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# The trend of critical thinking disposition in medical students and its relationship with their academic performance

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## Abstract:

**BACKGROUND:** Critical thinking is one of the important skills required for medical students. It is considered as a main component in medical education and training competent physicians. The current study aimed to investigate the trend of critical thinking disposition of medical students and its association with their academic performance.

**MATERIALS AND METHODS:** This descriptive cross sectional study was conducted in 2019 on 315 medical students of Ahvaz Jundishapur University of Medical sciences. A two-section questionnaire was used for data collection. The first section dealt with demographic characteristics and the second section included Ricketts critical thinking disposition inventory using *t*-test, analysis of variance, and Pearson correlation coefficient.

**RESULTS:** Mean and standard deviation of critical thinking disposition of medical students was  $121.85 \pm 11.32$ . No significant difference was observed between the mean score of critical thinking disposition and years of study ( $P = 0.74$ ,  $F = 0.590$ ). Pearson correlation test also showed no significant association between critical thinking disposition and the students' grade point average ( $P = 0.89$ ,  $r = 0.007$ ).

**CONCLUSIONS:** The results of the current study showed that medical students' level of critical thinking disposition is above average, and there is no significant correlation between critical thinking disposition and years of study and academic performance of the students. It seems that the educational process in medical school has not been effective in improving the level of students' critical thinking disposition.

## Keywords:

Academic performance, medical student, thinking

## Introduction

Medical faculties involved in training of health-care manpower are always worried about improvement of quality of graduates in providing health care. Physicians in health-care system are faced with unprecedented problems in workplace to which there is no unique and absolutely correct answer. Therefore, they should often make clinical decisions regarding complicated matters with little guidance

and limited time and resources. The problem-solving ability in patient bedside is invaluable. Critical thinking can provide a wider view, creative solutions, and multiple paths when dealing with problems.<sup>[1-3]</sup>

According to the evidences, critical thinking skills have been linked to improved patient outcomes, better quality patient care, and improved health outcomes in health-care system. Critical thinking is one the important skills in clinical decision-making. Reinforcement of critical thinking skill lets

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the physician provide the best health-care services by making informed decision.<sup>[4,5]</sup> In this regard, world federation for medical education (WFME) introduces critical thinking as the main skill for medical students to be achieved during their educational courses.<sup>[6]</sup>

Critical thinking is a reasonable, systematic, effective, logical, and outcome-based thinking which analyzes and investigates the information scientifically. Critical thinking consists of two aspects of skill and disposition. Aspect of skill of critical thinking emphasizes cognitive strategies. Without positive disposition regarding critical thinking, this type of thinking does not manifest itself, it is an attribute or habit of mind that is integrated into one's beliefs or actions to effectively solve problems and make decisions as a product of thinking.<sup>[7,8]</sup> Skills are not enough to enable a person to think critically; if that person does not have the disposition or motivation to do them, there will be no critical thinking.<sup>[9]</sup> Therefore, critical thinking disposition is a vital part of critical thinking process.

Since medical training system is now faced with many challenges in satisfying the expectations of society in promoting health. The necessity of training creative, thoughtful, and efficient graduates with high potential of decision-making is indispensable. Naturally, critical thinking provides this opportunity for physicians to provide more valuable services in caring process through making accurate decisions.<sup>[9,10]</sup>

Experts of medical education consider the development of critical thinking skills necessary for medical students to improve quality of medical education and introduce this skill as one of the medical education standards accreditation of schools of medicine.<sup>[4,11]</sup>

Training medical students to provide appropriate care for patients in today's developed world needs education which reinforces critical thinking. Therefore, to be aware of the quality of education provided in universities, it is necessary to evaluate the growth and development of critical thinking in students. Despite the importance of critical thinking in the educational process, the results of various studies indicate that in general, students' ability to use critical thinking skills is low. The trend toward critical thinking in university students has yielded different results. Some studies have reported an increasing trend in the level of students "critical thinking and some other studies have reported a lack of difference in the level of students" critical thinking in different years and a descending trend.<sup>[12-15]</sup>

Training medical students to provide appropriate care for patients needs education which reinforces critical thinking. Therefore, to be aware of the quality

of education provided in universities, it is necessary to evaluate the growth and development of critical thinking in students. The finding of Taheri *et al.* study showed a difference among critical thinking disposition of first and last semester and critical thinking disposition in students of last semester was greater than that of the first semester students.<sup>[12]</sup> Barkhordary, Shakurnia and Baniasad, and Kaya *et al.* in their studies on students of nursing and medicine found no significant statistical difference among critical thinking disposition based on the year of study.<sup>[13-15]</sup> Results of the study by Fathiazar *et al.* and Lei *et al.* indicate that the trend of mean critical thinking disposition in students is descending.<sup>[16,17]</sup> Numerous factors for the difference or lack of difference in critical thinking among students during study years in university are reported which necessitates performing further studies in this regard to clarify its reasons.<sup>[16,18,19]</sup>

Findings of the studies conducted on the relationship between critical thinking and educational performance have also showed different results. While some studies point to the positive association between critical thinking disposition and educational performance, results of other studies report lack of such association between these two variables.<sup>[20-22]</sup> Therefore, due to heterogeneity of results, further studies in this regard can be helpful. Given the importance and role of critical thinking in the future profession of medical students and in the diagnosis and treatment of diseases, and the necessity of having the ability to analyze and critically think in the complicated and vital environment of health system in which they will be employed after graduation, critical thinking is important for diagnosis and treatment of diseases due to , without critical thinking, physicians are prone to cognitive errors, Cognitive errors can lead to diagnostic errors, which result in increased patient morbidity and mortality.

A diagnostic errors leads to error treatment and since there is no comprehensive research regarding critical thinking disposition of medical students in this university, this study aimed to investigate the status of critical thinking disposition in students of medical fields, its trend during education in university, and its association with educational performance.

## Materials and Methods

### Study design and setting

This research is a descriptive cross-sectional study which investigates the trend of critical thinking disposition and its association with educational performance of medical students.

### Study participants and sampling

Study population was all medical students studying at

Ahvaz Jundishapur University of Medical Sciences in academic year of 2019–2020, and their number was 1759 individuals based on the reports by educational office of the faculty of medicine.

Sample size in this study was estimated to be 317 using Morgan and Krejcie table. Due to probability of incomplete questionnaires and considering 5% of attrition rate, 332 students were considered as study sample.

### Data collection tool and technique

Willingness to participate in the study and informed completion of the questionnaire were considered as inclusion criteria and lack of willingness to participate in the study and not completing the questionnaire were considered as exclusion criteria.

Data gathering tool in the study was a two-section questionnaire. The first section consists of demographic characteristics of students. The second section is the Ricketts critical thinking disposition inventory. This questionnaire is a self-assessment tool which examines critical thinking disposition in students. The questionnaire consists of 33 questions in three subscales of innovation (11 phrases); maturation (9 phrases) and involvement (13 phrases), and is graded as 5-scale Likert from<sup>[1]</sup> absolutely disagree to<sup>[5]</sup> absolutely agree.<sup>[23]</sup>

Validity and reliability of the questionnaire have been assessed and confirmed in previous studies.<sup>[24]</sup> In Iran, Pakmehr *et al.* confirmed the validity and reliability of the Persian version of the questionnaire using factorial analysis and calculating Cronbach’s alpha coefficient.<sup>[25]</sup> In the current study, validity and reliability of the questionnaire were assessed using the opinion of experts (face validity) and calculating Cronbach’s alpha coefficient, and Cronbach’s alpha achieved for whole questionnaire was 0.828 and for items of innovation, maturation, and involvement, it was 0.730, 0.542, and 0.819, respectively.

Range of scores is among 33–165 with a mean of 99, and the score of 99 is considered an average level in assessment of the level of critical thinking disposition. These values are between 1 and 55 with an average of 33 for the subscale of innovation, between 9 and 45 with an average of 27 for the subscale of maturation, and between 13 and 65 with an average of 39 for the subscale of involvement.

In this study, the grade point average (GPA) value of the students was considered as index and criterion for assessment of educational achievement. Classification of students into two groups with high and low educational achievement based on cut-off point of GPA of students in this study which obtained at 15.93 was done.

The researcher uploaded the questionnaire to a website and sent its link for 332 medical students after obtaining ethical approval and permission from the school of medicine. After being briefed on the objectives of the study, the students were asked to respond the questions one by one and to send the filled questionnaire for the researcher.

The questionnaires were anonymous and the students were assured that their information would remain confidential.

To assess normality of the variables, Kolmogorov–Smirnov test was used. Result of this test showed that data distribution was normal ( $P = 0.43$ ). Data were analyzed after coding using SPSS version 18 (IBM Corporation, Armonk, NY, USA). To analyze data, descriptive, and inferential methods were used. Mean, standard deviation, and frequency were used to analyze data descriptively, and to compare groups, analysis of variance (ANOVA) and *t*-test were used. Pearson correlation coefficient was used to determine probable association between the students’ score of critical thinking disposition and their GPA.  $P < 0.05$  was considered as statistically significant in all tests.

### Ethical consideration

All procedures followed were in accordance with the ethical standards of the responsible committee on human experimentation (institutional and national) and with the Helsinki Declaration of 1975, as revised in 2000. Informed consent was obtained from all participants for being included in the study.

## Results

Most students were female (61%) and the rest were male (39%). The mean grade point average of the students was 15.91; 179 students had GPA higher than the mean value (57%). The mean total score of critical thinking disposition of the students was  $121.85 \pm 11.32$ .

Table 1 shows the mean and standard deviation of critical thinking disposition score and its subscales of innovation, maturation, and involvement. According to the findings, the mean score of critical thinking disposition was greater than the average in the students.

**Table 1: Mean and standard deviation of critical thinking disposition of medical students**

Variable	Mean±SD	Minimum	Maximum
Innovation	44.72±4.52	24	55
Maturation	26.39±3.69	18	39
Involvement	50.74±6.49	27	65
Critical thinking disposition	121.85±11.32	80	156

SD=Standard deviation

**Table 2: Comparison of mean of critical thinking disposition of medical students by educational year**

Variable	Educational year	Number of students	Mean±SD	95%	F	P
Innovation	First	40	45.13±3.86	43.89-46.36	0.591	0.73
	Second	41	44.85±4.23	43.52-46.19		
	Third	46	44.04±2.83	43.20-44.89		
	Fourth	43	44.88±4.49	43.50-46.27		
	Fifth	42	45.60±4.88	44.07-47.12		
	Sixth	45	44.38±5.81	42.63-46.12		
	Seventh	58	44.40±4.90	44.11-45.68		
	Total	315	44.72±4.52	44.22-45.22		
Maturation	First	40	25.78±4.03	26.53-28.37	2.33	0.032
	Second	41	25.32±3.32	25.28-27.74		
	Third	46	26.28±3.25	25.96-28.66		
	Fourth	43	25.67±2.85	24.80-26.55		
	Fifth	42	27.31±4.32	25.32-27.25		
	Sixth	45	26.51±4.10	24.27-26.37		
	Seventh	58	27.45±3.49	24.48-27.07		
	Total	315	26.39±3.69	25.98-26.80		
Involvement	First	40	50.88±5.62	49.08-52.67	0.836	0.54
	Second	41	51.68±5.77	49.86-53.50		
	Third	46	49.91±4.70	48.52-51.31		
	Fourth	43	50.26±7.28	48.02-52.50		
	Fifth	42	51.40±7.38	49.10-53.71		
	Sixth	45	51.80±7.09	49.67-53.93		
	Seventh	58	49.70±6.97	47.86-51.52		
	Total	315	50.74±6.45	50.02-51.46		
Critical thinking disposition	First	40	121.78±10.50	118.42-125.13	0.590	0.74
	Second	41	121.85±9.61	118.82-124.89		
	Third	46	120.24±7.83	117.91-122.56		
	Fourth	43	120.81±12.14	117.08-124.55		
	Fifth	42	124.31±13.34	120.15-128.47		
	Sixth	45	122.69±13.29	118.70-126.68		
	Seventh	58	121.53±11.67	118.46-124.60		
	Total	315	121.85±11.32	120.60-123.11		

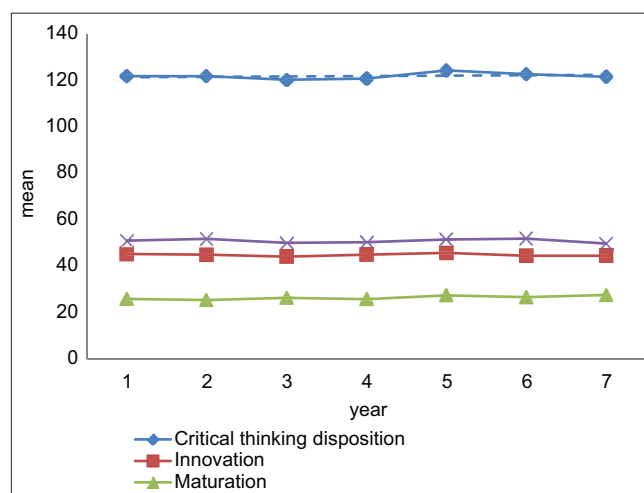
SD=Standard deviation

ANOVA test showed no significant difference between the educational years and mean score of critical thinking disposition ( $P = -0.74$ ,  $F = 0.590$ ).

Comparison of mean scores of students in subscales also showed no significant difference in the subscales except for maturation subscale which showed significant difference in various years of education ( $F = 2.333$ ,  $P = 0.032$ ) [Table 2].

Out of the 332 questionnaires distributed among students, 315 questionnaires were completely filled and returned (response rate of 94.6%). Mean age of students was 23.43 years with standard deviation of 2.46 (19 to 29 years).

Mean of critical thinking disposition in males and females was  $122.83 \pm 11.44$  and  $121.23 \pm 11.23$ , respectively. Comparing the mean scores of critical thinking disposition and its subscales using independent *t*-test showed no significant difference between critical thinking disposition by gender ( $P = 0.22$ ) [Figure 1].



**Figure 1:** Mean scores of critical thinking disposition and its sub-scales during years of education

Mean scores of critical thinking disposition in students with low and high GPA were  $122.13 \pm 11.60$  and  $121.64 \pm 11.60$ , respectively; and the result of independent

*t*-test indicates that there is no significant difference between in two groups of students ( $P = 0.70$ ). Pearson correlation test also showed that there is no significant correlation between the students' critical thinking disposition and GPA ( $P = 0.89, r = 0.007$ ).

## Discussion

In the current study that the trend of critical thinking disposition of medical students was evaluated, the results showed that mean score of critical thinking disposition of the medical students was  $121.85 \pm 11.32$  which is greater than the average level, given the score range of 33–165. Results of the studies conducted in Tehran and Isfahan Universities of Medical Sciences also showed the level of critical thinking disposition of the medical students to be at an average level<sup>[12,26]</sup> which is in line with the current study. In explaining this result, it can be argued that medical students need to strengthen the level of their critical thinking disposition compared to other students. This is because the level of critical thinking disposition of medical students is far from the desired level and because in medical sciences, students' future careers require the ability to solve problems and make decisions about patient problems to provide appropriate services. Therefore, appropriate measures need to be taken in educational programs so that this skill is maximized in these students.

Other results of the current study indicate that as medical students go to proceed in their educational programs, their score of critical thinking disposition does not increase. Although it is expected that the critical thinking disposition will increase in higher years of study at university when the students become more experienced, the findings indicate that there is no significant relationship between the critical thinking disposition and academic years. It seems that the educational process in medical school has not been effective in improving the level of students' critical thinking disposition. Probably, since in the educational programs of medical students, the category of critical thinking disposition has not received special attention, and new educational facilities and methods of medical education are not employed to strengthen this principle. Not surprisingly, no significant difference in critical thinking disposition of students during the study period can be expected. In fact, neglecting the reinforcement of critical thinking disposition in medical education at university has led to unchanged in critical thinking disposition of students, which should be taken as a serious warning. Numerous factors can play a role in justifying the lack of growth in critical thinking disposition in universities, especially Iranian universities during the years of study. For example, in most universities, the lecture method is used predominantly in teaching and less emphasis on

active teaching methods. Lecture as a dominant method, in many universities, promotes a passive method of teaching in which critical thinking is either only implicitly taught or barely taught. Researchers suggest that to improve the critical thinking disposition, teachers should pay more attention to active methods such as problem-based learning, simulation, concept map, and appropriate assessment methods.<sup>[4,26]</sup>

In field of medical sciences, researchers have compared the level of critical thinking disposition during years of education in medical students and have reported different results. The results of the current study were in line with the findings of the studies by Barkhordary, Shakurnia and Baniasad, Athari, and Kaya *et al.* which did not report any significant difference among critical thinking disposition and years of education.<sup>[10,13-15]</sup> However, our results are not in line with those of Taheri *et al.*<sup>[12]</sup> and Mslm<sup>[27]</sup> which reported an ascending trend between critical thinking disposition and years of education and those of Fathiazar *et al.*<sup>[16]</sup> and Huang *et al.*<sup>[28]</sup> which reported a descending trend. These discrepancies can be the result of factors such as training environment, training method, methods of assessment, and various cultural factors.

According to the results, there was no significant association between critical thinking disposition and educational performance. This issue can be a result of dominance of traditional training method of assessment of students in Iranian universities where in the assessment of students, the skill of critical thinking and analysis is not considered, and memorization is more emphasized. Ranjbar and Esmaili<sup>[29]</sup> investigated critical thinking disposition in nursing and midwifery students and its association with the educational status, and their results did not show any significant association, which was in line with the current study.

According to the findings of a research by Mirzaie and Mirzaie, there was a significant association between elements of curriculum and critical thinking disposition, such that reinforcing each of the elements of curriculum (content, objective, method, and assessment) was accompanied with reinforcement of critical thinking disposition in students.<sup>[30]</sup> Pakmehr *et al.* also showed that there is a significant association between quality of training and critical thinking disposition of the students.<sup>[31]</sup>

Therefore, any targeted attempt to promote quality of teaching methods should be performed considering other elements of medical curriculum. Importance of developing critical thinking skills is so important that some experts consider critical thinking as the major objective of university education and experiences and

believe training is teaching critical thinking to the student.

Unfortunately, the methods of teaching and learning in the Iranian Universities pay more attention to increasing and strengthening memorization, and less to training and developing the skills of critical thinking. Therefore, to fulfill its mission, the higher education system needs to review the goals, content and educational materials, teaching-learning methods and assessment system, and everything related to the curriculum.

### Limitation and recommendation

The most important limitation of this research is that the study sample was limited to medical students of Ahvaz Jundishapur University of Medical Sciences, so the generalizing of the results should be done cautiously. It is recommended to select a larger study sample from universities of medical sciences of the country in further studies. In addition, design of the current study was cross-sectional, and there is no possibility of assessment of changes in critical thinking disposition level in students from the entry to university until graduation.

### Conclusions

The findings showed that critical thinking disposition in medical students is higher than average, and there is no significant association between critical thinking disposition and years of education and educational performance of the students. Given the positive relationship between curriculum elements and students' critical thinking disposition, it is necessary to review the curriculum and its elements, especially in the field of teaching-learning strategies.

The curriculum should be organized in a way that strengthens the critical thinking disposition and skills of in medical students. It is suggested that more comprehensive research be conducted in other universities of medical sciences by considering other variables related to the critical thinking disposition to identify the factors and variables predicting the critical thinking disposition levels in students.

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### Conflicts of interest

There are no conflicts of interest.

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