

# Research Paper:

## Comparing the Status of Critical Thinking and Its Associated Factors in Students



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Please cite this article as Dargahi A, Vosoughi M, Hamidzadeh Arbabi Y, Sadeghi H, Hosseinpour R. Comparing the Status of Critical Thinking and Its Associated Factors in Students. Archives of Hygiene Sciences. 2021; 10(4):263-270. <http://dx.doi.org/10.32598/AHS.10.4.38.16>

doi <http://dx.doi.org/10.32598/AHS.10.4.38.16>



### Article info:

Received: 02 Apr 2021

Accepted: 25 May 2021

Publish: 01 Oct 2021

### Keywords:

Creativity, Thinking, Students, Critical thinking, Health disciplines, Related factors

## ABSTRACT

**Background & Aims of the Study:** By being aware of the state of critical thinking and the factors affecting it in students, it is possible to help improve the planning and quality of education. This study aimed to comparatively determine the status of critical thinking and the factors affecting it in students.

**Materials and Methods:** The present cross-sectional study's population and the sample consisted of health disciplines students of Ardabil University of Medical Sciences in Ardabil City, Iran. All students of the two entrances of 2017 and 2020 were enrolled in the study by completing a virtual questionnaire. According to the relevant results, 155 individuals completed the questionnaire. Descriptive and analytical tests in SPSS v. 20 analyzed the collected data.

**Results:** The minimum score of critical thinking was 4, the maximum was 16, and the Mean±SD essential score of thinking was 10.17±2.56 in all students. Among the studied variables, only the relationship between the subscales of inference and inductive reasoning with the year of entry of the studied students was significant (P=0.02) and (P=0.026). In other cases, there was no significant correlation between demographic variables, such as age, gender, the year of entry, native or non-native, the field of study, and grade point average with the overall scores of critical thinking and its subscales (P>0.05).

**Conclusion:** The current study results indicated that the critical thinking skills of health students of Ardabil University of Medical Sciences are poor in all dimensions and subscales. Considering the importance of critical thinking in the development, progress, and well-being of individuals and societies, reviewing and correcting the curriculum, training and empowering teachers concerning critical thinking skills, and teaching it in higher education and academic centers.

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## 1. Introduction

Critical thinking skills are the ability to search for a problem or situation, integrate all available information about that problem, and arrive at a solution or hypothesis to justify one's orientation [1]. According to educational experts, critical thinking is essential in achieving desirable academic results and proper performance in the job and profession [2]. In other words, some thinkers consider critical thinking as the primary goal of education and academic experience and one of the standards of medical education. Besides, critical thinking is viewed as a topic of school accreditation [3, 4]. Furthermore, the development of critical thinking skills is among the main goals of colleges and universities [5]; thus, the quantitative expansion of the higher education system, regardless of the quality of education and including students' critical thinking status, will have consequences such as academic failure, academic dependence, lack of entrepreneurship, and poor knowledge production [1]. According to surveys, most students do their homework mechanically and without critical thinking [6]; thus, students do not develop critical thinking during their university years [2]. Accordingly, more than 80 percent of administrators and employers require universities to emphasize developing students' critical thinking skills [7].

Moreover, evidence and day-to-day experience at universities indicate that numerous students lack the affective experience of liberating learning at university. Depth, efficiency, influence, and effectiveness in Iranian university education have been controversial. We observe improper science education around us. Students' scientific socialization is not satisfactory. Their scientific minds and critical thinking do not flourish, and their desire for an impartial search for meaning and truth is not aroused [8]. Therefore, critical thinking is considered among the essential requirements of human activity [9]; thus, improving students' critical thinking skills are among the topics of interest in the teaching process [7]. Although critical thinking has been studied in recent decades, research on critical thinking revealed that this issue has been inadequately addressed; education professionals are concerned about students' inability to think critically [9-11]. Studying students' critical thinking and reasoning and the factors influencing this field can be beneficial [7]. A review of the literature suggests that various studies have been conducted on the critical thinking status of students in areas such as medicine, nursing, and midwifery [2, 10]; however, little research has been conducted on the critical thinking of health students. Health students and health workers play an essential role in pro-

viding, maintaining, and promoting health and disease prevention in the community. Therefore, the present study was conducted to comparatively determine the status of critical thinking and the factors affecting it in health students of Ardabil University of Medical Sciences.

## 2. Materials and Methods

This descriptive-analytical cross-sectional study was conducted in the second half of 2020. The research population included incoming students in Environmental Health Engineering, Occupational Health Engineering, and Public Health of Ardabil School of Health in 2017 and 2020. We did not perform a sampling. All students of the two entrances were enrolled in the study by completing the questionnaire virtually. The number of incoming students for two years equaled 160. After completing the questionnaire, 5 subjects failed to complete the questionnaire and were excluded; thus, 155 subjects entered the study. Due to the Coronavirus Disease 2019 (COVID-19) pandemic conditions, we used an online question site (online questionnaire software, online survey, and Persian form maker), i.e., purchased online; the questions of the critical thinking questionnaire were typed and prepared. Then, the names and mobile phones of the students were collected from the faculty education, and a student group was formed in the WhatsApp platform; the link of the electronic questionnaire of critical thinking was shared in that group.

Furthermore, the students were instructed to enter the mentioned link and complete the questionnaire. Concerning the inclusion and exclusion criteria, all students of the three majors in the two entrances of 2017 and 2020 who had chosen a unit in the second semester of the academic year 2020-2021 participated in the study. The California Critical Thinking Questionnaire (CCTST) was used to collect the necessary data. The California Critical Thinking Skills Test was developed and standardized by Davoodi et al. [12] and Baba Mohammadi et al. [13] to measure critical thinking skills in individuals. The California Critical Thinking Questionnaire has 34 items. Each item has 4-5 options. There is only one correct answer for each item; therefore, the subject gets a score of 0 or 1 in each item.

A person's overall score ranges between 0 and 34. This questionnaire has 5 dimensions or subscales, as follows: analysis (9 items), evaluation (14 items), inference (11 items), inductive reasoning (16 items), and deductive reasoning (14 items). The time required to complete the test questions is 45 minutes. Out of 34 questionnaire items, 19 were 4-choice questions, and 15 were 5-choice ques-

tions. The average score of the questionnaire is 15.89, and a score lower than that indicates poor critical thinking, and a higher score indicates strength and increased critical thinking skills. To evaluate the reliability of the Critical Thinking Questionnaire, a pilot study was conducted, and 20 questionnaires were distributed and collected among similar samples of the subjects; the related results presented a Cronbach's alpha of 0.77; therefore, this test has the necessary reliability.

In this research, the evaluation subscale indicates determining the validity of the content and evaluating the relationship between them. Inductive reasoning means a general conclusion from details or deriving results based on logical reasons, deductive reasoning means decision-based on inference or partial conclusion of generalities, inference implies the ability to draw the findings, and analysis means recognizing the purpose of the content and realizing the connections between them. Demographic variables included age, gender, place of residence (native or non-native province), the field of study, and year of university entry. To comply with the principles of research ethics (Code: IRARUMS.REC.1398.616), the questionnaire was completed by the respondents without specifying their name and surname. After completion in the press line, the results were transferred to SPSS v. 20 and analyzed by descriptive statistics and correlation coefficient tests.

### 3. Results

The present study results revealed that 155 students participated in this study. According to the obtained results, the minimum and maximum age of the study participants were 18 and 37 years, respectively. Besides, the Mean±SD age of the study subjects was measured to be 21.53±2.51 years. Overall, 55 (35.5%) subjects were male and 100 (64.5%) were female. Furthermore, 81 (52.3%) were native students of the province, and 74 (47.7%) were non-native. Additionally, 87(56.1%) individuals entered in 2017 and 68 (43.9%) entered in 2020. The minimum grade point average was 13.13, the maximum was 19.18, and the Mean±SD grade point average of students was computed as 16.43±1.35. Furthermore, 47 (30.3%) of the subjects were environmental health engineering students, 49 (31.6%) were occupational health engineers, and 59 (38.1%) were public health students. The minimum score of students' critical thinking was 4, the maximum score equaled 16, and the Mean±SD score was calculated to be 10.12±2.54. The number of participating students, the minimum grade obtained, the maximum grade obtained, and their Mean±SD are presented in Table 1.

As per the Table 1, the highest score of critical thinking belongs to environmental health students, and the lowest is public health students. The mean scores of students in the fields of Environmental Health Engineering, Occupational Health Engineering, and Public Health in two different entrances in the subscales are listed in Table 2.

**Analysis Subscale:** The score of the analysis subscale varies between 0 and 9. In this study, the analysis score was between 0 and 6, and the mean score of the analysis construct was 2.5±1.17. The highest score under the analysis scale was related to the public health entrance 2017(2.91), and the lowest was related to the public health entrance 2020(2.08). The minimum score was expected to be 4.5; however, because the mean score was lower than that, this subscale was assessed as poor in the students studied.

**Evaluation subscale:** The score of the questionnaire evaluation subscale varies between 0 and 14. In this study, the acquired score of the students ranged between 1 and 9, and the Mean±SD score of the students in the evaluation structure was 4.11±1.62. The highest score under the evaluation scale was related to occupational health entrance 2020 (4.4), and the lowest was related to public health entrance 2020 (3.73). The minimum score was expected to be 7; however, this subscale was also assessed as poor because the average score was lower.

**Inference subscale:** The score of the inference subscale varies between 0 and 11. In this study, the score of the inference construct was between 0 and 7, and the Mean±SD score of students in this construct was 2.93±1.37. The highest score under the inference scale was related to the environment health entrance 2017 (3.55), and the lowest was related to the public health entrance 2020 (2.54). The minimum score of this subscale was expected to be 5.5; however, because the mean score was lower than that, this subscale was evaluated as poor in the studied students.

**Inductive reasoning subscale:** The score of the inductive reasoning subscale varies between 0 and 16. In this study, the score of inductive reasoning ranged from 0 to 9, and the Mean±SD score of this reasoning was 4.29±1.77. The highest score in this subscale was related to the environment health entrance in October 2017 (4.64). The lowest score obtained in the inductive reasoning subscale was related to public health students' entrance 2020 (4.16). The minimum score was expected to be 8; however, this subscale was also assessed as poor in the studied students because the mean score was lower than this.

**Deductive reasoning subscale:** The score of the deductive reasoning subscale varies between 0 and 14. In this

**Table 1.** Distribution of the number of students participating

Field of Study and Entrance Year	No.	Min.	Max.	Mean±SD
Environmental health, Entrance 2020	22	7	15	11±2
Environmental health, Entrance 2017	25	4	14	10.52±2.4
Occupational Health, Entrance 2020	24	5	15	10.13±2.43
Occupational Health, Entrance 2017	25	6	16	10.64±2.75
Public Health, Entrance 2020	25	5	16	9.72±2.72
Public Health, Entrance 2017	37	5	16	9.16±2.43

study, the score of deductive reasoning ranged from 0 to 9, and the Mean±SD score of this reasoning was 4.28±1.79. The highest score under the deductive reasoning scale was related to the health entrance 2017(4.82), and the lowest was related to the public health entrance 2020(3.62). The minimum score was expected to be 7; however, this subscale was also evaluated as poor in the studied students because the mean score was lower than that.

Among the studied variables, only the relationship between the subscales of inference and inductive reasoning with the year of entry of the studied students was significant. In other words, the premise of the 2017 entry was better than the 2020 entry (P=0.02).

Furthermore, the inductive reasoning of entry 2020 in the two disciplines of environmental health and public health was better than entry 2017 of those two disciplines (P=0.026). In other cases, there was no significant corre-

lation between demographic variables such as age, gender, year of entry, native or non-native, the field of study, and grade point average with the overall mean scores of critical thinking score and its subscales (P>0.05).

#### 4. Discussion

Critical thinking, or the ability to reason and think independently and flexibly, guarantees social and personal life development. Those who have this skill are successful people, and of course, if a society has more critical thinkers, that society will be more successful and developed. This study aimed to compare the status of critical thinking in health students of Ardabil University of Medical Sciences. In this study, the mean score of students' critical thinking was 10.17±2.56. It was calculated less than the expected score. This means that the critical review of health students (environmental health engineering, occupational health engineering, and public

**Table 2.** Distribution of average scores of students

Critical Thinking Subscales/ field of study entrance	Mean±SD						P
	Environmental Health 2017	Environment 2020	Occupational Health 2017	Occupational 2020	Public Health 2017	Public 2020	
Analysis (9 items)	2.46±1.06	2.4±1.53	2.41±1.18	2.76±1.39	2.91±1.72	2.08±1.34	>0.05
Evaluation (14 items)	4.09±1.34	4.24±1.76	4.25±1.59	4.4±1.68	3.96±1.59	3.73±1.74	>0.05
Inference (11 items)	3.55±1.22	3.08±1.53	2.63±1.14	2.8±1.61	2.96±1.46	2.54±1.28	>0.05
Inductive reasoning (16 items)	4.18±1.76	4.64±1.58	4.13±1.54	4.44±2.1	4.18±1.62	4.16±2.03	>0.05
Deductive reasoning (14 items)	4.59±1.33	4.04±1.59	4.38±1.53	4.56±2.06	4.82±1.56	3.62±1.34	>0.05

health) of the Faculty of Health of Ardabil University of Medical Sciences is weak. This finding is low and poor, compared to the results of studies of Sheikhmonsi et al. [2], Jafarzadeh et al. [14]. The Mean±SD score of critical thinking skills in Athari et al.'s analysis was 12.48±3.23, in Mahboubi et al.'s study was 12.45±2.12, in Jafarzadeh et al.'s study was 11.7±3.2 and in Sheikh Monsi's et al.'s study was 10.91±3.37. However, the results of this study were similar to the effects of Hariri and Bagherinejad studies [15] conducted on health students of Mazandaran University of Medical Sciences. The Mean±SD score of critical thinking in Mazandaran health students was calculated to be 10.19, and the mean score of critical thinking in the present study was 10.12±2.54, which was estimated at a low level. This finding seems to be a logical one. Because, for admission in the fields of environmental health engineering and occupational health engineering, a better grade is required than public health. According to the results of Baba and Khalili's study, the scores of the critical thinking skills test in students at the beginning of entering the university are not very desirable, and the rank of the candidate in the national exam could not be related to these skills [13].

There are various factors involved in this field, including IQ and academic ability. According to the results of the Karagöl and Bekmezci study, people with higher IQ have better critical thinking in terms of critical thinking than other people [16]. Also, according to Gholamrezaei et al., those with higher academic ability have better critical thinking skills [17]. There was no significant relationship between demographic factors such as age, gender, place of residence and year of entering university and the status of critical thinking skills of health students ( $P>0.05$ ), which is consistent with the results of the study of Sheikh Monsi et al. and the findings of Hariri and Bagherinejad. In the study of Sheikh Monsi et al., gender, marital status, work experience, and interest in the field and degree were not involved in its development [2]. Of course, some researchers have shown that men think critically better than women, and some have shown that women think critically better than men. Also, older students have better critical thinking than new entrants and master's degree students than the bachelor's degree [18, 19], but this difference is not significant at the 0.05 level. Research on Indonesian students also shows that they do not have enough mastery of this skill [20]. However, the present study results are consistent with the findings of Din et al. [21].

According to Din Research in Punjab, Pakistan, students have an excellent positive attitude towards critical thinking, but the level of critical thinking and the ability

to reflect critical thinking in reading skills do not match the critical thinking attitude [21]. However, the results of this study are not consistent with the findings of Esperanza Zuriguel [22]. According to the study of Esperanza Zuriguel et al., the level of critical thinking of nurses is moderate and essential thinking is significantly related to some social and demographic characteristics such as age, work experience, shift work, type of employment and contract and educational level. While in our study, the level of students' thinking was poor, and the relationship between demographic variables and critical thinking was not significant. The reason may be related to the student group in the present study. Because both the level of critical thinking of nurses was higher than students and their critical thinking was related to demographic factors such as age and work experience, However, in our study, both the level of critical thinking of students was lower, and their critical thinking was not significantly related to demographic factors such as the age of entry and field of study.

In addition, numerous studies and reports from the US Department of Education show that university graduates lack critical thinking and problem-solving skills. In contrast, critical thinking is essential for success in education and work [23]. However, critical thinking in the curriculum is considered as the fourth element of primary education (after reading, writing, and arithmetic), and all academic systems have deemed it necessary to take courses in this field [11].

But it seems that the necessary action has not been taken in this regard in Iran yet. Perhaps the arrangement of high school courses in the experimental sciences group and how they are taught in this field is not ineffective. Because, unlike the experimental group of humanities, in the field of experimental sciences, the course of logic is not included, which may negatively impact the introduction, conclusion, and reasoning of students in the topics. In addition, the concern of accepting the entrance exam to the university has caused demands in parents and students, and this has caused teachers to emphasize more on the entrance exam questions and testing methods instead of thinking critically. Regarding the factors affecting critical thinking, various topics such as: high curiosity, high desire to engage with new ideas, introspection with insight, verbal perception, personality factors, personality readiness, cognitive ability, mental health (lack of Anxiety and depression), self-acceptance, positive communication with others, overcoming and dominating the environment, having a purpose in life, developing personality, feeling of high self-efficacy, type of evaluation and entrance exams of university courses, having a



systematic view, self-beliefs efficiency, student involvement with the problem and trying to solve it, self-regulation metacognition, self-efficacy for cognitive skills and self-efficacy for daily affairs, strong school curriculum, thinking in educational environments in dealing with educational issues, socioeconomic base, memory content and theoreticality of courses, and not using the laboratory for teaching, academic motivation, cultural-political context of the place of study, the requirements of the school community, diploma grade point average, previous semester grade point average, teaching styles of teachers, students' learning styles and students, the power and skill of inference of learners, the ruling spirit of the education system, the ruling spirit of the university, the weak ability of problem solving skills, the weak ability of analytical skills, trust in the contents of virtual networks, personal experiences, academic success or failure, students' health level, not equipped teachers, trainers and professors with critical thinking science and critical thinking skills, etc.

Based on the findings of this study and other research in this field, it can be stated that although students' critical thinking is very important, it has not been taken into account during the study period in universities, and the current teaching methods of the country's educational system are not able to increase the level of students' critical thinking. In this regard, the weakness of the curriculum, lack of proper attention to the subject of critical thinking in the curriculum, lack of use of appropriate teaching methods by educators, and also the lack of appropriate processes in education may be the reasons for the lack of critical thinking during university studies [24]. While developing critical thinking skills in educating health science students has been expressed as one of higher education goals [15, 25]. It seems appropriate attention to the subjects of health disciplines on the subject of critical thinking, the use of appropriate teaching methods by educators as well as the use of appropriate processes during education, improving active learning strategies by students, and reviewing curricula with emphasis on critical thinking at the macro level be effective.

Self-report completeness of the questionnaire and cross-sectional study were the limitations of this study. Because the questionnaire was self-administered and dependent on self-report data, it is difficult to predict and understand whether respondents conducted the survey honestly. Finally, because it was an internet-based online survey, respondents may not complete it with sufficient motivation. In addition, there are various tools for measuring critical thinking skills. The California Thinking Questionnaire appears to be above the level of knowledge of health students, despite its validity and reliability in Iran. It is recommended that future research focus

more on other thinking skills such as creative thinking skills, problem-solving and metacognition skills, critical thinking orientation, and comparing results with other faculties using other critical thinking assessment tools. In addition, evaluating the impact of faculty empowerment courses on the concept of critical thinking skills and critical thinking teaching methods is suggested.

## 5. Conclusion

This study indicates that critical thinking skills are weak in health students of Ardabil University of Medical Sciences in all dimensions and subscales. Considering the importance and position of critical thinking in increasing productivity, development and progress, and welfare of individuals and society, it is necessary to review and correct the curriculum, train and empower professors in critical thinking skills and teach it in higher education centers.

## Ethical Considerations

### Compliance with ethical guidelines

The study protocol was approved by the Ethics Committee of Ardabil University of Medical Sciences (Code: IRARUMS.REC.1398.616).

## Funding

This research was supported by the research project, Funded by the Ardabil University of Medical Sciences.

## Authors' contributions

Conceptualization, methodology, validation, formal analysis, investigation, supervision, funding acquisition: Yousef Hamidzadeh Arbabi and Abdollah Dargahi; Resources, writing - original draft, writing - review & editing: Mehdi Vosoughi and Hadi Sadeghi; Formal analysis, investigation, resources: Robab Hosseinpour.

## Conflict of interest

The authors declared no conflict of interest.

## Acknowledgments

The authors wish to acknowledge the financial support of carrying out this project, Ardabil University of medical sciences.

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