experimental group, with a 9% difference ($P=0.070$). This suggests that while the game-based approach may not have significantly improved grammatical accuracy, it did not hinder it either, allowing students to focus on fluency and expression.

Table 2. The analysis of statistical data in the control and experimental group

Statistical characteristics	*Rate of speech*	*Correct use of grammatical constructions*	*Fluent mastery of professionally oriented vocabulary*	*Lexico-grammatical test*
Control group (n=30)				
M	3,70	3,83	3,83	3,73
SD	0,65	0,75	0,65	0,74
Experimental group (n=30)				
M	4,40	4,17	4,37	4,13
SD	0,62	0,65	0,67	0,57
P	*<0,001*	*0,070*	*0,003*	*0,023*
Difference, %	19 %	9 %	14 %	1 1%

Source: compiled by the authors

Notes: P is the statistical significance of the difference in averages between the control and experimental groups.

Moreover, the experimental group exhibited a statistically significant advantage in their fluency with professionally oriented vocabulary, outperforming the control group by 14 % ($P = 0.003$). This indicates that the integration of game techniques not only enhanced the rate of speech but also enriched the students' vocabulary, which is crucial for effective communication in professional contexts.

A comparative analysis of vocabulary and grammar assessments further corroborated the effectiveness of the proposed teaching model. The experimental group's performance in these assessments was statistically significantly better by 11% compared to the control group ($P = 0.023$), reinforcing the idea that innovative teaching strategies can lead to improved learning outcomes. An essential aspect of successful learning is student motivation. To assess this, a post-experimental survey was conducted to evaluate general learning motivation among students. The results indicated a 14 % increase in motivation levels within the experimental group, in contrast to an 8 % increase observed in the control group. This boost in motivation can be attributed not only to the engaging nature of the subject matter but also to the effective teaching methods employed.

These methods encouraged the development of students' creative and critical thinking abilities, which are essential in today's learning environments. The use of games in education is built on principles of collaboration, teamwork, and active participation, allowing students to engage fully and express their creativity in a dynamic setting.

This approach fosters a sense of community among learners and promotes an enjoyable learning atmosphere, which can significantly enhance the educational experience. Furthermore, the incorporation of game-based learning strategies aligns well with contemporary educational theories that advocate for experiential learning. By allowing students to immerse themselves in practical, real-world scenarios, they can develop not only their language skills but also soft skills such as problem-solving, adaptability, and effective communication. In conclusion, the findings of this study highlight the positive impact of game-based learning techniques on speech rate, vocabulary fluency, and overall student motivation.

The results suggest that such innovative approaches can be instrumental in enhancing the learning process, making it more effective and engaging for students. As educational methodologies continue to evolve, integrating playful and interactive elements into the curriculum may pave the way for more robust and comprehensive learning experiences, ultimately preparing students for success in their professional endeavors.

The evidence presented here advocates for further exploration and application of these techniques in various educational contexts to maximize their benefits.

Table 3. The analysis of the questionnaire survey answers in the experimental group

Question	*Completely disagree*	*Almost agree*	*Completely agree*	*Undecided*
The use of games was useful for memorizing speech material	-	15 (50 %)	12 (40 %)	3 (10 %)
Games help to overcome the language barrier	-	18 (60 %)	11 (36.7 %)	1 (3.3 %)
Game activities influence the development of your attention and memory	1 (3.33 %)	16 (53.33 %)	9 (30 %)	4 (13.33 %)
Game-based foreign language class structure had a greater impact on your motivation to learn a foreign language	-	17 (57 %)	10 (33 %)	3 (10 %)
Games help to improve your reading, writing, listening and speaking skills	-	16 (53.33 %)	10 (33.33 %)	4 (13.33 %)
The use of games improves your understanding of grammar rules and vocabulary	1 (3.33 %)	17 (57 %)	11 (36.6 %)	1 (3.33 %)

As we can judge from the results of the received answers, the most of the respondents consider the use of game technologies appropriate and effective, and,as we can see, it confirms the effectiveness of the use of game-based techniques in foreign language lessons for students of technical universities.

5. Conclusion

The findings from the experimental study clearly indicate that integrating game techniques into the educational framework offers numerous significant benefits. These methodologies not only enhance students' engagement but also empower them to adopt a more proactive stance in their learning journey.

By incorporating elements of play, students are encouraged to confront psychological barriers and language challenges that they might otherwise shy away from. This is particularly crucial for those preparing for careers in the management of enterprises within the mineral and raw materials sector, where effective communication is essential. The enthusiastic participation of students in classes utilizing game-based approaches highlights their increased interest in the

subject matter. This heightened engagement fosters a motivating learning environment, which is instrumental in alleviating common anxieties associated with communicating in a foreign language. As students become more comfortable with these interactions, they experience a decrease in shyness and stress, allowing them to express themselves more freely.

Moreover, the experiment underscored the necessity of employing a variety of game types in foreign language instruction, especially in technical universities. This diversity not only aids in skill development but also equips students with the competencies required for success in the mining industry.

The analysis of the experimental data reveals that the proposed model, which leverages game techniques, enhances students' comprehension of the material while rendering the learning experience more effective and enjoyable.

In addition to boosting motivation, the implementation of game techniques prepares students for real-world scenarios where foreign language skills are crucial. This is particularly relevant in professional communication settings, where clarity and confidence can significantly impact operational success. The positive changes observed in students,including improvements in memory retention, motivation levels, language proficiency, and understanding of grammatical structures, further reinforce the effectiveness of these methods.

Furthermore, the application of game-based learning strategies aligns with contemporary educational theories that advocate for interactive and student-centered learning environments. By fostering collaboration and competition, games can simulate real-life situations, making the learning process more relatable and applicable. This experiential learning approach not only enhances language acquisition but also cultivates essential soft skills, such as teamwork, problem-solving, and adaptability, which are invaluable in the dynamic field of mineral resource management. In conclusion, the integration of game techniques in teaching foreign languages at technical universities is not merely a pedagogical trend; it is a transformative approach that significantly enriches the educational experience. As future specialists in the mining industry navigate the complexities of global communication, these innovative teaching strategies will undoubtedly play a pivotal role in shaping their professional capabilities and confidence.

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