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The association between the learning styles, personality traits and academic achievement of preclinical first-year medical students at the School of Medicine in Mostar

Gabriela Frljić[1], Eva Jelavić[2], Ivona Čarapina-Zovko[3], Boris Jelavić[4,5]

[1]AMEOS Klinikum am Bürgerpark, Bremerhaven, Germany, [2]Mostar Medical Center, Mostar, Bosnia and Herzegovina, [3]Department of Psychology, Faculty of Humanities and Social Sciences, University of Mostar, Mostar, [4]School of Medicine, University of Mostar, Mostar, [5]Department of Otorhinolaryngology and Maxillofacial Surgery, Mostar University Hospital, Mostar, Bosnia and Herzegovina

ABSTRACT

Background: Variations in the results of research on the association between learning preferences, personality traits, and academic achievement have been reported. The aim of this cross-sectional study was to determine the relationship between the first-year academic achievement of medical students and their learning styles and personality traits.

Methods: Preclinical medical students completed a questionnaire assessing sociodemographic data and course grades, as well as the Index of Learning Styles and the International Personality Item Pool 50 questionnaires. The indicator of academic achievement was the grade point average (GPA) of first-year courses.

Main findings: The majority of students were well balanced in the active/reflective and sequential/global dimensions. Almost 70% of students showed a preference for sensing in the sensing/intuitive dimension. In the visual/verbal one, there was a shift toward visual learning, since only slightly over 2% of students preferred the verbal type. Male students had a preference for the intuitive style, while female ones favored sensing learning. GPA was not affected by sex or residency status. There were no significant differences in GPA between the examined learning preferences. There were no major correlations between the examined personality traits and GPA.

Principal conclusions: This study did not provide evidence of significant interrelation between the learning preferences, personality traits, and academic achievement of preclinical medical students.

Key words: learning style, personality trait, medical students, academic performance, Felder-Soloman Index of Learning Styles, Big Five

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ORCID IDs of the authors:
G.F. 0000-0001-8672-2976
E.J. 0000-0002-5654-1856
I.Č.Z. 0000-0001-6978-5844
B.J. 0000-0002-1952-4192

Corresponding author:
Boris Jelavić,
Department of Otorhinolaryngology and Maxillofacial Surgery, Mostar University Hospital, Bijeli brijeg bb, 88000 Mostar, Bosnia and Herzegovina
E–mail: slav.boris@tel.net.ba

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INTRODUCTION

Different cognitive, noncognitive and demographic factors have been researched as possible predictors of academic success in the study of medicine (1). In terms of noncognitive factors, the learning styles and personality traits of the candidates are not used as criteria for medical college admissions (1).

The term learning styles refers to gathering, processing, interpreting, organizing and thinking about data. Out of 71 models of learning styles which were identified in research conducted in 2004, critical analysis singled out 13 significant models (2). The studies using Kolb's model have established a link between the convergent style and better success in medical school, while results for the divergent, accommodating and assimilating styles have been contradictory (1). Works utilizing Biggs' presage, process and product (3P) model found the strategic approach to be linked to better success of medical students, while outcomes for the deep and surface approaches have been contradictory (1).

Personality traits represent patterns of receiving and establishing interrelationships with other people and occurrences. The personality of a student can affect their processing and storage of data, which then affects their academic success (3). Therefore, there is a possible connection between personality traits and academic success. There are multiple personality trait models. Certain dimensions of the five-factor model of personality (conscientiousness, extraversion, neuroticism, agreeableness and openness to experience) have been proven the most appropriate in researching the connection between academic success and personality traits (4, 5).

The findings about connections between the learning styles, personality traits and academic success of medical students can be useful to teachers of preclinical and clinical courses in selecting the most efficient methods of transferring the knowledge to students, and to the latter in choosing more efficient styles of learning for different preclinical and clinical courses.

We hypothesized that learning styles and personality traits can be a good predictor of academic achievement and should be taken into account to enhance students' performances in medical school. Therefore, the aim of this study was to determine the relationship between the first-year academic achievement of medical students and their learning styles and personality traits.

PARTICIPANTS AND METHODS

Preclinical medical students who took all first-year courses in the 2019-2020 academic year at the School of Medicine of the University of Mostar, in Mostar, Bosnia and Herzegovina, were the target group of this cross-sectional analysis. At the time of the survey, the majority of these students were taking second-year courses, while a few were repeating their first year of study. An email with an attached template invited students to participate and give informed consent. Students were told that the use of a pseudonym or their full name on a questionnaire was their own decision. In an email survey, these students were asked to complete a questionnaire assessing sociodemographic data and course grades, as well as the Index of Learning Styles and International Personality Item Pool 50 (IPIP-50) questionnaires. The grade point average (GPA) of first-year courses was the indicator of academic achievement.

Measures

The Index of Learning Styles (ILS) was developed by Felder and Soloman to determine an individual's learning preferences (6). The ILS is a 44-item instrument comprising four scales, assessing active/reflexive, sensing/intuitive, visual/verbal, and sequential/global aspects. There are 11 dichotomous questions for each scale. Persons with scores from 1 to 3 are well balanced and have a mild preference for one dimension of the scale, those with scores from 5

to 7 have a moderate preference, and those with scores from 9 to 11 have a strong one (7).

Active learners improve their retention and understanding of information by discussing or explaining it to others. Reflective learners prefer to think about the material first (6, 7). Sensing learners prefer learning facts and solving problems using well-established methods; they enjoy courses that have connections to the real world. Intuitive learners appreciate discovering possibilities and relationships, like innovation and abstract information. They do not like courses that require memorization and routine calculations (6, 7). Visual learners remember what they see, like pictures, diagrams, flow charts or demonstrations. Verbal learners get the most out of written and spoken explanations (6, 7). Sequential learners gain understanding in linear, logical steps. Global learners learn in large jumps, randomly absorbing material until they suddenly "get it" (6, 7).

The International Personality Item Pool 50 (IPIP-50) measures the Big Five domains through 50 items (8). A five-point Likert-type scale ranging from 1 (very inaccurate) to 5 (very accurate) was used. There are 10 items for each factor. The Croatian version of the IPIP-50 has a Cronbach's alpha coefficient of 0.87 for the extraversion domain, 0.79 for the agreeableness one, 0.81 for the conscientiousness one, 0.91 for the emotional stability one, and 0.70 for the intellect/imagination one (9).

Statistical analysis

The normality of the distribution has been tested with the Kolmogorov-Smirnov test. With respect to the number of compared samples and the normality of the data, comparisons of the grade point averages and the IPIP-50 scores were performed with the parametric Student's t-test or nonparametric Kruskal-Wallis *H* test. Because of the small study sample, Fisher's exact test was used to determine differences in the frequencies of the ILS categories. Correlations between scores for the IPIP-50 and grades were examined with Pearson's correlations. Values of $p<0.05$ were regarded as being statistically significant. All statistical analyses were performed utilizing Statistical Package for the Social Sciences (SPSS) for Windows (Version 13.0; SPSS Inc., Chicago, IL, USA).

RESULTS

Out of 63 students satisfying the study criteria, three (4.76%) refused to participate and 15 never responded to repeated messages. Finally, 45 (71.42%) students with completed questionnaires were included in the statistical analysis. The students' sociodemographic data are presented in Table 1.

There were more female students than male ones (the male-to-female ratio was 0.60:1). All students declared that studying medicine was their own decision. Academic achievement was not affected by sex or residency status. Frequencies of occurrence of the eight Felder-Silverman styles, grouped according to the degree of preference, are presented in Table 1. There were no significant differences in academic achievement between the examined learning preferences.

The sex distribution of the different categories of learning styles is presented in Table 2. There were no significant sex differences in shares of preferences except in the sensing/intuitive scale. Male students had a preference for the intuitive style, while female ones favored sensing learning.

In the next step, both mild degrees of two directions of each dimension of the Index of Learning Styles formed the joint balanced category for that dimension, and the moderate and strong degrees of the same direction together formed a category for each of the two preferences of the same dimension.

Table 1. The relationship between the sociodemographic data, learning styles and first-year academic achievement of preclinical medical students

	Students Number (%)	Grade point average*		Statistics
		$\bar{X} \pm SD$	Median [IQR]	
Sex				
Male	17 (38)	3.29±0.65		t=1.534†; p=0.132
Female	28 (62)	3.58±0.59		
Studying medicine was my own decision				
Yes	45			
No	0			
Residency				
With family	23 (51)		3.33 [0.67]	H=0.116‡; p=0.944
With roommate	19 (42)		2.33 [1]	
Alone	3 (7)		3.33 [-]	
Activist/reflector				
Activist strong	2 (4)		3.75 [-]	H=5.452‡; p=0.244
Activist moderate	10 (22)		3.33 [0.75]	
Activist mild	16 (36)		3.58 [0.79]	
Reflector mild	14 (31)		3.5 [1.33]	
Reflector moderate	3 (7)		3 [-]	
Reflector strong	0			
Sensing/intuitive				
Sensing strong	14 (31)		3.25 [0.88]	H=7.040‡; p=0.218
Sensing moderate	17 (38)		3.66 [0.92]	
Sensing mild	9 (20)		3.55 [0.67]	
Intuitive mild	2 (4.5)		2.5 [0]	
Intuitive moderate	2 (4.5)		3.92 [-]	
Intuitive strong	1 (2)		-	
Visual/verbal				
Visual strong	8 (18)		3.25 [0.75]	H=4.035‡; p=0.401
Visual moderate	14 (31)		3.75 [0.88]	
Visual mild	15 (33)		3.33 [1.33]	
Verbal mild	7 (16)		3.17 [0.33]	
Verbal moderate	1 (2)		-	
Verbal strong	0		-	
Sequential/global				
Sequential strong	0			H=0.807‡; p=0.937
Sequential moderate	5 (11)		3.67 [1.42]	
Sequential mild	22 (49)		3.42 [0.75]	
Global mild	11 (25)		3.17 [0.83]	
Global moderate	6 (13)		3.25 [1.67]	
Global strong	1 (2)			

* Possible range from 1 to 5; † Student's t-test; ‡ Kruskal-Wallis H test; Standard deviation (SD); Interquartile range (IQR)

Table 2. Sex distribution of the learning style preferences of preclinical medical students

	Males (n=17) Number (% of 17)	Females (n=28) Number (% of 28)	Chi-square test	p
Activist/reflector			3.247	0.549
Activist strong	0	2 (7.1)		
Activist moderate	4 (24)	6 (21.4)		
Activist mild	6 (35)	10 (35.7)		
Reflector mild	7 (41)	7 (25)		
Reflector moderate	0	3 (10.7)		
Reflector strong	0	0		
Sensing/intuitive			10.339	0.028*
Sensing strong	8 (47)	6 (21.4)		
Sensing moderate	3 (17.6)	14 (50)		
Sensing mild	3 (17.6)	6 (21.4)		
Intuitive mild	2 (12)	0		
Intuitive moderate	0	2 (7.1)		
Intuitive strong	1 (5.8)	0		
Visual/verbal			1.815	0.885
Visual strong	3 (17.6)	5 (17.9)		
Visual moderate	4 (23.5)	10 (35.7)		
Visual mild	7 (41.2)	8 (28.6)		
Verbal mild	3 (17.6)	4 (14.3)		
Verbal moderate	0	1 (3.6)		
Verbal strong	0	0		
Sequential/global			3.102	0.585
Sequential strong	0	0		
Sequential moderate	2 (11.8)	3 (10.7)		
Sequential mild	7 (41.2)	15 (53.6)		
Global mild	4 (23.5)	7 (25)		
Global moderate	4 (23.5)	2 (7.1)		
Global strong	0	1 (3.6)		

* Fisher's exact test; p-values < 0.05 were regarded as being statistically significant

The majority of students were well balanced in the active/reflective dimension (Figure 1).

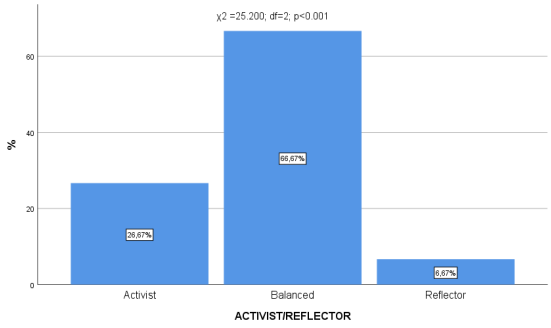

Figure 1. Shares of learning preferences in the active/reflective scale of the Index of Learning Styles questionnaire (chi-square test)

Almost 70% of students showed a preference for sensing in the sensing/intuitive dimension (Figure 2).

In the visual/verbal dimension, there was a shift toward visual learning, since only slightly over 2% of students favored verbal (Figure 3).

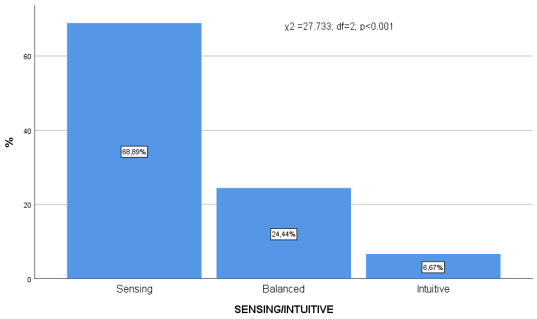

Figure 2. Shares of learning preferences in the sensing/intuitive scale of the Index of Learning Styles questionnaire (chi-square test)

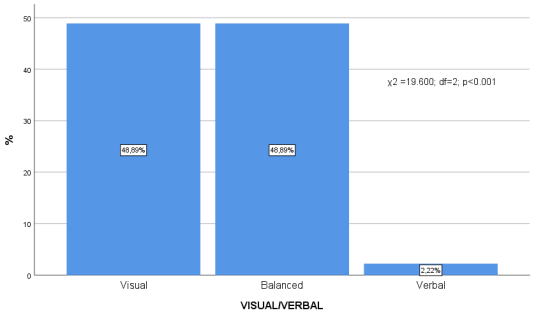

Figure 3. Shares of learning preferences in the visual/verbal scale of the Index of Learning Styles questionnaire (chi-square test)

The majority of students were well balanced in the sequential/global dimension (Figure 4).

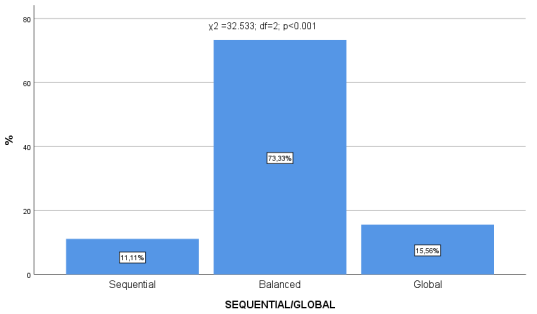

Figure 4. Shares of learning preferences in the sequential/global scale of the Index of Learning Styles questionnaire (chi-square test)

Comparisons of learning styles according to academic achievement (grade point average; the possible range was from 1 to 5) are shown in Figures 5, 6, 7, and 8. There were no significant differences in academic achievement between learning preferences in the active/reflective dimension (Figure 5).

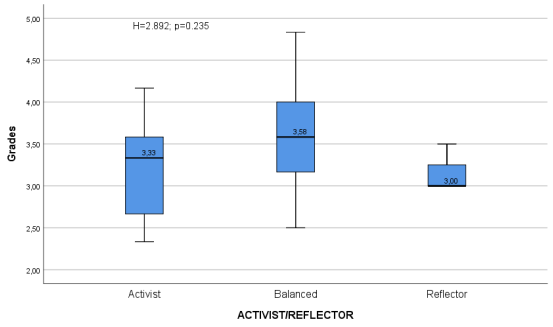

Figure 5. Comparison of learning styles in the active/reflective scale of the Index of Learning Styles questionnaire according to grade point averages (Kruskal-Wallis *H* test)

There were no significant differences in academic achievement between learning preferences in the sensing/intuitive dimension (Figure 6).

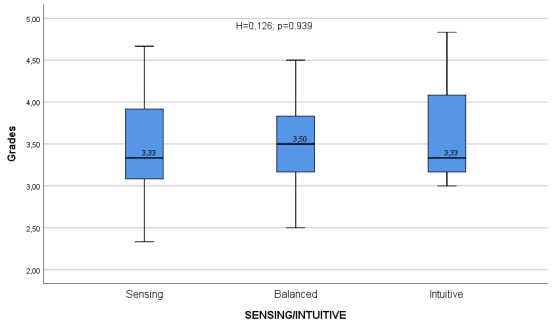

Figure 6. Comparison of learning styles in the sensing/intuitive scale of the Index of Learning Styles questionnaire according to grade point averages (Kruskal-Wallis *H* test)

There were no significant differences in academic achievement between learning preferences in the visual/verbal dimension (Figure 7).

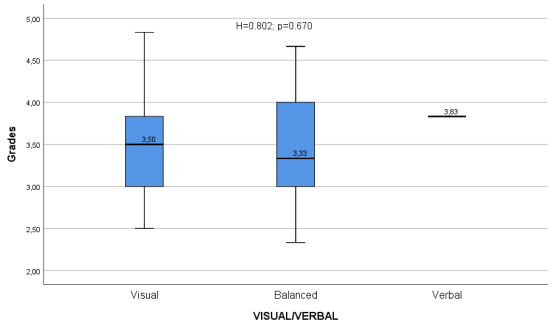

Figure 7. Comparison of learning styles in the visual/verbal scale of the Index of Learning Styles questionnaire according to grade point averages (Kruskal-Wallis *H* test)

Table 3. The International Personality Item Pool 50 questionnaire scores of the first-year medical students

Scale†	Whole study group (n = 45)	Males (n = 17)	Females (n = 28)	Males vs. females*	
	$\bar{X}$±SD	$\bar{X}$±SD	$\bar{X}$±SD	t	p
Extraversion	33.088±5.5	33.47±5.821	32.86±5.886	0.340	0.735
Agreeableness	38.955±4.5	38.24±4.880	39.39±3.510	0.924	0.361
Conscientiousness	37.422±4.719	35.47±5.702	38.61±6.238	1.688	0.099
Emotional stability	31.733±4.429	33.47±4.474	30.68±5.982	1.660	0.104
Intellect	36.555 ±3.392	35.65±4.595	37.11±4.122	1.103	0.276

* Student's t-test; † Possible range from 10 to 50

There were no significant differences in academic achievement between learning preferences in the sequential/global dimension (Figure 8).

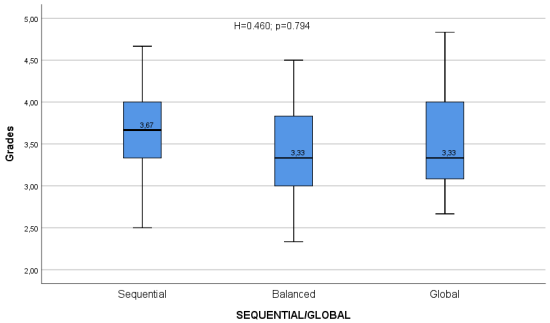

Figure 8. Comparison of learning styles in the sequential/global scale of the Index of Learning Styles questionnaire according to grade point averages (Kruskal-Wallis H test)

The scores of the IPIP-50 questionnaire are shown in Table 3. There was no significant difference between the sexes in all scales.

The Pearson's correlation coefficients between the IPIP-50 scores and grade point averages were calculated. There were no significant correlations between the examined personality traits and academic achievement (Table 4).

Table 4. The Pearson's rank correlation coefficients between the International Personality Item Pool 50 scores and grade point averages of the first-year medical students

		Grade point average	
		r	p
Males (n=17)	Extraversion	-0.003	0.991
	Agreeableness	-0.393	0.119
	Conscientiousness	0.248	0.337
	Emotional stability	0.036	0.892
	Intellect	0.034	0.898
Females (n=28)	Extraversion	-0.264	0.175
	Agreeableness	-0.046	0.816
	Conscientiousness	0.226	0.247
	Emotional stability	0.213	0.276
	Intellect	0.107	0.586
Whole study group (n=45)	Extraversion	-0.169	0.266
	Agreeableness	-0.170	0.266
	Conscientiousness	0.277	0.065
	Emotional stability	0.089	0.563
	Intellect	0.111	0.467

DISCUSSION

This analysis showed the expected predominance of women in relation to men in the examined group of medical students (10). As anticipated, the connection between academic success and sex and living place has not been established. Based on the study of the literature before the start of the research, we expected that this paper would demonstrate the association of some learning styles with better academic achievement (1, 11, 12, 14). However, a connection like this was not confirmed by this investigation. An even greater surprise is the lack of significant connection between academic success and examined personality traits, especially conscientiousness and openness to experiences that both anecdotally and in the scientific literature were usually considered factors that positively correlate with better academic success.

One study from Thailand (11) used the Index of Learning Styles questionnaire to explore the learning styles of medical students. Like in our investigation, in the active/reflective dimension, the majority of preclinical students were well balanced (59%), followed by 32% of activists and only 9% of reflectors. In our results, in the sensing/intuitive dimension, 69% of students demonstrated a preference for sensing, while 72% of Thai preclinical students were well balanced with shares of 14% for sensing and 14% for intuitive styles. As in our analysis, in the visual/verbal dimension, the Thai paper showed a shift toward visual style (44%) since only 12% of students favored verbal style. In the sequential/global dimension, most Thai students utilized a sequential style (59%), differing from our students who were mostly well balanced (73%) in this dimension with a share of only 11% for the sequential style. In our work, there were no significant differences in academic achievement between learning preferences in all dimensions. The Thai preclinical students showed an association with both the reflective and sequential learning styles, with higher academic achievement defined as a grade point average equal to or greater than 3.0 (11).

A study performed on first-year medical students in Sarajevo (12) showed better academic achievement in females than in males. This sex difference was not found in our investigation. Grades were not affected by residency status in either analysis. The reflective students from Sarajevo had higher grades than students who were balanced or active. There were no significant differences in other ILS scales. Academic achievement had a significant negative correlation with extraversion and significant positive correlation with conscientiousness (12). The authors speculated that extrovert students spend more time socializing and neglecting learning by seeking other activities, while introverts spend more time learning (12). We did not find any significant correlations between examined personality traits and academic achievement in our sample. Nayak (13) used the Eysenck Personality Inventory to evaluate extraversion in first-year medical students in India. Students with high extraversion had poorer academic achievement, but a statistically significant association between grades and extraversion scores was not identified.

In a study conducted in Kazakhstan, first-year medical students favored visual (80%) and sequential (60%) to verbal and global learning styles (14). Differences in learning preferences between males and females were found. Male students showed preferences for visual while female students preferred the sequential style. Students with sensing style demonstrated a significantly better performance in anatomy and genetics, while the global style was linked to better achievement only in genetics. An analysis performed on undergraduates at the Faculty of Education in Turkey examined the relationship between learning styles and personality traits (15). The results of the Kolb's Learning Style Inventory and the Big Five Inventory demonstrated that the majority of students were assimilators and that "agreeable" was the dominant personality trait. A significant association of GPA and sex with the distribution of learning styles was not found. In addition, this work revealed that students' learning preferences did not differ significantly according to their personality types. Therefore, the authors concluded that "one's way of learning is independent of one's personality" (15).

Bokhari et al. (16) utilized the visual, auditory, read/write, kinesthetic (VARK) questionnaire to investigate learning styles and approaches of medical students in Pakistan. The kinesthetic style was preferred by 32% of students and followed by aural, visual, and read/write styles with shares of 26%, 21%, and 21%, respectively. The kinesthetic style was the favorite learning style for all of the examined five study years. The majority (53%) of students had a preference for a bimodal approach. A tendency toward a decreased share of the unimodal approach and increased share of the multimodal approach was associated with the shift from lower years to higher ones (16). Unlike the aforementioned

paper, one by Mozaffari et al. (17) reported that the kinesthetic style was favored by the least percentage of dental students in Iran. In this investigation employing the VARK questionnaire, the most frequent style was the read/write one. Unimodal and bimodal approaches were the most frequent models of learning. Regarding the frequency of used learning styles, no significant difference between students with better or poorer academic achievement was found (17).

In an investigation by Almigbal, the majority of medical students (43%) chose to learn using all VARK modalities (18). A significant difference in the learning style distribution between male and female students was found. Male ones preferred the kinesthetic style while females favored only the aural, visual, or read/write ones, or the bimodal, and all VARK approaches. Frequencies of learning styles were not affected by residency, marital status, or study resources. Finally, no significant association between academic achievement and learning style preferences was identified (18).

The School of Medicine in Mostar uses a traditional format for teaching. Other teaching styles applied by different medical schools include problem-, case-, and enquiry-based styles (19). In addition, traditional medicine courses are offered at the School of Medicine in Mostar. Integrated medicine courses are not available in medical schools in the country. Therefore, students from the region cannot choose a medical school which has the optimal balance for their learning style.

The potential weakness of the current study may be the small sample size. Furthermore, the analysis was performed only on preclinical students. It is known that there are differences in the structure of exams between preclinical and clinical courses requiring different approaches to the learning process. Therefore, the current results cannot be generalized to the whole population of medical students. Additional research on the differences in learning styles between preclinical and clinical medical students is needed.

CONCLUSIONS

This study did not provide evidence of significant interrelation between learning preferences, personality traits, and academic achievement of preclinical medical students. The reported variations in results between our investigation and previous ones from different countries may be linked to variations in teaching methods and differences in the personalities of the examined participants.

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CONFLICT OF INTEREST

Author GF declares that she has no conflict of interest; author IČZ declares that she has no conflict of interest; author EJ declares that she has no conflict of interest; author BJ declares that he has no conflict of interest.

AUTHORS' CONTRIBUTIONS

GF: acquisition of data, literature review, contribution to study conception and design, supervision, writing the paper; EJ: acquisition of data, contribution to study conception and design, interpretation of data, literature review, supervision, critical revision of the paper; IČZ: contribution to study conception and design, literature review, supervision, interpretation of data, critical revision of the paper; BJ: study conception and design, supervision, literature review, analysis and interpretation of data, critical review, assistance in writing the paper.

ETHICAL BACKGROUND

Institutional review board statement: The study was conducted according to the guidelines of the Declaration of Helsinki, and approved by the Ethics Committee of the School of Medicine in Mostar (Reg. No. 01-1-1612/20, November 23, 2020).

Informed consent statement: Informed consent was obtained from all subjects involved in the study.

Data availability statement: We deny any restrictions on the availability of data, materials and associated protocols. Derived data supporting the findings of this study are available from the corresponding author on request.

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