

Как да мотивираме чуждестранните студенти в обучението по химия в медицински университет?

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How to motivate foreign students to study chemistry at a medical university?

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Abstract:

The importance of implementing innovative strategies to sustain student motivation and educational quality is crucial for positioning Bulgaria as a destination where affordable, high-quality English-language medical education can be obtained.

In their first semester at a medical university, students are required to study chemistry, which serves as the basis of clinical disciplines such as toxicology and clinical laboratory. This report highlights our experience with implementing innovative methods for teaching foreign students. Students are provided with an original scientific article that combines both chemistry and clinical subjects. This is also their initial experience engaging with scientific literature as future physicians. Students are tasked with analysing and making a presentation based on the article. To analyse student performance, we conducted a survey in combination with an analysis of current control and final exam results.

Keywords: chemistry, medicine, medical university, motivation, teaching methods

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ВЪВЕДЕНИЕ

Currently, more than 6000 foreign students are enrolled in medical education at six Bulgarian medical universities, highlighting Bulgaria's attractiveness as an educational destination where affordable high-quality medical education can be obtained. These high results are based on the historical traditions in Bulgarian medical education, high academic standards, and universities' competitiveness in the global education market. Moreover, the growth in foreign student enrollment improved Bulgarian universities' positions in international university ranking systems, enhancing their international recognition. These successful results completely coincide with the goals and policies set in higher education strategies and policies ¹.

To maintain success, it is also necessary to respond to the challenges that appear. One of the biggest issues facing education in the digital era is the adoption of innovative teaching methods and strategies. These methods must provide high-quality, English-taught medical education with an emphasis on problem-solving studies and build interdisciplinary relationships between preclinical and clinical disciplines. Moreover, these methods need to motivate students to achieve higher learning goals ².

Medicine is a master's degree program, full-time education, which has been studied for 6 years (10 semesters plus a 12-month prediploma clinical clerkship).

Specialty "Medicine" is a regulated profession from professional direction 7.1. Medicine, area of higher education 7. Health care and sports. In the Faculties of Medicine (FM) of the Medical Universities, the training for acquiring higher education in

the specialty "Medicine", educational qualification degree "master's degree", with the professional qualification "master's doctor" is conducted in accordance with the Law on Higher Education and the Ordinance on the Uniform State Requirements for the Acquisition of Higher Education in the Specialties of "Medicine" and "Dental Medicine" and "Pharmacy" for an Educational Qualification Degree master's degree.

Studied disciplines are subdivided into preclinical (chemistry, biophysics, biochemistry, etc.) and clinical (toxicology, anaesthesiology, etc.). Chemistry is an obligatory, preclinical discipline that is studied in the first year for one semester. Learned knowledge is crucial for various preclinical and clinical disciplines, such as biochemistry, clinical chemistry, toxicology, and so on. Despite the obligatory chemistry admission exam, students have different levels of chemistry knowledge and practical experience.

Teaching chemistry at medical universities has its own challenges³. Herein, in an attempt to answer the main question: "How to motivate foreign students to study chemistry at a medical university?", we propose an innovative educational approach that is used at the Medical University of Plovdiv. To shed more light on the effect of the proposed educational method on students' motivation, we analysed students' expectations and learning outcomes.

ИЗЛОЖЕНИЕ

The study was conducted at the Medical University of Plovdiv in Bulgaria during the winter semester of the academic year 2023/2024. In the initial research group, twenty-two foreign students studying chemistry were enrolled. The overall process was subdivided into the following steps: Step 1. After inviting students to participate in the study, the following requirements for participation were established: 1) they must have successfully passed the first colloquium, and 2) they were informed that participating in the research would not result in extra marks for their overall academic performance. Enrolled students answered the questionnaire on the SurveyMonkey platform. They can choose to work individually or in small groups of two to three students. Step 2. The training focused on how to work with scientific databases and scientific literature. This training tried to explain to students the following: (1) What is an original scientific article? (2) What are the different types of academic papers? (3) How can scientific articles be read? (4) What are the Scopus, Web of Science, and PubMed databases? (5) How can keywords be searched in these databases? (6) How can a bibliography be formatted? (7) What subtleties can be applied to the search for and processing of scientific information? Step 3. By searching scientific databases, enrolled students were asked to find a research paper that combines the chemical knowledge studied in a chemistry course with practical application in a clinical discipline. Step 4. Paper selection- After their work with the databases, together with the teaching assistant, students selected a suitable scientific paper that combines elements of both clinical and preclinical disciplines. Step 5. Paper study and presentation- Based on the selected paper, students prepared and presented a short 10-minute presentation.

To evaluate the impact of the newly proposed teaching method on student motivation and expectations, we analysed the data obtained from a questionnaire-based survey and students' academic performance.

The sociodemographic characteristics of the respondents are shown in Table 1. All respondents confirmed that they were first-year medical students at the Medical University of Plovdiv, Bulgaria. This study included 22 first-year foreign medical students: 10 were male and 12 were female. Almost one-third were from Germany (31.8%), and the remaining 22.7%, 13.6%, 13.6%, and 4.5% were from Greece, the UK, Italy, and Bulgaria, respectively. Only 4.5% indicated that they had lived in another country from the European Union, while 9.1% lived in a country outside the European Union.

Table 1. Sociodemographic characteristics of the study participants (n=22).

Demographic characteristics		n	%
Gender	Women	10	45.5%
	Men	12	54.5%
Country of origin	Bulgaria	1	4.6%
	Italy	3	13.6%
	Germany	7	31.8%
	UK	3	13.6%
	Greece	5	22.7%
	Turkey	0	0%
	Other country from European Union	1	4.5%
	Other country outside European Union	2	9.1%

A greater percentage of the students had graduated from high school (86.4%) or college (13.6%). Approximately one-quarter of the students (22.7%) stated that they had prior experience in the natural sciences; the remaining students had different educational backgrounds. Most of them (90.9%) indicated that they had studied chemistry in a previous stage of their education. Furthermore, more than half of them stated that they self-assessed their chemistry knowledge before entering university as medium (45.5%) or higher than medium-good (18.2%) or excellent (13.6%).

Table 2. Background of the respondents (n=22).

Question	Answers	n	%
What is the level of your previous education?	High school	19	86.4
	College	3	13.6
	University	0	0
	None of the above	0	0
What is the field of study in your previous education?	Natural sciences	5	22.7
	Technical sciences	0	0
	Humanities	1	4.5
	Social sciences	0	0.00
	Economics and business	1	4.5
	Language school	0	0
	None of the above	15	68.2
Have you studied chemistry in your previous education?	Yes	20	90.9
	No	2	9.1
How would you rate your knowledge in chemistry before you entered university?	Very low	3	13.6
	Low	2	9.1
	Medium	10	45.5
	Good	4	18.2
	Excellent	3	13.6

Of the 22 students who applied for participation, 18 (82%) successfully prepared and defended their presentations. There were 211 students from the chemistry course.

Enrolled in the study group had an average result of 4.50 ± 0.99 , whereas the other results indicated an average of 3.01 ± 1.36 . During the second colloquium, the group's average score was 4.17 ± 1.65 , while the other students' average score was 3.12 ± 1.42 . In the study group, 72.2% (13/18) passed the second colloquium, while the remaining students passed at almost 46.2% (90 out of 211). As a result, a greater number of students who enrolled in the study group passed the first and second colloquiums.

The analysis of the results from the exam session revealed that the final grade for those with presentations was 4.67 ± 1.08 , while the remaining students scored 4.00 ± 1.34 . All students of the study group and 126 (70.8%) out of the rest 178 students passed the exam in the regular session

Generally, students who took part in the study had higher success rates and passed the tests and the exam with better results than did the other students.

Table 3. The results from colloquiums and final exam.

Student performance		Passed		Results	
		n	%	Average Result	STDEV
Colloquium 1	Enrolled students	18	100	4.50	0.99
	Not enrolled students	80	41.2	3.01	1.36
Colloquium 2	Enrolled students	13	72.2	4.17	1.65
	Not enrolled students	90	46.2	3.12	1.42
Final exam	Enrolled students	18	100	4.67	1.08
	Not enrolled students	126	70.8	4.00	1.34

This comprehensive analysis of the results from the current semestrial work and final exam showed that the implementation of scientific articles had a positive impact on students' motivation and learning outcomes. The students achieved better results on the second colloquium, final exam, and overall results.

We conducted a survey using a Likert scale to measure the motivation of the respondents to participate in additional seminars and classes in chemistry. The respondents were asked, "How would the following factors influence your motivation to participate in additional seminars and classes in chemistry?". They had to choose the answer to each option according to how much it would influence their motivation to participate in additional chemistry classes and seminars. The scales ranged from 1 (it would not influence my motivation) to 5 (it would significantly influence my motivation). The results are presented in Table 4.

Table 4. Analysis of the motivation measurement of the respondents.

N	Statement	It would not influence my motivation		Insignificant effect		Neutral effect		Moderate effect		It would significantly influence my motivation		Data	
		n	%	n	%	n	%	n	%	n	%	Total	Mean
1	Better understanding chemistry	0	0	0	0	3	13.6	5	22.7	14	63.6	22	4.50
2	New social contacts	0	0	1	4.6	4	18.2	12	54.6	5	22.7	22	3.95
3	Participation in scientific conferences for students	0	0	0	0	3	13.6	8	36.4	11	50.0	22	4.36

**ВТОРА НАЦИОНАЛНА НАУЧНО-ПРАКТИЧЕСКА КОНФЕРЕНЦИЯ
ДИГИТАЛНА ТРАНСФОРМАЦИЯ НА ОБРАЗОВАНИЕТО –
ПРОБЛЕМИ И РЕШЕНИЯ**

4	Higher grade in the final chemistry exam	1	4.6	1	4.6	2	9.1	8	36.4	10	45.4	22	4.14
5	Future perspectives for research in chemistry and medicine	0	0	1	4.5	3	13.6	4	18.2	14	63.6	22	4.41

Additional chemistry seminars and classes have a significant impact on student motivation: (1) to better understand chemistry (mean=4.50), (3) to participate in student scientific conferences (mean= 4.36), (5) to consider future perspectives for research in chemistry and medicine (mean=4.41), and (4) to achieve a higher grade on the final chemistry exam (mean=4.14). On the other hand, the possibility of making new social contacts had a moderate effect on the motivation to attend additional chemistry seminars and classes (2) (mean=3.95). Moreover, the relatively low variability between items (1, 2, 3, 5) suggested moderate agreement within the group, while (3) demonstrated a high level of diversity within the group.

ЗАКЛЮЧЕНИЕ

Motivating students in the current digital era of education is a complex task. Based on the overall results from this study, applying the proposed new pedagogical approach to the chemistry education of foreign students in medical universities leads to the integration of knowledge from chemistry courses with other preclinical and clinical disciplines and the creation and development of skills for searching different scientific databases; as a result, this approach leads to the improvement of the soft skills of students. Moreover, this approach can be used as an addition to the existing teaching methods, additionally motivating students to achieve better learning outcomes.

ЛИТЕРАТУРА

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