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Telecommunication project methods as an effective tool in modern education

Marina Lebedeva, Vladimir Beketov, Marina Taranova
Department of Internal, Occupational Diseases and Rheumatology, I.M. Sechenov First Moscow State Medical University, Moscow, Russian Federation

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ABSTRACT

This article is devoted to the study of the problem of insufficient involvement of philology students in the educational process, which negatively affects their academic performance. To solve this problem, a telecommunication project was developed and implemented to improve learning efficiency and student engagement. The research was based on a pilot project with one group, and survey methods were also utilized to measure the level of student engagement in the learning process. Statistical analysis results indicate a noticeable improvement in students' academic performance after the implementation of the innovative telecommunication course, with the average score increasing from 75.5 to 80.1, supported by a statistically significant level. Survey data on student engagement demonstrate a high level of positive attitude towards the use of technology in the educational process. The overall trend indicates a positive attitude towards new technologies in education. The practical significance of this article lies in highlighting telecommunication project methods as an effective tool in modern education. Applying the results of this research in educational practice can contribute to the development and implementation of new educational programs based on telecommunication projects.

Corresponding Author:

Marina Lebedeva
Department of Internal, Occupational Diseases and Rheumatology
I.M. Sechenov First Moscow State Medical University
8-2 Trubetskaya Str., Moscow-119991, Russian Federation
Email: malebedeva7@outlook.com

1. INTRODUCTION

With each passing day, technologies are increasingly penetrating the sphere of education, providing new opportunities and challenges for educators and students. In modern education, telecommunication projects are becoming an important element that determines the effectiveness of learning and the development of educational processes [1], [2]. A telecommunication project is oriented towards the development, implementation, or improvement of a communication and data transmission system to ensure effective communication among project participants or users in a broader sense [3]. The topic of telecommunication project methods in education deserves attention and research as it is crucial for adapting educational systems to modern requirements and expectations.

Technological education describes the application of information and communication technologies as a means to enhance teaching and learning outcomes [4]. The essence of telecommunication projects lies in the utilization of information and communication technologies to create and implement educational programs [1]–[3]. This approach provides learners and educators with the opportunity to interact in a virtual environment, overcoming geographical and cultural barriers, and ensuring better access to education for

individuals with limited mobility. It contributes to the creation of a global educational community where knowledge exchange becomes more open and accessible. Such projects can be implemented in various sectors, including business, education, healthcare, and the public sector. They are aimed at ensuring effective communication and data transmission in modern information societies [1]. However, despite all the advantages, telecommunication project methods in education also face certain challenges and issues. An important aspect is not only the technical but also the pedagogical readiness of students and teachers to use modern technologies for educational purposes [5]. It is necessary to equip learners with the competencies required for effective technology utilization and to develop teaching methodologies that best fit into the context of telecommunication projects [5]–[7]. Attention should also be paid to the quality and safety of education in the digital environment. With the proliferation of online information, there is a need to develop critical thinking skills and source evaluation among learners [2], [8]–[10]. Additionally, issues of confidentiality and data protection require serious attention to ensure the security of the learning process. This article addresses the challenge of ensuring the technical and pedagogical readiness of students and instructors for the utilization of contemporary technologies in educational contexts. Its focus lies in the development of telecommunications projects aimed at enhancing the learning process and engaging students, necessitating the preparation of educational participants for the effective utilization of such technologies.

The relevance of this article is determined by the rapid development of information technologies and their influence on educational systems. Research into telecommunication project methods in modern education aims to identify optimal strategies for integrating technologies, maximizing their benefits, and minimizing potential negative consequences. The motivation for writing this article is based on the need to expand knowledge and understanding in the intersection of education and telecommunications.

This article makes a significant contribution to the field of education, specifically regarding the utilization of telecommunications projects to enhance the effectiveness of the learning process and engage students. Research has shown that the implementation of telecommunications projects in education has a certain positive impact on teaching effectiveness. The application of such projects significantly increases student engagement and facilitates a deeper comprehension of the educational material. The practical significance of the article lies in the opportunity for more effective use of telecommunications in education to stimulate activity and deep understanding of the material. The research contributes methodologically to the study of the effectiveness of educational programs using innovative technologies. A comprehensive approach to teaching and combined analysis of results can serve as a model for future research in the field of pedagogy and education.

In the context of rapid advancements in modern technologies and societal globalization, education must respond to new challenges and demands. Traditional teaching methods often prove insufficient in preparing students for the realities of the contemporary world, where telecommunications technologies play a pivotal role. Thus, the motivation behind this article lies in the necessity to investigate the effectiveness of a systematic approach to adapting telecommunications project-based methods in modern education. This endeavor not only aims to enhance the quality of the learning process but also to contribute to the development of the educational system as a whole, ensuring its alignment with contemporary technological and social challenges. The research hypothesis posits that a systematic approach to adapting telecommunications project-based methods enables a more effective integration of modern communication technologies into educational practice, thereby enhancing the quality of education.

The study aimed to present the results of a pilot study on the effectiveness of the developed telecommunication project. The goal of the pilot study is to implement telecommunication technologies into the educational program of philology students. The objectives of the study are: i) to develop a telecommunication project for philology students; ii) to assess the effectiveness of the developed telecommunication project; and iii) to measure the level of engagement of participants in innovative learning.

2. LITERATURE REVIEW

In the contemporary educational landscape, innovative communication technologies (ICT) play a pivotal role in ensuring effective learning and interaction [6], [11], [12]. Teaching methods based on innovative projects have become an integral part of pedagogical strategy, providing unique opportunities for the development of communication skills, knowledge exchange, and global collaboration [13]. In this context, the adoption of telecommunication project methods in modern education represents a relevant and promising direction that warrants careful consideration and investigation. There is recognition that telecommunication projects can significantly enrich the educational experience. Research conducted in various countries around the world emphasizes that the use of virtual environments and technological platforms for educational purposes contributes to a deeper understanding of the material and the development of critical thinking skills among students [14], [15].

Telecommunication projects in education represent an innovative method based on the utilization of communication tools and information technologies to organize the learning process [1], [3], [9]. These projects not only deepen students' understanding of subjects but also stimulate the development of their communicative and collaborative skills [8]–[10]. Several studies underscore the enhancement of educational process effectiveness through telecommunication projects [2], [9], [10]. This is attributed not only to the accessibility of a wide range of educational resources but also to the opportunity to participate in global educational research projects. It is also noted that the use of communication tools enhances international educational initiatives and creates unique opportunities for students to broaden their cultural horizons [8]. Successful integration of telecommunication projects into educational programs requires educators to be flexible and innovative [3], [8], [10]. They emphasize the importance of continuously updating teaching practices in line with the rapidly changing technological environment. However, discrepancies in theory and methodology pertain to issues regarding the preparation of educational personnel for the effective utilization of technologies in teaching [16]. Some research indicates insufficient attention to the professional training of teachers for work in the digital educational space [7], [17]. Professional communities in these countries actively discuss the need for the implementation of new teaching standards for teachers so that they can effectively integrate technologies into their pedagogical practice. Other studies have shown that teachers undergo continuous training throughout the academic year and demonstrate skills in specific areas of digital teaching competence, such as security and communication, although there is still a deficit in the creation of digital content [16].

Thus, there are gaps in research concerning the quality of education in the online environment [5], [7], [18]. Despite several positive aspects, challenges exist in the implementation of telecommunication projects [19], [20]. The study highlight issues of technology accessibility and the necessity to ensure quality learning in conditions of remote communication. Despite the growing number of online courses and distance programs, there is a lack of a unified methodology for assessing their implementation effectiveness. This necessitates deeper research into evaluation criteria and quality standards in online education. Limitations in existing research lie in the fact that most works focus on technological aspects, leaving aside questions of pedagogical methodology and adaptation to cultural context [2], [7], [18], [20]. This creates problems in realizing the potential of technologies in education. The new educational landscape requires a series of measures to be taken, including the need for training specialists in education to facilitate the assimilation of the current context, highlighting online learning and ICT [21], [22].

In the contemporary educational context, the relevance of the study is justified by the necessity of integrating innovative technologies to improve learning. The development of digital and interactive tools creates a demand for effective educational strategies. The novelty of the article lies in proposing a comprehensive approach to the adaptation of technologies, in the active utilization of telecommunication technologies in the educational process. This aspect endows the work with originality and presents interest in the development of future educational programs.

3. METHOD

3.1. Study design

The study was based on a pilot project involving one group. This approach was chosen for the systematic examination of the impact of the telecommunication project on the effectiveness of the educational process. This method allows for the assessment of changes in knowledge levels within one group before and after the implementation of innovative learning. Additionally, it enables the systematic investigation of the project's impact and the testing of hypotheses regarding the improvement of educational quality. Furthermore, a survey method was utilized in the study to measure the level of student engagement in the learning process.

3.2. Participants

The study involved 112 students recruited from three higher educational institutions in Russia, all enrolled in the first or second year of the philology program. The participating institutions were the Linguistics Faculty of Sechenov University, the philological faculties of the State Academic University for the Humanities (GAUGN), and the Russian State Social University (RSSU) Moscow. The advertisement was disseminated within the universities informing students about the upcoming experiment; the primary selection criterion was enrollment in the philology program, alongside informed voluntary consent from the students. Participants were selected voluntarily, demonstrating readiness to actively engage in the experiment and adhere to the proposed learning program. Criteria for exclusion from the study included students from other majors and those who did not consent to participate. The average age of participants was 19 years old, with males comprising 37% of the sample and females with 63%. Additionally, six educators participated in the study. These instructors were highly qualified specialists in the field of philology, holding master's degrees and possessing over seven years of teaching experience. They developed the educational program, conducted the training sessions, and assessed the participants' knowledge and skills.

3.3. Procedure

The study was conducted among philology students from the aforementioned universities over 12 weeks. Students underwent training based on a systemic approach to adapting telecommunications to enhance the effectiveness of the educational process. Students were from various courses, and their initial assessment of knowledge and skills was based on their performance in the first semester of specific philology subjects. Subsequently, the participant group was provided with a training program based on a systemic approach, encompassing the fundamentals of philology. The systemic approach to the research involves a comprehensive examination of the problem of effectively integrating telecommunications into educational practices. This entails addressing various aspects such as technology, educational practices, and students' needs, which influence the successful adaptation of telecommunications to educational practices. Students received specific assignments for independent work, followed by presentations utilizing various online technologies. The estimated preparation time was 90-100 minutes per week. The program covered diverse topics related to linguistics, literature, and other aspects of philology as presented in Table 1.

Upon completion of the training, a reassessment of the level of knowledge and skills in the group was conducted. For each practical session, students received scores from educators; the end-of-course grades were aggregated and divided by the number of practical assignments, resulting in educators obtaining an average score for innovative teaching for each participant. The results underwent statistical analysis to identify differences in student achievements. Additionally, at the end of the training, a survey was conducted to assess engagement in the learning process using a 5-point scale questionnaire, as shown in Table 2.

Table 1. Training program on the project "Philology 2.0: telecommunication learning"

Module	Lectures	Learning content	Practical assignments	Innovative technologies
Introduction to digital resources	Definition of philology and its branches. Analysis of linguistic units in literary texts.	Foundations of using electronic libraries, databases, and online archives to search for literary works.	Skills in searching, filtering, and analyzing information through electronic libraries and online archives.	Interactive electronic textbooks, online discussions and forums, virtual tours and excursions, utilization of artificial intelligence.
Linguistics and technologies	Philosophical aspects of language. Basics of semiotics and its application in philology.	Application of linguistic tools in a digital environment.	Utilization of linguistic programs and online resources for analyzing semiotic aspects of texts.	
Literary studies and interactive resources	Linguistic interpretation of literature. Stylistics and lexical choice in literary works.	Integration of literary studies with virtual libraries and multimedia resources.	Creation of an interactive educational resource on a literary work.	
Interactive webinars and discussions	Comparative literature and cultural studies: principles of comparative analysis in literature, the influence of cultural context on literary movements.	Regular meetings - webinars with invited experts, discussing current issues and trends in philology.	Formation of virtual clubs for discussing literary and linguistic aspects.	
Technological tools for independent research	Principles of textual criticism: analysis of manuscripts and printed texts. Basics of text editing and proofreading.	Providing access to specialized platforms for literary studies.	Utilization of online platforms for creating interactive tasks in linguistics and literary studies.	

Project objective: to develop and enhance the educational process for philology students through the utilization of contemporary telecommunication technologies.

Table 2. Survey for measuring students' engagement level in technology-enhanced learning

No.	Survey questions
1.	Technologies used in the educational process make learning more interesting and engaging.
2.	I prefer using digital resources (e-books, video tutorials, telecommunication projects) instead of traditional educational materials.
3.	The use of online platforms for learning gives me more flexibility in the educational process.
4.	I actively participate in discussions and virtual lessons conducted using technology.
5.	Interactive teaching methods, such as webinars and virtual lectures, enhance my understanding of the study material.
6.	I believe that the use of technology in the educational process helps me better prepare for my future profession.
7.	The opportunity to use mobile learning applications is an important aspect of the educational process for me.
8.	I am willing to use new technologies, even if they require additional effort to learn.
9.	Electronic libraries and resources help me complete educational tasks more efficiently.
10.	I feel that technology in education makes the learning process more modern and relevant.

Rate the level of agreement with the statements using a scale from 1 to 5, where: 1=Strongly disagree; 2=Disagree; 3=Neutral; 4=Agree; 5=Strongly agree

3.4. Data collection and analysis

Surveying to measure engagement was conducted online using the Google Forms platform. Participants had a limited time to complete the test-30 minutes. The frequency of students' responses to the questionnaire was recorded in the SPSS program by assigning the highest score of 1 (5/5=1) "very good" and 0.8 (4/5=0.8) "good", and so on.

To determine the internal consistency and reliability of the questionnaire, Cronbach's alpha coefficient was used. This allows assessing the extent to which the internal elements of the tests are interrelated and homogeneous. The methodology is considered reliable as the obtained indicator is not lower than 0.77. To test the validity of the methodology, the concordance coefficient was chosen. The coefficient takes values not lower than 0.61, indicating a good level of validity of the methodology.

Data analysis was performed using the statistical package statistical package for the social sciences (SPSS) version 25.0. This tool allows for efficient processing and analysis of large volumes of data. To evaluate the statistical significance of differences in academic performance between students before and after the implementation of the new program, Student's t-tests will be used. A student's t-test is a statistical method used to determine if there are statistically significant differences between the means of two independent samples. Shapiro-Wilk assured the authors that there were no grounds to reject the null hypothesis that the data are normally distributed.

3.5. Ethical issues

This study was designed and conducted following approval from the administrations of the educational institutions. A research protocol was developed, which all participants and administrators followed prior to the commencement of research activities. Participation in the study was carefully coordinated with all participants. Personal data of participants were anonymized to other participants in the research process.

4. RESULTS AND DISCUSSION

4.1. Academic performance of students

Before the experiment, the baseline knowledge of philology students was assessed based on their grades from the first semester of study without innovative technologies. Statistical analysis indicated that the group of students (N=112) had a similar level of baseline knowledge before intervention (mean score: X=75.5, SD=4.6). The student group underwent an intensive telecommunication course, which included virtual tours, interactive textbooks, online discussions, and multimedia projects. Upon completion of the course, educators tallied and calculated the average scores of the students to gauge the level of material assimilation and changes in their knowledge. Statistical analysis revealed a significant improvement in the average score after experimental instruction (mean score: X=80.1, SD=5.2). The students' average academic performance increased by 4.6 points, which was supported by a statistically significant level. All these data are presented in Table 3.

Table 3. Academic performance of students

Group	Number of participants	Average test score							
		Before studying	SD	t-criteria	P-value	After studying	SD	t-criteria	p-value
Students	112	75.5	4.6	2.3	0.033	80.1	5.2	3.8	0.029

4.2. Student engagement

The values from Table 4 suggest that students generally have a positive attitude towards technology in the learning process and exhibit a high level of engagement. On average, students agree that the use of technology adds interest and excitement to the learning process, with little variability in responses. Additionally, students prefer the use of digital resources such as e-books, video lessons, and telecommunication projects, highly valuing their effectiveness in the learning process. Students believe that the use of online platforms adds more flexibility to the learning process, although there is some variability in ratings.

Research participants are generally actively involved in discussions and virtual lessons, but there is greater variability in responses, which may indicate differences in levels of engagement. Interactive teaching methods, such as webinars and virtual lectures, are perceived by students as contributing to a better understanding of the study material. Overall, students are willing to embrace new technologies, even if it requires additional effort to learn. Electronic libraries and resources are seen by students as a means to more effectively complete academic tasks, as they perceive that the use of technology makes the learning process more modern and relevant, and they rate this aspect highly. These results indicate a general positive trend towards the use of technology in the learning process and high student engagement.

Table 4. Student engagement

	Question	Mean	SD
1.	Technologies make learning interesting.	4.2	0.8
2.	Preference for digital resources.	4.5	0.7
3.	Flexibility in using online platforms.	4.0	0.9
4.	Active participation in discussions and virtual lessons.	3.8	1.0
5.	Interactive methods contribute to understanding.	4.4	0.6
6.	Technologies help prepare for future professions.	4.3	0.7
7.	Importance of mobile applications.	3.9	0.8
8.	Willingness to use new technologies.	4.1	0.9
9.	Electronic libraries and resources.	4.2	0.7
10.	Technologies make the learning process modern.	4.6	0.5

Innovative education constitutes an integral part of advancing innovative teaching practices and entrepreneurship [23]. The primary goal of modern education is to educate young people to become responsible members of society in the coming years: the youth of this generation should have the opportunity to play an active role in shaping the future. However, through traditional teaching methods, this goal may not be fully achieved - there is a need to integrate cutting-edge technologies, such as telecommunication projects, IoT, cloud computing, artificial intelligence, and machine learning, into the educational process to develop sustainable entrepreneurial practices aimed at achieving a better future [23].

One of the aims of a particular study was to analyze the correlation between teachers' perceptions of technological innovations, organizational innovation climate, and innovative teaching using information and communication technologies (ICT) in Taiwan [24]. Participants responded to a questionnaire using a five-point Likert scale for each factor, and their responses were analyzed using structural equation modeling (SEM). The study under consideration revealed that the organizational innovation climate and the adoption of technological innovations are significantly and positively associated with innovative teaching using ICT. In our study, students generally agree that the use of technology enhances interest in the learning process, and they also noted that technology makes the learning process more modern and relevant.

Another factor to consider is teachers' self-perceived need for training in the use of new technologies. In this regard, a previous study indicated that 50.0% felt a moderate need, while 37.0% reported a high need [25]. Additionally, the study found that respondents who reported low competence in digitalizing teaching demonstrated a statistically significantly higher need for training. Although this study did not investigate teachers' perceptions of innovative technologies, the examination of student engagement conducted in this work revealed that the use of technology enhances students' interest and engagement in the learning process, and innovative technologies are perceived by students as contributing to a better understanding of course material. From these findings, it can be inferred that teachers need to undergo training and utilize ICT in the educational process to increase students' interest, motivation, and engagement.

In another study, an innovative technology was utilized: 3D holographic technology [26]. The results demonstrated that 3DHT has a significantly positive impact on student learning (SMD=0.835, 95% CI [0.516, 1.153], p=0.000). The findings of this study align with those of this research, as the innovative teaching methodology we employed—a telecommunications project—also showed a positive effect on student learning: their academic performance increased by 4.6 points after innovative teaching.

To address the fundamental issue of the increasing volume of knowledge versus the limited number of instructional hours within engineering curricula, the authors of a study developed and implemented a telecommunications engineering conveyor for communication networks as a case study within the telecommunications engineering program [27]. This conveyor adheres to a problem-oriented design, as the courses within it are closely interrelated, providing a deep theoretical foundation and practical practices aligned with a culminating project. This ensures that students must develop systemic capabilities to design a communication system, component, or process that meets specifications by applying what they have learned in this telecommunications engineering pipeline. The results indicated positive student feedback regarding the implementation of such a telecommunications engineering conveyor for communication networks [27]. Both in our study and in the study concerning the telecommunications engineering conveyor, the application of telecommunications projects led to positive outcomes, such as increased student engagement and improved academic performance. In both instances, students rated the implementation of innovative approaches in the educational process positively.

Another study addresses the issue of using project-based methods in foreign language education [28]. According to the findings, the project method serves as an educational tool to activate cognitive activity, develop creativity, and foster certain personal qualities. It predicts student cognitive activity, problematizes educational material, connects learning with students' life experiences, and organizes learning as an activity. Furthermore, the use of this method allows for a departure from authoritarian teaching styles and reorients

student work towards independence, with an emphasis on research, exploratory, and creative activities. In this research, as well as in the study on foreign language education, the use of a project-based approach facilitated the development of student independence and creativity, as well as their cognitive activity.

Telecommunications standards have become a reliable mechanism for strengthening collaboration between industry and research institutions to accelerate the evolution of communication systems [29]. The article describes a methodology for teaching wireless communication standards. Through software-defined radio technology, the authors outline a practical learning environment that facilitates the development of numerous essential technical and programming skills without inherent difficulties and costs. The telecommunications environment is portable and can be easily replicated in other educational institutions and adapted to their educational needs and constraints. Similarly to our research, this study emphasizes the importance of telecommunications technologies in the educational process. Technologies play a key role in creating an effective learning environment that promotes the development of critical skills and enhances educational quality.

Another study aimed to examine the impact of intranet and telecommunications tools among administrative staff in vocational education institutions in higher education institutions in Cross River State, Nigeria [30]. The analysis results showed that the presence of intranet and telecommunications tools in higher education institutions in Cross River State has a significant impact on organizational effectiveness among the administrative staff of vocational training institutions. Based on the research findings, the following recommendations were made that management should ensure the proper provision of intranet services, such as local area networks (LAN), for the rapid dissemination of information for decision-making, and telecommunications tools, such as telephones and fax communication, should be provided by the government to all administrative managers to ensure swift and effective communication among staff. Our research aligns with these findings, as both studies demonstrate that telecommunications technologies can significantly influence operational efficiency, whether in the educational process or in the organizational effectiveness of administrative staff. In both cases, the use of telecommunications tools leads to improved overall effectiveness and work outcomes. Thus, the utilization of innovative technologies to enhance the quality of education should primarily adopt a theoretical nature, encompassing the acquisition of contemporary knowledge and skills necessary for the successful conduct of educational activities, as well as the integration of educational forms, methods, and tools into the pedagogical process [31]. Illustrated through the field of pedagogical sciences, theoretical knowledge can be employed through methodically grounded innovative educational technologies, capable of promptly addressing the tasks of fully conveying theoretical knowledge to students and independently applying the knowledge acquired from them in practice.

4.3. Limitations

This experiment was conducted among three educational institutions in the country; therefore, the results cannot be generalized to the entire nation. Gender was not considered during the experiment. Additionally, the number of participants was small. Additionally, the participation of only one group, rather than a comparison between two groups, could have influenced the results. These factors could be addressed in future research, including assessing the sustainability of improvements in academic performance and student engagement in the long term and comparing the effectiveness of technological education with traditional methods to identify best practices.

5. CONCLUSION

During the study, it was found that the application of the telecommunication projects method in modern education undeniably positively impacts the effectiveness of learning. The implementation of telecommunication projects significantly enhances students' engagement and depth of material comprehension. Statistical analysis demonstrates a notable improvement in students' academic performance following the integration of the innovative telecommunication course - the average score increased from 75.5 to 80.1, substantiated by a statistically significant level.

The results of the student engagement survey indicate a high level of positive attitudes toward technology in the educational process. Students actively endorse the utilization of digital resources, online platforms, and interactive teaching methods. The overarching trend suggests a favorable perception of new technologies in education.

The scientific significance of the findings lies in expanding the theoretical understanding of the impact of telecommunication projects on the educational process. The research confirms the influence of innovative technologies on academic performance and student engagement. The practical value is expressed in the potential for more effective utilization of telecommunications in education to stimulate activity and deepen material comprehension. The research results can be utilized in the development and implementation of educational programs utilizing technology to enhance students' academic performance, and programs

incorporating virtual excursions, interactive textbooks, and multimedia projects may be effective in increasing knowledge levels.

The results provide data for further research in the optimization of technology-based educational strategies. They can inform the development of educational programs focusing on telecommunication projects and serve as a basis for modifying teaching methods in various subject areas. The principles and technologies successfully applied in the study can be adapted for corporate educational programs, improving learning effectiveness. Further research can deepen understanding of how specific parameters of telecommunication projects influence learning in different contexts. It is important to consider adapting the method for different age groups and types of learning.

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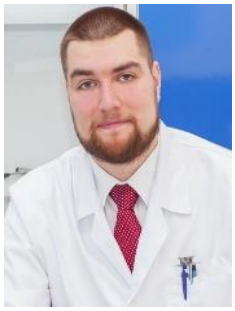
BIOGRAPHIES OF AUTHORS

Marina Lebedeva is MD, PhD, currently works as an associated professor at the Department of Internal, Occupational Diseases and Rheumatology, I.M. Sechenov First Moscow State Medical University, Moscow, Russian Federation. Her research interests include: modern teaching methods, online education, educational process. She can be contacted at email: malebedeva7@outlook.com.



Vladimir Beketov is MD, PhD, currently works as an associated professor, Chair of Department of Internal, Occupational Diseases and Rheumatology, I.M. Sechenov First Moscow State Medical University, Moscow, Russian Federation. His research interests include: modern teaching methods, innovative technologies, technological education. He can be contacted at email: vlbeketov@outlook.com.

Marina Taranova is MD, PhD, currently works as an associated professor at the Department of Internal, Occupational Diseases and Rheumatology, I.M. Sechenov First Moscow State Medical University, Moscow, Russian Federation. Her research interests include: modern teaching methods, online education, technological education. She can be contacted at email: mataranova@outlook.com.