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# Creativity and its determinants among medical students

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## Abstract:

**INTRODUCTION:** The ultimate goal of education at all levels is the ability to generate and foster students' creativity. This study aimed at determining and comparing creativity and its influencing factors among medical students.

**SUBJECTS AND METHODS:** In this cross-sectional study conducted in 2019, 720 medical students in Shahroud public and private universities were selected and studied through stratified cluster random sampling. Data were collected using the Guilford Creativity Questionnaire. The data were analyzed using Chi-square, Pearson correlation coefficient, *t*-test, and multiple logistic regression with a significance level of 0.05.

**RESULTS:** The mean creativity score of the students was  $131.4 \pm 13.8$ . The mean creativity scores on the fluency, elaboration, originality, and flexibility dimensions were  $49.2 \pm 5.3$ ,  $22.1 \pm 3.4$ ,  $34.8 \pm 4.7$ , and  $25.4 \pm 3.5$ , respectively. In terms of creativity levels, 75.2% of the students ( $n = 542$ ) had moderate creativity and 23.8% ( $n = 171$ ) had high creativity. A significant relationship was observed between creativity and educational level ( $P = 0.006$ ). Multiple logistic regression results showed that educational level with an odds ratio of 0.59 was associated with a decreased chance of creativity.

**CONCLUSION:** Most of the students had moderate creativity. Moreover, among the factors examined in this study, variables other than the field of the study and educational level had no significant effect on students' creativity. Therefore, using collaborative and cooperative learning and problem-based learning strategies, teachers' critical thinking styles, establishing teamwork groups, concept mapping, and using innovative and creative teaching methods can help to enhance students' creativity.

## Keywords:

Creativity, fluency, medical students, pliability

## Introduction

Creativity is one of the important characteristics of human behavior that influences one's personal and social development.<sup>[1,2]</sup> It is also one of the valuable and effective resources in the development and progress of society.<sup>[3,4]</sup> Today, the ranking of societies and countries is based on the production of knowledge that is rooted in the creativity of individuals,<sup>[5]</sup> and the ultimate goal of education at all levels is the ability to generate and enhance creativity in students.<sup>[6]</sup> Since the younger generation upon entering the new realms of life faces the challenge of depletion

of the natural resources and increased daily life problems, it needs to develop its intellectual and practical skills to adapt more and more to the world of replete with technology and challenges to solve its problems.<sup>[7]</sup> An American psychologist views creativity as a way of sensitizing and dealing with problems and deficiencies, gaps in knowledge, identifying problems, and seeking solutions and testing and modifying them.<sup>[8]</sup>

Guilford defines creativity as the ability and skill to create new and innovative things.<sup>[9]</sup> Although it is difficult to define creativity, there is a general consensus that creativity has four main elements of fluency (the ability to produce many ideas),

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elaboration (the ability to pay attention to details), originality (the ability to produce new, unusual, and fresh ideas), and flexibility (the ability to produce a variety of ideas or methods).<sup>[10-12]</sup>

The most important attributes mentioned for creative people are the fluency of thought, flexibility, innovation, the ability to create new definitions of problems, and sensitivity to problems, and the creative people are people whose new ideas are recognized and accepted by others.<sup>[13-16]</sup>

The importance of creativity in the medical sciences is to the extent that health-care personnel often need creative solutions to interact with patients and clients and to make decisions and solve specific problems that arise in their careers and services.<sup>[17,18]</sup> Medical students must master a huge amount of courses and topics in a limited time. They must acquire comprehensive knowledge of the subjects and good communication skills to take care of their patients. Therefore it is necessary to incorporate various techniques of creating and improving creativity in their curricula.<sup>[19]</sup> Therefore, universities should play an important role in the generation, growth, and development of creativity, and they are responsible for the identification of the current status of creativity in students, as well as its barriers and causes, and the results of such studies can be effective in planning to improve creativity and growth.<sup>[20,21]</sup> The results of a study in Australia showed that <10% of medical students were highly creative and less than half (48%) of students had acceptable creativity.<sup>[13]</sup> The results of another study in Poland indicated that Polish and Chinese students had acceptable creativity characteristics.<sup>[2]</sup> The results of some studies show low creativity,<sup>[21,22]</sup> moderate creativity,<sup>[23,24]</sup> and high creativity among students.<sup>[15,25-28]</sup>

Since in each society, students as intellectual and creative human resources have a special position, it is necessary to identify the required conditions for educating qualified people, especially in the medical sciences, who will be in charge of the health care of others after graduation. Therefore, this study aimed at determining creativity and its influencing factors among medical students of public and private medical universities in Shahroud, Northeast of Iran.

## Subjects and Methods

In this cross-sectional study conducted in 2019, 720 students of public and private universities of medical sciences in Shahroud were selected and studied through multistage random sampling. With regard to the total number of medical students in two universities, i.e., 2900 students, in the first stage, stratified sampling was done in Shahroud Islamic Azad University and

Shahroud University of Medical Sciences. In the second stage, after specifying the number of participants in each university and in each field of the study, based on the list of students active in each semester, and the required size of the sample in each university and field of study, a number of classes were randomly selected as clusters and the students in those classes were studied.

In this study, creativity was measured using the Persian version of Guilford's creativity instrument.<sup>[9,29]</sup> The Persian version of the questionnaire consists of 60 three-choice items and it measures four subscales of fluency, elaboration, originality, and flexibility. A higher score on the questionnaire indicates a higher level of creativity. The reliability of the Persian version of creativity instrument was assessed using alpha Cronbach's coefficients and was reported 0.85, 0.82, 0.84, and 0.80 for the subscales of fluency, originality, flexibility, and elaboration, respectively.<sup>[29]</sup> In our study, the internal consistency of the Persian version of creativity using alpha Cronbach's coefficient was 0.88. Each item was scored on a 3-point scale ranging from 1 to 3 where 1 shows low creativity, 2: moderate creativity, and 3: high creativity. The overall score is a sum of four subscales and ranges from 60 to 180. In the Persian version of creativity questionnaire, items 1–22 measure fluency and items 23–33, 34–49, and 50–60 also measure elaboration, originality, and flexibility, respectively. Scores of fluency range between 22 and 66, and for elaboration, originality, and flexibility, they can, respectively, range between 11 and 33, 16 and 48, and 11 and 33. Here again, a higher score indicates a higher level of fluency, elaboration, originality, and flexibility.<sup>[29]</sup> The total scores <100, 100–140 and over 140 were categorized as low, moderate, and high creativity levels.<sup>[24]</sup>

The creativity questionnaire was anonymously self-administered to the participants whose participation in the study was voluntary. The proposal for this study was approved by the Ethics Committee of Shahroud University of Medical Sciences (Code: IR.SHMU.REC.1392.54).

The collected data were analyzed using the Chi-square test, *t*-test, Pearson correlation coefficient, and multiple logistic regression tests. The normality of quantitative variables was assessed using Kolmogorov–Smirnov test. The significance level for all tests was set at 0.05.

## Results

The average age was equal to  $21.9 \pm 2.2$  years. Most of the participants (65.1%) were female; 73 (10.1%) were married, 478 (66.4%) of them were residents in the dormitory; 182 (25.3%) of them lived in houses away from the family, and 60 (8.3%) of them lived in their own

homes with their families. The proportion of sampling from public and private universities was 55.6% and 44.4%, respectively.

The mean score of creativity among students was  $131.4 \pm 13.8$ , which is a moderate score. The mean creativity score for dimensions of creativity was  $49.2 \pm 5.3$  for fluency,  $22.1 \pm 3.4$  for elaboration,  $34.8 \pm 4.7$  for originality, and  $25.4 \pm 3.5$  for flexibility. In this study, 76.2% of the participants ( $n = 549$ ) had moderate creativity and 23.8% ( $n = 171$ ) had high creativity.

Neither were significant relationships observed between creativity levels with gender, type of university, place of residence, marital status, and job status, but there was a significant relationship between the level of education ( $P = 0.006$ ) with creativity levels and students of medicine showed higher levels of creativity [Table 1].

There was no significant difference between the mean creativity score and its dimensions ( $P \geq 0.05$ ) among students of the public and private universities of medical sciences, except for flexibility ( $P = 0.005$ ), [Table 2].

Multiple logistic regression results showed that among the factors studied, only educational level with an odds ratio of 0.59 was associated with a decreased chance of creativity so that the chances of high creativity at higher levels of education are almost twice as low as those at lower levels [Table 3].

### Discussion

The overall creativity score level was moderate. Some studies have reported a higher mean creativity score than the one found in this study,<sup>[26-28,30]</sup> while some others have reported a lower mean creativity score compared to our findings.<sup>[13,22,23,25,31-34]</sup> One reason for such discrepancies is probably the types of universities and disciplines and social and cultural environments. Creativity and curiosity are logically required for caregiving decisions for medical students who are involved in sophisticated caregiving situations during their education and training, and after graduation, they will simultaneously assume the critical responsibility of health education and health care. Therefore, their creativity needs to be promoted so that they can have excellent performance in their jobs.

The mean score of fluency and flexibility is similar to those found in a previous study conducted in Shahroud University of Medical Sciences.<sup>[24]</sup> The mean scores for these subscales found in this study are higher than those reported in some studies<sup>[27,30]</sup> and lower than those reported in another study conducted in Iran.<sup>[28]</sup>

Some studies in Iran have reported higher mean scores for elaboration and originality dimensions, which is

**Table 1: Association between levels of creativity and some variables**

Variable	Creativity (%) n		$\chi^2$	P
	Moderate	High		
Gender				
Male	196 (78.1)	55 (21.9)	0.719	0.226
Female	353 (75.3)	116 (24.7)		
Level of education				
Professional Doctorate	124 (67.4)	60 (32.6)	12.61	0.006
Continuous BSc	418 (79.47)	108 (20.53)		
Associate	7 (70)	3 (30)		
Marital status				
Married	57 (78.08)	16 (21.92)	0.696	0.706
Single	492 (76)	155 (24)		
Employment				
Employed	22 (73.33)	8 (26.77)	0.989	0.610
Unemployed	527 (76.4)	163 (23.6)		
Residence				
Dormitory	368 (77)	110 (23)	0.858	0.651
House (away from family)	138 (75.8)	44 (24.2)		
House (with family)	43 (71.7)	17 (28.3)		
University				
Public	310 (77.5)	90 (22.5)	0.777	0.380
Private	239 (74.7)	81 (25.3)		

**Table 2: Mean scores of creativity and its dimensions in public and private universities under the study**

Variable	Mean±SD	t	P
Fluency			
Public	49.00±5.25	-0.859	0.390
Private	49.35±5.46		
Elaboration			
Public	22.14±3.53	0.459	0.646
Private	22.02±3.29		
Originality			
Public	34.54±4.79	-1.508	0.132
Private	35.07±4.62		
Flexibility			
Public	25.08±3.49	-2.813	0.005
Private	25.82±3.53		
Overall creativity			
Public	130.76±13.95	-1.447	0.148
Private	132.26±13.70		

SD=Standard deviation

**Table 3: Multiple logistic regression for the relationship between creativity and variables in the study**

Variable	$\beta$	Wald $\chi^2$	OR	CI	P
University	0.64	0.081	1.066	0.686-1.658	0.776
Gender	0.141	0.493	1.151	0.777-1.706	0.482
Age	0.006	0.016	1.006	0.919-1.101	0.898
Place of residence	0.003	0.001	1.003	0.714-1.409	0.988
Marital status	0.116	0.132	1.123	0.599-2.106	0.717
Occupation	-0.332	0.550	0.717	0.298-1.726	0.458
GPA	0.075	1.586	1.078	0.959-1.211	0.208
Educational level	-0.523	7.241	0.592	0.405-0.867	0.007
Constant	-1.479	0.530	0.228	-	0.467

OR=Odds ratio, CI=Confidence interval, GPA=Grade point average

inconsistent with recent results.<sup>[27,28,30]</sup> However, the findings of this study are similar to the previous study conducted in Shahrood University of Medical Sciences.<sup>[24]</sup>

There was no significant difference between creativity and gender, which is consistent with the results of some studies<sup>[24,27,35,36]</sup> but not with some others.<sup>[28,37]</sup> It may be argued that gender differences in creativity may originate from cultural and social factors, and some misconceptions such as “men are more intelligent and that women should make more efforts to succeed” may exaggerate gender differences. Despite such misconceptions, in Iran today, having the same conditions and facilities as boys, girls are more likely to reach high levels of education, and in some academic disciplines, they outnumber boys.

The results showed no significant relationship between creativity and place of residence, marital status, occupation, and semester. The results of this study were consistent with the findings of a study at Tehran University and one in Shahrood University.<sup>[24,27]</sup> The results of some other studies, however, show a significant relationship between students’ creativity and their years of study at university, which is not consistent with the results of this study.<sup>[25,32,38]</sup>

The results showed no significant relationship between creativity and grade point average, which is inconsistent with the results of some studies<sup>[24,26,39-41]</sup> but in line with the results of some other studies in Iran and the world.<sup>[24,34,42-44]</sup> The absence of a meaningful relationship between creativity and the grand point average does not indicate the absence of creativity. One possible reason for the absence of such a relationship may be the examination questions which focus more on the lower levels of Bloom’s taxonomy such as “remember” and “understand” and the higher levels of the taxonomy such as “evaluate” and “create” are often ignored, and what creativity scales measure is not the same as what academic achievement tests measure. In other words, university-based teachings that determine academic achievement and grade point averages emphasize traits that are not necessarily attributes of creative thinking. With traditional teachings in Iranian universities, university professors and instructors place great emphasis on remembering and achieving high scores, and as long as the structure of the higher education system is based on this, the absence of a relationship between creativity and students’ grand point averages seems to be natural.

The results, however, showed a significant relationship between creativity and field of the study, which is consistent with the findings of some studies<sup>[27]</sup> but inconsistent with some others.<sup>[30,45]</sup> This difference seems

to be rooted in a variety of factors, such as differences in educational systems, teaching methods, and educational content in recent years in the field of medicine.

This study was a well-designed study with a large sample size that used a standardized questionnaire. However, it was a cross-sectional study, and the associations found in the study must be interpreted cautiously. In addition, a specific group of students (including students of medical sciences) were studied, a fact which makes it unwarranted to generalize the findings to other students.

## Conclusion

More than three-quarter of the students had moderate creativity. Moreover, among the factors examined in this study, except for the field of study and level, other factors had no significant effect on students’ creativity. Recognizing that creativity is a key component of health service providers’ performance, it is therefore important to enhance their creativity so that they can have an excellent performance. The use of collaborative and problem-based learning strategies, critical thinking styles of instructors, teamwork or team-based learning, concept mapping, and the use of innovative and creative teaching methods can facilitate the achievement of this goal. In addition, further studies are suggested to focus on exploring the relationships between creativity and factors other than the variables examined in this study.

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## Conflicts of interest

There are no conflicts of interest.

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