

Original article

## Are we ready to implement the *Flipped Classroom* in medical education? Insights from students' perspectives: A Cross-Sectional Study

**Dragan Spaić<sup>1</sup>, Srdjan Mašić<sup>1</sup>, Dejan Bokonjić<sup>2</sup>, Nina Rajović<sup>3</sup>, Zoran Bukumirić<sup>3</sup>, Nada Avram<sup>4</sup>, Vladimir Milutinović<sup>5</sup>, Jelena Vladičić Mašić<sup>6</sup>, Jovan Kulić<sup>1</sup>, Radenko Čančar<sup>7</sup>, Nataša Milić<sup>3</sup>**

<sup>1</sup>University of East Sarajevo, Faculty of Medicine Foča, Department of Primary Health Care and Public Health, Foča, Republic of Srpska, Bosnia and Herzegovina

<sup>2</sup>University of East Sarajevo, Faculty of Medicine Foča, Department of Pediatrics, Foča, Republic of Srpska, Bosnia and Herzegovina

<sup>3</sup>University of Belgrade, Faculty of Medicine, Institute of Medical Statistics and Informatics, Belgrade, Serbia

<sup>4</sup>University of East Sarajevo, Faculty of Medicine Foča, Department of Ophthalmology, Foča, Republic of Srpska, Bosnia and Herzegovina

<sup>5</sup>University Clinical Center of Serbia, Clinic for Eye Diseases, Belgrade, Serbia

<sup>6</sup>University of East Sarajevo, Faculty of Medicine Foča, Department of Internal Medicine, Foča, Republic of Srpska, Bosnia and Herzegovina

<sup>7</sup>Health center Valjevo, Blood bank, Valjevo, Serbia

Primljen – Received: 26/11/2025

Prihvaćen – Accepted: 29/04/2026

### Corresponding author:

Dragan Spaić, MD

Studenška 5, 73300 Foča

E-mail: dragan.spaic@ues.rs.ba

Copyright: ©2026 Dragan Spaić et al. This is an Open Access article distributed under the terms of the Creative Commons Attribution 4.0 International (CC BY 4.0) license.

### Summary

**Introduction.** The development of information technologies in education has enabled the introduction of new teaching approaches, among which the *Flipped classroom* (FC) model has gained increasing attention. The FC model has emerged as a student-centered approach that promotes active learning in medical education. The aim of this study was to examine students' perceptions of the FC implementation in medical education.

**Method.** A cross-sectional study was conducted on a sample of 63 third-year medical students at the Faculty of Medicine in Foča. Data were collected through an anonymous online questionnaire distributed via the Moodle platform, consisting of six domains and a total of 31 statements.

**Results.** Students expressed generally positive attitudes toward the FC model: over 50% provided positive responses, about one-third were neutral. The highest average scores were related to learning independence ( $\bar{x} = 3.84$ ) and preparedness and motivation for classes ( $\bar{x} = 3.79$ ). No statistically significant differences were found between male and female students' attitudes, while students with a higher-grade point average ( $\geq 8.50$ ) showed significantly more favorable attitudes in the domains of overall attitudes ( $p = 0.036$ ) and communication ( $p = 0.013$ ). Logistic regression analysis indicated that the communication domain was a significant predictor of belonging to the group with higher academic achievement ( $p = 0.020$ ).

**Conclusion.** The results indicate that medical students perceive the FC positively and recognize its contribution to better motivation, independence, and interactivity in the learning process. These findings may serve as a basis for further research on the impact of this model on academic outcomes and for a deeper understanding of students' perceptions of modern learning approaches in medical education.

**Key words:** flipped classroom, medical education, learning motivation, academic achievement, student perception

## Introduction

The development and widespread use of the internet, computer technologies, and mobile phones have profoundly transformed both the world we live in and the educational process across all scientific disciplines, particularly in the field of medicine. These changes have led to the introduction of new learning methodologies, such as the use of virtual patients and blended/hybrid learning, which replace the traditional *ex cathedra* approach and make the learning process simpler, more flexible, and more effective [1, 2, 3, 4]. Although the aforementioned studies have demonstrated numerous advantages of the new learning methods, their implementation was not widely adopted until the COVID-19 pandemic, when traditional educational practices became impossible to conduct. Consequently, higher education institutions were required to reorganize the teaching process and communication with students in alternative ways, utilizing various electronic platforms for communication and learning [5, 6, 7]. Among the learning methodologies applied, one was the *Flipped Classroom* model, which transforms traditional instruction by reversing the usual learning sequence. Instead of studying after the professor's lecture, students first engage in independent learning at home, using various video materials, presentations, and/or interactive modules. Subsequently, during class sessions, they discuss the pre-prepared topic together with the professor and peers, thereby applying their knowledge and clarifying any uncertainties [8]. By means of this method, the learning process increasingly takes place outside the classroom, while various forms of preparatory activities for class sessions enhance interaction and promote the active participation of students in the in-class learning process [9]. The *Flipped Classroom* methodology dated back to the year 2000, when Maureen and colleagues, faced with a shortage of class time and a large volume of material, asked

students to prepare relevant chapters from the textbook in advance, so that lectures could focus on presenting key facts and discussing areas of uncertainty [10]. In the following years, Jonathan Bergmann and Aaron Sams prepared various learning materials (textual video, or audio) and made them available on appropriate online platforms. By using them, students gained certain advantages, including the ability to review the content multiple times, pause at unclear sections of the lecture, and take detailed notes [11]. In most studies, the *Flipped Classroom* has proven to be a more effective learning method, demonstrating better outcomes on knowledge assessments. Students also reported higher satisfaction with this approach compared to traditional learning methods [12, 13]. Conversely, some studies have found no statistically significant differences between the *Flipped Classroom* and traditional learning methods in terms of knowledge assessment scores or student satisfaction with the learning methodology [14, 15, 16]. Despite the growing body of evidence supporting the effectiveness of the *Flipped Classroom* model, limited research has focused on students' perceptions within specific medical disciplines and their relationship with academic achievement. In particular, there is a lack of evidence examining whether specific domains of the FC experience, such as communication, are associated with students' academic performance.

Drawing on the above, the aim of our study was to examine students' attitudes toward the implementation of the *Flipped Classroom* in the course *Medical Statistics*, as well as their overall perception of this learning model and its potential application in other medical courses.

## Method

This research represents a cross-sectional study conducted after completion of the course, organized through *Flipped Classroom* design. Prior

to each class, students were provided with video materials and presentations via the Moodle platform. Classroom sessions were then used for discussion, clarification of concepts, and problem-solving activities. The participants were third-year medical students at the Faculty of Medicine in Foča, enrolled in the Medicine program, who attended the *Medical Statistics* course during the winter semester of the 2024/2025 academic year. A convenience sample of students attending the course was included in the study. A total of 63 students participated in the study. Of the 68 eligible students, 63 completed the questionnaire, yielding a response rate of 92.65%. Data were collected using an online questionnaire hosted on the "Moodle" e-learning platform. Students were given 30 minutes to complete the questionnaire. Participation in the study was anonymous and voluntary. The study was approved by the Ethics Committee of the Faculty of Medicine in Foca and conducted in accordance with institutional ethical standards.

The questionnaire used in this study was adapted from the study by Pejcin and colleagues [17] and was developed based on the studies conducted by Aljaraideh and Farrah and their collaborators [18, 19]. The questionnaire consisted of six sections (domains) with a total of 31 items/statements. All attitudinal items were measured using a five-point Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree). For the purpose of statistical analysis, Likert-scale responses were treated

as interval data. To assess internal consistency, Cronbach's alpha coefficient was calculated for each domain. Prior to analysis, one negatively worded item in the Overall Attitudes domain ("Students would rather watch a traditional teacher-leading lesson than a lesson video.") was reverse-coded to align with the scoring of other items. Cronbach's alpha values ranged from 0.866 to 0.916, indicating very high internal consistency for all questionnaire domains. The detailed results of the reliability analysis are presented in the Results section (Table 1). Compared to the study by Pejcin and colleagues, which included 33 items/statements, two questions were omitted in the present study: "Have you heard of the term *Flipped Classroom*?" and "Have you ever attended a *Flipped Classroom* session?" These questions were excluded because, during the first class, students were provided with an explanation of the *Flipped Classroom* model and informed that it would be applied throughout the course. Additionally, prior to this study, this learning methodology had not been implemented at the Faculty of Medicine in Foča. The first part of the questionnaire consisted of three questions related to the demographic characteristics of the participants. The second part included eight questions addressing overall attitudes toward the *Flipped Classroom*. The next five questions focused on communication during the implementation of this teaching methodology. The fourth part

**Table 1.** Internal consistency of questionnaire domains (Cronbach's alpha)

Questionnaire domains	Items (n)	Cronbach's Alpha ( $\alpha$ )
Overall attitudes toward the Flipped Classroom	8	0.866
Communication during teaching	5	0.911
Independence in learning	7	0.892
Preparedness and motivation for learning	5	0.916
Creative thinking and collaborative work	3	0.878

\*Note: Cronbach's alpha values above 0.70 indicate acceptable internal consistency, values above 0.80 good reliability, and values above 0.90 excellent reliability.

concerned attitudes related to independent learning and comprised seven questions. Preparedness and learning motivation were assessed in the fifth part containing five statements, while the final part consisted of three statements and addressed creative thinking and group work during the teaching/learning process. For the purpose of statistical comparison, students' grade point average (GPA) was categorized into two groups (<8.50 and ≥8.50). In the grading system used at the Faculty of Medicine, passing grades range from 6 to 10; therefore, the passing interval was divided into two approximately equal parts (6.0–8.49 and 8.50–10.0) to distinguish between students with lower and higher academic achievement.

### Statistical analysis

Statistical analysis was performed using SPSS software, version 29 (IBM Corp., Armonk, NY, USA). Descriptive statistics were used to summarize the demographic characteristics of the participants and the responses to questionnaire items. Continuous variables were presented as mean ± standard deviation (SD), while categorical variables were presented as absolute frequencies and percentages. The internal consistency of the questionnaire domains was assessed using Cronbach's alpha coefficient. Differences between groups were examined using the independent samples t-test. Logistic regression analysis using the forward stepwise (Likelihood Ratio) method was selected to identify the most parsimonious set of predictors associated with higher academic achieve-

ment, particularly given the study design and the relatively small sample size. Model fit was assessed using the Hosmer–Lemeshow goodness-of-fit test, and the Nagelkerke R<sup>2</sup> coefficient was used to estimate the proportion of explained variance. A p-value < 0.05 was considered statistically significant.

## Results

The internal consistency of the questionnaire domains was assessed using Cronbach's alpha coefficient. As shown in Table 1, Cronbach's alpha values ranged from 0.866 to 0.916, indicating very high internal reliability of the instrument.

A total of 63 participants took part in this study, of whom 46 (73%) were females. The participants' age ranged from 21 to 24 years. The minimum average grade of the students was 7.86, while the maximum average grade was 10.00. No statistically significant differences were found between male and female participants in terms of age ( $t = -0.165$ ,  $p = 0.869$ ) or average grades ( $t = -0.651$ ,  $p = 0.518$ ). The demographic characteristics of the participants are presented in Table 2.

The majority of participants expressed a positive attitude toward statements regarding the implementation of the *Flipped Classroom* model in the medical education process. However, approximately one-third of respondents provided neutral responses, indicating a certain level of uncertainty or mixed perceptions regarding the *Flipped classroom* approach. Detailed distribution of participants' responses to specific question-

**Table 2.** Demographic characteristics of the participants

	n (%)	Age, $\bar{x} \pm sd$	Average Grade, $\bar{x} \pm sd$
Male	17 (27.0)	21.50±0.80	8.70±0.55
Female	46 (73.0)	21.60±0.75	8.80±0.50
Total	63 (100.0)	21.60±0.80	8.80±0.50

naire statements is presented in Supplementary material (Table S1).

For instance, 34 (54.0%) participants agreed or strongly agreed with the statement that the *Flipped Classroom* reduced the number of frustrating sessions, while 41 (65.1%) agreed or strongly agreed that watching vid-

eo materials and taking notes effectively contributed to learning.

The distribution of responses to the statement, "I would like more professors to use the *Flipped Classroom* model," is presented in Figure 1, while the distribution of responses to the statement, "I am more motivated to learn

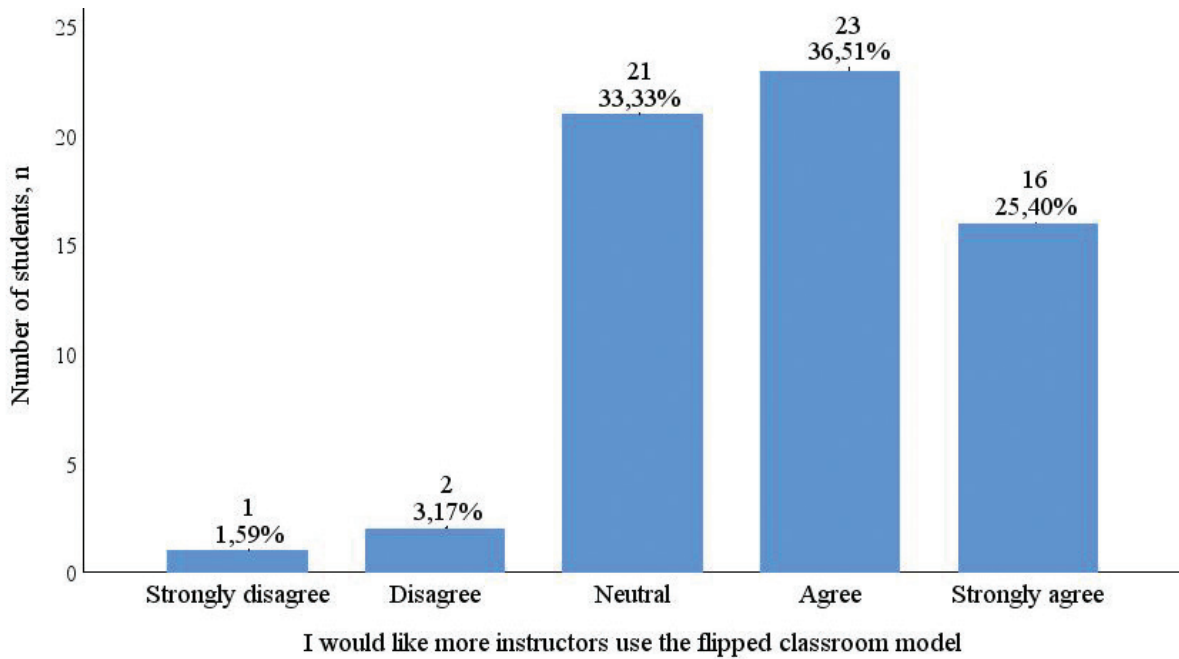


Figure 1. Interest in applying the Flipped Classroom model to other subjects

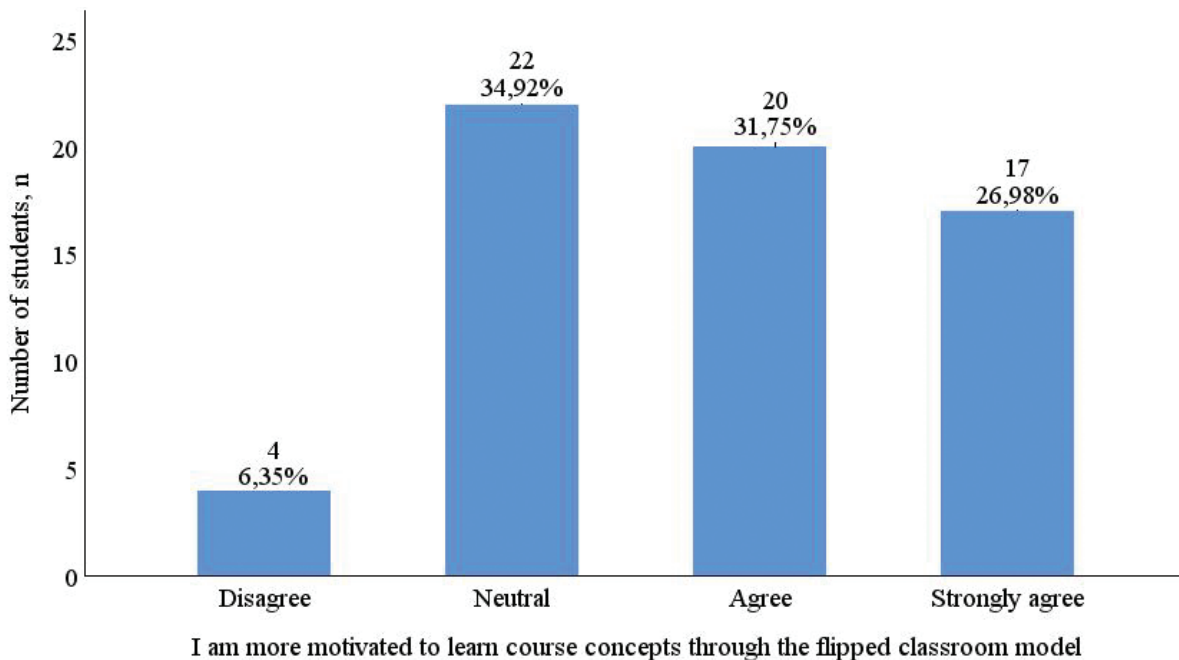


Figure 2. Motivation for learning through the Flipped Classroom model

**Table 3.** Average domain scores by sex

	Sex	n	$\bar{x}$	SD	t-test	p-value
Overall Attitudes	Male	17	3.71	0.74	0.255	0.799
	Female	46	3.66	0.67		
Communication	Male	17	3.62	0.75	-0.483	0.631
	Female	46	3.73	0.83		
Learning Independence	Male	17	3.78	0.71	-0.295	0.769
	Female	46	3.84	0.72		
Preparedness and Motivation	Male	17	3.88	0.87	0.627	0.533
	Female	46	3.74	0.78		
Creative Thinking and Group Work	Male	17	3.61	0.89	-0.868	0.389
	Female	46	3.83	0.92		

course concepts through the *Flipped Classroom*," is shown in Figure 2.

The results of the independent samples t-test showed that there was no statistically significant difference between male and female students in any of the examined domains of the questionnaire related to the perception and learning approach within the *Flipped classroom* model. The mean values for all domains were very similar between sexes, indicating that sex was not a significant factor in shaping respondents' attitudes toward this teaching model. Detailed results are presented in Table 3.

The examination of attitudes toward the *Flipped classroom* model among students with lower (< 8.50) and higher ( $\geq$  8.50) grade point averages (GPAs) showed that the mean scores for all questionnaire domains were higher among students with higher GPAs. The results of the independent samples t-test indicated statistically significant differences between students with lower and higher GPAs, in two domains of the examined instrument. Specifically, respondents with GPA  $\geq$  8.50 rated the domains related to Overall Attitudes toward the *Flipped classroom* ( $t = -2.150$ ,  $p = 0.036$ ) and Communication ( $t = -2.555$ ,  $p = 0.013$ ) significantly more favorably. These

results suggest that students with higher GPAs exhibit a stronger positive attitude and greater inclination to accept this learning model in the educational process compared to students with lower GPAs (< 8.50). In contrast, no statistically significant differences were observed in the other questionnaire domains (Learning Independence, Preparedness and Motivation, and Creative Thinking and Group Work) indicating relative uniformity of student attitudes in these aspects of evaluating the *Flipped classroom* model. Detailed results are presented in Table 4.

The results of the multiple logistic regression analysis, conducted using the stepwise forward method based on the Likelihood Ratio approach, revealed that the Communication variable was the only statistically significant predictor of belonging in one of the two grade point average categories (< 8.50 and  $\geq$  8.50). Its regression coefficient was  $B = 0.903$  ( $p = 0.020$ ), and the corresponding odds ratio (OR = 2.467, 95%CI = 1.154–5.275) indicated that an increase in the Communication score more than doubled the likelihood of a student belonging to the higher GPA group. In practical terms, students who rated communication within the *Flipped classroom* more positively were ap-

**Table 4.** Students' attitudes toward the Flipped Classroom by grade point average

	GPA	n	$\bar{x}$	SD	t-test	p-value
Overall Attitudes	<8.5	19	3.40	0.78	-2.150	0.036
	≥8.5	44	3.79	0.62		
Communication	<8.5	19	3.33	0.94	-2.555	0.013
	≥8.5	44	3.87	0.69		
Learning Independence	<8.5	19	3.56	0.90	-1.716	0.099
	≥8.5	44	3.94	0.59		
Preparedness and Motivation	<8.5	19	3.53	1.00	-1.434	0.164
	≥8.5	44	3.89	0.68		
Creative Thinking and Group Work	<8.5	19	3.51	1.00	-1.522	0.133
	≥8.5	44	3.87	0.86		

proximately 2.5 times more likely to belong to the higher GPA group.

The overall model was found to be statistically significant ( $\chi^2 = 6.230$ ,  $p = 0.013$ ), indicating that it reliably distinguished between students with lower and higher GPAs. The Nagelkerke coefficient of determination ( $R^2 = 0.133$ ) suggested that the model accounted for approximately 13.3% of the variance in the dependent variable. Furthermore, the model's goodness of fit was supported by the non-significant Hosmer–Lemeshow test result ( $p = 0.321$ ), implying that the model adequately represented the observed data and did not exhibit a significant lack of fit.

## Discussion

This study aimed to examine the perceptions of students at the Faculty of Medicine in Foča regarding the implementation of the *Flipped classroom* model in the teaching process, as well as to identify factors contributing to better academic achievement, expressed through students' grade point averages. The results obtained provide a deeper understanding of the various factors shaping students' attitudes toward this learn-

ing model. Furthermore, the findings of this research may assist in identifying key predictors of the successful implementation of the *Flipped classroom* model in medical education.

A meta-analysis encompassing 45 studies across various fields of health education (including medical, nursing, and pharmacy students) confirmed that the implementation of the *Flipped classroom* model led to significantly better academic performance compared to traditional forms of education [20]. Descriptive statistics from this study indicate that students generally hold positive attitudes toward the *Flipped classroom* model, with the highest mean scores observed in the questionnaire domains related to *Learning Independence* and *Preparedness and Motivation*. This suggests that students value the opportunity to organize their own learning and feel more prepared for examinations when they are actively engaged in the teaching process. This form of personalized learning has been well received by students, as revealed in numerous studies [21, 22]. Although the overall results indicate generally positive student perceptions, a notable proportion of respondents selected neutral responses across several questionnaire items. Approximately one-third of the students

expressed neutral attitudes toward certain aspects of the *Flipped classroom* model. This may suggest that some students are still adapting to this relatively different instructional approach or may not have had sufficient experience with this model to form a clear opinion. The presence of neutral responses indicates that while many students recognize the advantages of the *Flipped classroom*, additional support, clearer guidance, and gradual implementation may be necessary to further enhance student engagement and acceptance of this teaching method. Furthermore, a study conducted by Uchida et al. [23] demonstrated that students who participated in classes using the *Flipped classroom* model exhibited significantly higher self-confidence before examinations. This is attributed to better preparation and increased motivation during the teaching process facilitated by the *Flipped classroom* model, which in turn may be associated with improved learning outcomes and a more efficient learning process. Wang et al. [21] explain the enhanced preparedness and motivation through the Self-Determination Theory (SDT) proposed by Deci and Ryan, which posits that individuals have an innate need for growth and development. This process occurs when three basic psychological needs are satisfied: autonomy, competence, and relatedness [24]. The *Flipped classroom* provides substantial autonomy in the learning process, as students have continuous access to materials through an online platform, allowing them to study at times that best suit their individual schedules. In this study, 71% of respondents indicated that the *Flipped classroom* model supported independence in learning. Additionally, competence and relatedness were fostered in this model through interactive engagement and communication with instructors and peers. The data analyzed in this research showed that students with higher grade point averages reported greater interaction with both instructors and fellow students within the *Flipped classroom* setting. This active participation promotes the development of competencies, deeper understanding of the subject mat-

ter, and enhanced creativity and teamwork, findings that are further supported by the study conducted by Naing et al. [20]. The finding that communication within the *Flipped Classroom* environment emerged as the only statistically significant predictor of higher academic achievement further underscores the importance of interactive learning processes. This suggests that the benefits of the *Flipped Classroom* model may not be solely attributed to content delivery outside the classroom, but rather to the quality of in-class engagement. Effective communication, both peer-to-peer and between students and instructors, facilitates clarification of complex concepts, encourages active participation, and promotes deeper cognitive processing. These mechanisms are particularly relevant in conceptually demanding subjects such as medical statistics, where discussion-based learning may enhance understanding beyond passive content exposure. Furthermore, a study conducted by El Sadik et al. explains that in-class discussions are important for fostering critical understanding and deeper comprehension of the subject matter, in accordance with the levels of Bloom's taxonomy [25]. However, it is important to interpret these findings with caution. Due to the cross-sectional design of the study, causal relationships cannot be established. Communication was identified as a significant predictor of higher academic achievement, but it cannot be concluded that improved communication directly leads to better academic performance. It is equally plausible that students with higher academic achievement are more likely to engage actively in communication during the learning process. Despite the statistical significance of the model, the relatively low Nagelkerke  $R^2$  value (13.3%) indicates limited explanatory power. This suggests that communication accounts for only a modest proportion of the variance in academic performance, and that other factors, such as prior knowledge, self-regulation, learning strategies, and cognitive abilities, likely play a more substantial role. Therefore, communication should be interpreted as an important,

but not dominant, contributor to academic success within the *Flipped Classroom* framework. This finding reinforces the view that academic achievement in medical education is inherently multifactorial and cannot be explained by a single domain of the learning experience.

Although some studies suggest that female students may exhibit a slightly more positive attitude toward the *Flipped classroom* model [17], the majority of the available research [26, 27], including the findings of our study, does not confirm statistically significant differences in perception or academic performance between sexes. These findings suggest that sex is not a decisive factor in the acceptance or effectiveness of this pedagogical approach. One possible explanation for this pattern is that the *Flipped classroom* model equally promotes active participation, autonomy, and collaboration among all students, regardless of sex-related differences in educational approach.

Moreover, in the context of medical education, where course content is highly complex and requires a high level of engagement, it can be assumed that students' motivation to master the material and their professional orientation have a greater impact on perception and academic outcomes than sex. These findings are consistent with contemporary research, which emphasizes that factors such as academic motivation, self-regulation, and prior learning experience are more important predictors of success in the *Flipped classroom* model than sociodemographic variables, including sex [28, 29]. While assessing learning motivation, the results of this study indicate that 59% of students reported being more motivated to learn course concepts through the *Flipped classroom* model, while 62% agreed that the *Flipped classroom* could enhance their interest in classes. Furthermore, 62% of students expressed a desire for more instructors to implement this model in their courses. These findings collectively suggest that students are generally satisfied with the use of

the *Flipped classroom* model in medical education, a conclusion supported by other studies demonstrating that this model is well received in medical training and that students are largely satisfied with its implementation in the educational process. [25, 27, 30]. However, it should be noted that this study primarily assessed students' perceptions of the *Flipped classroom* model rather than its direct impact on objective learning outcomes.

### Study limitations

Although the results of this study provide valuable insights into students' perceptions of the *Flipped classroom* model in medical education, several limitations should be considered when interpreting the findings. The research was conducted on a non-random, convenience sample of students within a single course (Medical Statistics) and at a single institution, which limits the generalizability of the findings to other medical disciplines or educational settings. Data were collected using a self-report questionnaire, which might introduce subjectivity in responses. Besides, the cross-sectional study design did not allow for the assessment of changes in attitudes over time or the establishment of causal relationships. Future research should involve larger samples, employ a combination of quantitative and qualitative methods, and examine the long-term effects of this learning model on academic outcomes and the development of students' professional competencies.

### Conclusion

Third-year medical students at the Faculty of Medicine in Foča generally held positive attitudes toward the *Flipped classroom* model in the teaching process. It was found that sex did not represent a significant factor in shaping students' perceptions, whereas grade point

average was associated with attitudes in the domains of communication and overall perception of this model. Students with higher academic achievement showed a greater willingness to embrace this learning method, suggesting a potential role of academic success in fostering a positive perception and a more active approach to learning.

The *Flipped classroom* model is perceived to contribute to increased student motiva-

tion, independence, and interactivity, thereby creating a more stimulating environment for learning and the development of critical thinking. The obtained results are consistent with previous research findings and may serve as a foundation for further exploration of the impact of this model on academic outcomes, as well as for a deeper understanding of students' perceptions of contemporary learning approaches in medical education.

**Funding source.** The authors received no specific funding for this work.

**Ethical approval.** The Ethics Committee of the University of East Sarajevo, Faculty of Medicine Foča, Republic of Srpska, Bosnia and Herzegovina, approved the study

(No. 01-2-16/2025) and informed consent was obtained from all individual respondents. The research was conducted according to the Declaration of Helsinki.

**Conflicts of interest.** The authors declare no conflict of interest.

**Table S1.** Distribution of participants' responses by questionnaire domain

I) Overall attitudes	1	2	3	4	5	$\bar{x}$
1. Flipped classroom, along with delivery of content outside class and problem solving in class, is an instructional method appropriate for my education.	2 (3.0%)	3 (5.0%)	18 (29.0%)	14 (22.0%)	26 (41.0%)	3.94
2. Students would rather watch a traditional teacher-leading lesson than a lesson video.	7 (11.0%)	10 (16.0%)	21 (33.0%)	13 (21.0%)	12 (19.0%)	3.21
3. The flipped classroom reduces the number of frustrating sessions.	3 (5.0%)	3 (5.0%)	23 (37.0%)	23 (37.0%)	11 (17.0%)	3.57
4. The flipped classroom allows students to have more time for family, friends, play, and extracurricular activities.	2 (3.0%)	1 (2.0%)	13 (21.0%)	28 (44.0%)	19 (30.0%)	3.97
5. I wish more instructors would use the flipped or inverted classroom model.	1 (2.0%)	2 (3.0%)	21 (33.0%)	23 (37.0%)	16 (25.0%)	3.81
6. Flipped classroom is more engaging than the traditional classroom.	4 (6.0%)	3 (5.0%)	21 (33.0%)	22 (35.0%)	13 (21.0%)	3.59
7. I believe that I am able to learn material with flipped classroom instruction better than with traditional lecture-based instruction.	5 (8.0%)	5 (8.0%)	12 (19.0%)	25 (40.0%)	16 (25.0%)	3.67
8. Flipped classroom matches my learning style.	5 (8.0%)	1 (2.0%)	17 (27.0%)	27 (43.0%)	13 (21.0%)	3.67

<b>II) Communication</b>	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>	<b><math>\bar{x}</math></b>
9. The flipped classroom gives students more opportunities to communicate with each other.	3 (5.0%)	4 (6.0%)	22 (35.0%)	23 (37.0%)	11 (17.0%)	3.56
10. Flipped classroom courses did not limit my interaction with instructors.	0 (0.0%)	2 (3.0%)	21 (33.0%)	23 (37.0%)	17 (27.0%)	3.87
11. Flipped classroom gives me the opportunity to ask more questions inside the classroom.	1 (2.0%)	1 (2.0%)	23 (37.0%)	24 (38.0%)	14 (22.0%)	3.78
12. The flipped classroom helps students to ask questions and get immediate targeted answers to difficult concepts.	2 (3.0%)	2 (3.0%)	23 (37.0%)	22 (35.0%)	14 (22.0%)	3.70
13. Teachers are available for more one-on-one interaction with students in a flipped classroom.	2 (3.0%)	5 (8.0%)	20 (32.0%)	24 (38.0%)	12 (19.0%)	3.62
<b>III) Independence in learning</b>	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>	<b><math>\bar{x}</math></b>
14. Flipped classroom learning has reduced my dependency on the instructor.	3 (5.0%)	1 (2.0%)	23 (37.0%)	24 (38.0%)	12 (19.0%)	3.65
15. The flipped classroom allows students to have access to the lectures at any time easily.	1 (2.0%)	2 (3.0%)	18 (29.0%)	20 (32.0%)	22 (35.0%)	3.95
16. I got the ability to self-pace my learning with Flipped classroom courses.	1 (2.0%)	3 (5.0%)	21 (33.0%)	22 (35.0%)	16 (25.0%)	3.78
17. The flipped classroom supports students in becoming self-directed learners.	1 (2.0%)	0 (0.0%)	17 (27.0%)	26 (41.0%)	19 (30.0%)	3.98
18. I feel that watching videos and taking notes contributes efficiently to my learning.	0 (0.0%)	5 (8.0%)	17 (27.0%)	18 (29.0%)	23 (37.0%)	3.94
19. With flipped classroom, we have to do more work out of the classroom.	0 (0.0%)	3 (5.0%)	22 (35.0%)	24 (38.0%)	14 (22.0%)	3.78
20. Flipped classroom gives me less class time to practice the concepts of course.	0 (0.0%)	3 (5.0%)	25 (40.0%)	23 (37.0%)	12 (19.0%)	3.70
<b>IV) Preparedness and motivation</b>	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>	<b><math>\bar{x}</math></b>
21. With flipped classroom model, I feel more prepared for my exam.	3 (5.0%)	3 (5.0%)	23 (37.0%)	21 (33.0%)	13 (21.0%)	3.60
22. I feel that mastering learning through flipped classroom improved my course understanding.	1 (2.0%)	2 (3.0%)	17 (27.0%)	27 (43.0%)	16 (25.0%)	3.87
23. Flipped classroom can improve interest in class.	0 (0.0%)	4 (6.0%)	20 (32.0%)	21 (33.0%)	18 (29.0%)	3.84
24. Flipped classroom reduces the effort to understand the basic knowledge of the subject matter.	1 (2.0%)	2 (3.0%)	20 (32.0%)	27 (43.0%)	13 (21.0%)	3.78
25. I am more motivated to learn the concepts of course through the flipped classroom model.	0 (0.0%)	4 (6.0%)	22 (35.0%)	20 (32.0%)	17 (27.0%)	3.79

V) Creative thinking and collaborative work	1	2	3	4	5	$\bar{x}$
26. Flipped classroom encourages me to practice critical and creative thinking.	3 (5.0%)	4 (6.0%)	16 (25.0%)	23 (37.0%)	17 (27.0%)	3.75
27. The flipped classroom encourages learners to pose inquiries and find quick focused on solutions to troublesome ideas.	0 (0.0%)	7 (11.0%)	18 (29.0%)	21 (33.0%)	17 (27.0%)	3.76
28. Flipped classroom improved collaborative work and learning.	1 (2.0%)	4 (6.0%)	20 (32.0%)	19 (30.0%)	19 (30.0%)	3.81

### References:

- D'Alessandro DM, Lewis TE, D'Alessandro MP. A pediatric digital storytelling system for third year medical students: the virtual pediatric patients. *BMC Med Educ* 2004;4:10.
- Bernardo V, Ramos MP, Plapler H, De Figueiredo LF, Nader HB, Anção MS, et al. Web-based learning in undergraduate medical education: development and assessment of an online course on experimental surgery. *Int J Med Inform* 2004;73(9–10):731–42.
- Cook DA, Levinson AJ, Garside S, Dupras DM, Erwin PJ, Montori VM. Internet-based learning in the health professions: a meta-analysis. *JAMA* 2008;300(10):1181–96.
- Milic NM, Trajkovic GZ, Bukumiric ZM, Cirkovic A, Nikolic IM, Milin JS, et al. Improving Education in Medical Statistics: Implementing a Blended Learning Model in the Existing Curriculum. *PLoS One* 2016;11(2):e0148882.
- Torda A. How COVID-19 has pushed us into a medical education revolution. *Intern Med J* 2020;50(9):1150–3.
- Rose S. Medical Student Education in the Time of COVID-19. *JAMA*. 2020;323(21):2131–2.
- Basilaia G, Kvavadze D. Transition to online education in schools during a SARS-CoV-2 coronavirus (COVID-19) pandemic in Georgia. *Pedagogical Research* 2020;5(4):1–9.
- Harris B, Harris J, Reed L, Zelihic M. Flipped classroom: Another tool for your pedagogy tool box. *Developments in Business Simulation and Experiential Learning* 2016;43:325–33.
- Abeysekera L, Dawson P. Motivation and cognitive load in the flipped classroom: Definition, rationale and a call for research. *High Educ Res Dev* 2015;34(1):1–14.
- Lage MJ, Platt GJ, Treglia M. Inverting the classroom: A gateway to creating an inclusive learning environment. *J Econ Educ* 2000;31(1):30–43.
- Ağırman N, Ercoşkun MH. History of the flipped classroom model and uses of the flipped classroom concept. *Int J CurricInstr Stud* 2022;12(1):71–88.
- Cai L, Li YL, Hu XY, Li R. Implementation of flipped classroom combined with case-based learning: A promising and effective teaching modality in undergraduate pathology education. *Medicine (Baltimore)* 2022;101(5):e28782.
- Chowdhury TA, Khan H, Druce MR, Drake WM, Rajakariar R, Thuraisingham R, et al. Flipped learning: Turning medical education upside down. *Future Healthc J* 2019;6(3):192–5.
- Beom JH, Kim JH, Chung HS, Kim SM, Ko DR, Cho J. Flipped-classroom training in advanced cardiopulmonary life support. *PLoS One* 2018;13(9):e0203114.
- Allenbaugh J, Spagnoletti C, Berlacher K. Effects of a Flipped Classroom Curriculum on Inpatient Cardiology Resident Education. *J Grad Med Educ* 2019;11(2):196–201.
- Afzal S, Masroor I. Flipped Classroom Model for Teaching Undergraduate Students in Radiology. *J Coll Physicians Surg Pak* 2019;29(11):1083–6.

17. Pejcin I, Oroz S, Milojković Đ, Milić N, Milić N, Rajović N. Izokrenuta učionica - novi pristupučenju za studente medicine. *Medicinski podmladak* 2022;73(4):66–72.
18. Aljaraideh Y. Students' perception of flipped classroom: A case study for private universities in Jordan. *J Technol Sci Educ* 2019;9(3):368–77.
19. Farrah M, Qawasmeh A. English student's attitudes towards using flipped classrooms in language learning at Hebron University: Research in English Language Pedagogy 2018;6(2):275–94.
19. Naing C, Whittaker MA, Aung HH, Chellappan DK, Riegelman A. The effects of flipped classrooms to improve learning outcomes in undergraduate health professional education: A systematic review. *Campbell Syst Rev* 2023;19(3):e1339.
20. Wang X, Li J, Wang C. The effectiveness of flipped classroom on learning outcomes of medical statistics in a Chinese medical school. *Biochem Mol Biol Educ* 2020;48(4):344–9.
21. Rui Z, Lian-Rui X, Rong-Zheng Y, Jing Z, Xue-Hong W, Chuan Z. Friend or Foe? Flipped Classroom for Undergraduate Electrocardiogram Learning: a Randomized Controlled Study. *BMC Med Educ* 2017;17(1):53.
22. Uchida S, Shikino K, Ishizuka K, Yamauchi Y, Yanagita Y, Yokokawa D, et al. The flipped classroom is effective for medical students to improve deep tendon reflex examination skills: A mixed-method study. *PLoS One* 2022;17(6):e0270136.
23. Deci EL, Ryan RM. Self-determination theory: A macro-theory of human motivation, development, and health. *Can Psychol* 2008;49(3):182–5.
24. El Sadik A, Al Abdulmonem W. Improvement in Student Performance and Perceptions through a Flipped Anatomy Classroom: Shifting from Passive Traditional to Active Blended Learning. *Anat Sci Educ* 2021;14(4):482–90.
25. Prabhavathi K, KalyaniPraba P, Rohini P, Selvi KT, Saravanan A. Flipped classroom as an effective educational tool in teaching physiology for first-year undergraduate medical students. *J Educ Health Promot* 2024;13:283.
26. 27. Spaic D, Bukumiric Z, Rajovic N, Markovic K, Savic M, Milin-Lazovic J, et al. The Flipped Classroom in Medical Education: Systematic Review and Meta-Analysis. *J Med Internet Res* 2025;27:e60757.
27. Sun X, Yuan X, Zhang L, Zhang Y, Xiao X, Liu H, Ma F. Effectiveness of flipped classrooms in Chinese students of clinical medicine major undergoing clinical practice: a meta-analysis. *BMC Med Educ* 2025;25(1):205.
28. Mengesha AK, Ayele HS, Misker MF, Beyna AT. Assessing the effectiveness of flipped classroom teaching-learning method among undergraduate medical students at gondar university, college of medicine and health sciences: an interventional study. *BMC Med Educ* 2024;24(1):1108.
29. Ding C, Li S, Chen B. Effectiveness of flipped classroom combined with team-, case-, lecture- and evidence-based learning on ophthalmology teaching for eight-year program students. *BMC Med Educ* 2019;19(1):419.

## Da li smo spremni da primijenimo izokrenutu učionicu u medicinskom obrazovanju? Uvidi iz perspektive studenata: studija presjeka

Dragan Spaić<sup>1</sup>, Srđan Mašić<sup>1</sup>, Dejan Bokonjić<sup>2</sup>, Nina Rajović<sup>3</sup>, Zoran Bukumirić<sup>3</sup>, Nada Avram<sup>4</sup>, Vladimir Milutinović<sup>5</sup>, Jelena Vladičić Mašić<sup>6</sup>, Jovan Kulić<sup>1</sup>, Radenko Čančar<sup>7</sup>, Nataša Milić<sup>3</sup>

<sup>1</sup>Univerzitet u Istočnom Sarajevu, Medicinski fakultet Foča, Katedra za primarnu zdravstvenu zaštitu i javno zdravlje, Foča, Republika Srpska, Bosna i Hercegovina

<sup>2</sup>Univerzitet u Istočnom Sarajevu, Medicinski fakultet Foča, Katedra za pedijatriju, Foča, Republika Srpska, Bosna i Hercegovina

<sup>3</sup>Univerzitet u Beogradu, Medicinski fakultet, Institut za medicinsku statistiku i informatiku, Beograd, Srbija

<sup>4</sup>Univerzitet u Istočnom Sarajevu, Medicinski fakultet Foča, Katedra za oftalmologiju, Foča, Republika Srpska, Bosna i Hercegovina

<sup>5</sup>Univerzitetski klinički centar Srbije, Klinika za očne bolesti, Beograd, Srbija

<sup>6</sup>Univerzitet u Istočnom Sarajevu, Medicinski fakultet Foča, Katedra za internu medicinu, Foča, Republika Srpska, Bosna i Hercegovina

<sup>7</sup>Dom zdravlja Valjevo, Služba za transfuziju krvi, Valjevo, Srbija

**Uvod.** Razvoj informacionih tehnologija i njihova primjena u obrazovanju doprinijeli su razvoju novih nastavnih modela, među kojima se posebno izdvaja model izokrenute učionice. Ovaj model podrazumijeva aktivnije učešće studenata u procesu učenja, gdje se teorijski sadržaji savladavaju samostalno prije časa, dok se na času fokus stavlja na diskusiju, rješavanje problema i primjenu znanja. Cilj ovog istraživanja bio je da se ispita percepcija studenata o primjeni modela izokrenute učionice u nastavnom procesu medicine.

**Metod.** Studija presjeka sprovedena na uzorku od 63 studenta treće godine Medicinskog fakulteta Foča. Podaci su prikupljeni putem anonimnog online upitnika postavljenog na platformu Moodle, koji se sastojao od šest domena i ukupno 31 tvrdnje.

**Rezultati.** Većina ispitanika izrazila je pozitivan stav prema primjeni modela izokrenute učionice: više od 50% je imalo pozitivne stavove, dok je trećina bila neutralna. Studenti su najvećom prosječnom ocjenom ocijenili domene koji se odnose na nezavisnost u učenju ( $\bar{x} = 3,84$ ) i pripremljenost za nastavu i motivaciju ( $\bar{x} = 3,79$ ). Nisu utvrđene statistički značajne razlike u stavovima između studenata muškog i ženskog pola, dok su studenti sa višom prosječnom ocjenom ( $\geq 8,50$ ) pokazali značajno povoljnije stavove u domenima sveukupnih stavova ( $p = 0,036$ ) i komunikacije ( $p = 0,013$ ). Logistička regresija je pokazala da domen komunikacije predstavlja značajan prediktor pripadnosti grupi sa višim akademskim uspjehom ( $p = 0,020$ ).

**Zaključak.** Rezultati istraživanja ukazuju na to da studenti medicine pozitivno percipiraju model izokrenute učionice i prepoznaju njegov doprinos boljoj motivaciji, samostalnosti i interaktivnosti tokom procesa učenja. Ovi nalazi mogu poslužiti kao osnova za dalje istraživanje uticaja ovog modela na akademske ishode i za bolje razumijevanje percepcije studenata o savremenim oblicima učenja u medicinskom obrazovanju.

**Ključne riječi:** izokrenuta učionica, medicinsko obrazovanje, motivacija za učenje, akademski uspjeh, percepcija studenata