



Path Analysis of Critical Thinking Effect on Self-Efficiency Among Nursing and Medical Students

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ABSTRACT

Background: Critical thinking is the ability to ask appropriate questions and gather relevant information. It enables rational judgment and problem-solving for physicians and nurses. For the first time, this study examined two major groups of caregivers at the patient's bedside in terms of the relationship between critical thinking and self-efficacy.

Methods: This was a descriptive-analytical and cross-sectional study conducted in 2021. The sample was taken from Qazvin university of medical sciences' (QUM's) nursing and medical students through stratified random method. It was performed using structural equation method (n=377). Data collection tools included: demographic information, Ricketts critical thinking questionnaire, and GSE-17 questionnaire. Finally, data were analyzed through the correlation coefficient and multiple regression tests using SPSS₂₂ software at a significance level of 0.05.

Results: Results indicated that the model established at this step demonstrates good fitness. In this model $\chi^2 = 1919.91$, $df = 89$, $\chi^2 / df = 2.14$, $RMSEA = 0.05$, $NFI = 0.63$, $GFI = 0.77$ and $CFI = 0.76$. The structural equation model's standard estimation coefficients show that all the existing paths are at a significant level (CTH: CRV 0.96, CTH: COM 0.94, CTH: SFE -0.61; P-value < 0.05). Finally, the regression analysis showed an inverse effect of critical thinking on self – efficacy.

Conclusion: The study showed that critical thinking had a direct effect on self-efficacy. In addition, these two features have a significant effect on increasing the efficiency and making the right clinical decisions in medical and nursing groups. Therefore, upgrading these skills by updating curriculum will ultimately improve healthcare outcomes provided by these two specific groups.

Key words: Critical thinking, Self-efficacy, Path analysis

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Introduction

According to a report from the Ministry of Health and Medical Education (MOHME) 2002, critical thinking is one of the seven basic needs of medical and nursing students. Critical thinking helps medical and nursing students discuss independently, Judge purposefully, and reach a logical solution to a complex problem (1).

Manpower as intellectual and professional capital is the most important factor for the success of any organization, and ultimately, any society. Therefore, human resource with intellectual and behavioral skills and abilities bring about high productivity for the organization. They are considered a competitive advantage (1). Physicians and nurses play a vital role in the health system. These two groups are always exposed to clinical decisions for patient care. Thus, the importance of self-efficacy and critical thinking for the success of these people becomes clear (2).

The World Federation for Medical Education (WFME) considers critical thinking to be one of the standards of medical education. Critical thinking is vital to the competence of health professionals such as physicians and nurses to evaluate, diagnose, and care for patients correctly and effectively (3).

Self-efficacy is an effective psychological concept which plays an important and fundamental role in changing people's behavior. According to the definition of this concept, it is people's belief in their ability to develop and continue behaviors. According to Bandura theory, self-efficacy is the most important factor for managing and controlling life events. Inefficiency is identified as a determining factor in the type of behavior because it affects stages of choosing a person's behavior (4). Self-efficacy can play an effective role in promoting critical thinking. On the other hand, critical thinking can basically increase people's self-efficacy (a person's belief in his own inherent ability); therefore, it is a continuous cycle (5).

In today's world, stereotypes are not suitable for learning, and it is better for medical education system to move towards critical thinking (5, 6). In attention to critical thinking causes lack of deep

and clear insights, lack of interest in events, and choosing unconventional methods that will not lead to effective performance (5). Personal and social development requires skills such as critical thinking and self-efficacy (6). Job selection is also affected by student's self-efficacy (7). The students' belief in their abilities plays an important role in changing behavior and initiating and maintaining changes in their lives (8). The gap between theory and practice is palpable in some academic majors.

Health care is facing rapid changes regarding increase of knowledge. Critical thinking is essential for healthcare professionals to make clinical judgments when faced with clinical problems. Self-efficacy also narrows the gap between theory and practice and improves clinical skills (9-11). Learning strategies play an essential role in acquiring knowledge and are related to self-efficacy, motivation and emotions (12).

Critical thinking and self-efficacy can improve the efforts of medical and nursing students for learning. Physicians and nurse have the highest level of interaction with patients in providing medical services. Improving critical thinking skills and sense of self-efficacy in these two groups can have a tremendous impact on patients' treatment process at the micro level and improve the performance of the health care system at the macro level. Therefore, this study examined two major groups of caregivers at the patient's bedside in terms of the relationship between critical thinking and self-efficacy.

Materials and Methods

This was a descriptive-analytical and cross-sectional study conducted in 2021.

It was conducted at Qazvin University of Medical Sciences and its affiliated centers. The sample was taken from nursing and medical students studying at all levels. Sampling was done using stratified random method. Participants were placed in two classes of medical and nursing students. Morgan's table was used for sampling, and 377 students were selected from 864. Therefore, authors distributed 415 questionnaires



according to the number of students and with respect to the 10 % loss in the sample. The criterion was the students' ability, satisfaction, willingness, the study year, and attendance to clinical units to participate in the study. Participants who left the study were replaced with new ones.

Measuring tools

Data collection tool had three parts:

1) The first part included personal information like age, gender, level of education, marital status.

2) The Ricketts critical thinking tendency questionnaire: It had 33 questions and included 3 subscales: Creativity (11 questions), mental engagement (9 questions), and cognitive maturity (13 questions). Scoring was based on a five-point Likert scale from strongly agree to strongly disagree (13). The maximum and minimum scores obtained in this test were 165 and 33, respectively. In the study by Ghobadian in 2020, to obtain validity, he reported the correlation coefficients between the participants' scores in two stages of test and retest for all students ($r = 0.77$), females ($r = 0.88$) and males ($r = .68$). It had good validity. The reliability of this questionnaire was obtained by Cronbach's alpha coefficient which was 0.94 for the whole sample, 0.95 for females and 0.92 for males (14).

3) GSE-17 general self-efficacy questionnaire: Self-efficacy includes educational, occupational and social components. These 17 questions measure general self-efficacy with a mean of 99.57 and a standard deviation of 0.12. The maximum and minimum scores obtained in this test were 85 and 17, respectively. Scoring was based on a five-point Likert scale from strongly agrees to strongly disagree. If the scores of the questionnaire were between 17 and 34, self-efficacy was poor; between 34 and 51, it was moderate; and above 51, self-efficacy was very high. The reliability coefficients reported by Ganjavi et al. (15) for the entire questionnaire were estimated to be 0.89, which is acceptable. Dehghani et al. (16) in 2019, confirmed the validity of this questionnaire by using factor

analysis test.

The proposed initial model was shown in Figure 1. It was organized according to a comprehensive literature review of similar publications.

Data collection and analysis

Completing the questionnaires was done by a self-administered method. First, the researcher created an online version of the questionnaire and explained the questionnaire's research objectives and structure for the sample. Then, by allocating enough time, data were gathered. In this study, the authors used descriptive and analytical statistics.

In descriptive statistics, percentage, standard deviation, frequency distribution and mean are used to examine demographic characteristics of the participants and the status of each of the studied variables.

In inferential statistics section, the author examined the relationship between critical thinking and self-efficacy of students by correlation coefficient test. Multiple regression was used to predict the effective components. Finally, data were analyzed using SPSS₂₂ software at a significance level of 0.05.

The ethics committee of Qazvin University of Medical Sciences approved the present study with the code: (IR.QUMS.REC.1399.175). The researcher was introduced to the selected and qualified participants. He explained the objectives of the study to them. Their informed written consent was obtained and they were assured that their information would remain confidential.

Results

Sample characteristics

According to the descriptive statistics, the mean \pm SD of age was 22.58 ± 3.75 . Likewise, 147(43%) of the participants were female, and 190 (56 %), male. The sample consisted of 53.40 % medical students and 46 % nursing students. 306 (90.80 %) of them were single and 31 (9 %) were married. The majority of participants (76 %) were unemployed, and only 23.40 % were employed (Table 1).

Correlation coefficients

Table 2 shows the mean and standard deviation



of self-efficacy and critical thinking and its dimensions. It also demonstrates the study variables' correlation coefficient values in detail. Commitment has the highest mean (45.83 ± 4.33) among critical thinking dimensions. In contrast, eloquence had the lowest mean (31.87 ± 3.64). Nursing and medical students' critical thinking and all its dimensions were statistically significant and inversely related with self-efficiency (P -value < 0.05).

Structural equation modeling

The structural equation model's standard estimation coefficients demonstrate that all the existing paths are at a significant level. However, conforming to the values gained for the fitness indexes including χ^2 / df , GFI, RMSEA, CFI, and NFI reported in Table 3 are in the defined confine. Moreover, results indicated that the fitness model established at this step demonstrated good fitness.

In this model $\chi^2 = 1919.91$, $df = 893$, $\chi^2 / df = 2.14$, $RMSEA = 0.059$, $NFI = 0.63$, $GFI = 0.77$ and $CFI = 0.76$ (Table 3).

Regression analysis suggested an inverse effect of critical thinking on self-efficacy. In this regard, Table 4 shows the effect of critical thinking variables on self-efficacy in the final model. The relationship between the structural equation model's components was demonstrated in Figure 2. Critical thinking can inversely affect self-efficiency ($\beta = -1.42$, P -value < 0.05). Critical thinking is also directly related to CRV ($\beta = 1.00$, P -value < 0.05), ELQ ($\beta = 1.80$, P -value < 0.05) and COM ($\beta = 0.58$, P -value < 0.05).

Furthermore, in accordance with the structural equation model, Table 4 describes standard and non-standard coefficients, the ultimate model, and the level of relationship between critical thinking components and self-efficiency.

Table 1. Demographic properties of participants (N = 337)

Variable	Group	N (%)	Variable	Group	N (%)
Sex	Male	190 (56.4)	Job type	Student	242 (71.8)
	Female	147 (43.6)		Employed	12 (3.6)
Marital Status	Single	306 (90.8)	Self-employment	24 (12.5)	
	Married	31 (9.2)	Student's work	41 (12.1)	
Field of study	Medical	180 (53.4)	Level	Medical extern	159 (47.1)
				Undergraduate nursing student	141 (41.8)
				Postgraduate nursing student	14 (4.2)
	nursing	157 (46.6)		Employment status	79 (23.4)
				Medical interne	10 (3.0)
				Medical resident	13 (3.9)
			Unemployed	258 (76.6)	
			Employed	79 (23.4)	

Table 2. Values of dimensions through pearson correlation coefficient

Mean	1	2	3	4	5
1- SFE	38.273	1			
2- CTH	1.209	- 0.480*	1.000		
3- CRV	43.507	- 0.485*	0.871*	1.000	
4- ELQ	31.872	- 0.341*	0.801*	0.566*	1.000
5- COM	45.839	- 0.366*	0.838*	0.578*	0.515*

N = 337

*. Correlation is significant at the 0.01 level (2-tailed).



Table 3. Comparison of fitness indices in proposed model

Index	Limit	proposed model
χ^2/df	< 3.000	2.149
GFI	> 0.900	0.777
RMSEA	< 0.800	0.059
CFI	> 0.900	0.761
NFI	> 0.900	0.633

Table 4. Regression weights in the parameters of structural equation model in the final model

	Non standardized Estimate	Standardized Estimate	S.E.	C.R.	P
CTH ---> CRV	1.000	0.964			
CTH ---> COM	0.578	0.949	0.291	1.983	0.047
CTH ---> ELQ	1.801	1.081	0.311	5.789	**
CTH ---> SFE	- 1.420	- 0.611	0.241	- 5.902	**

** . Correlation is significant at the 0.001 level (2-tailed).

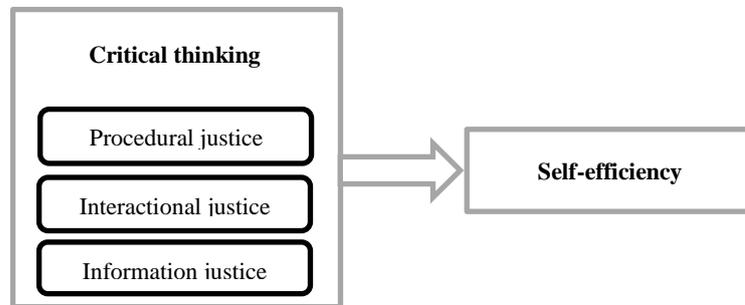


Figure 1. The proposed initial model

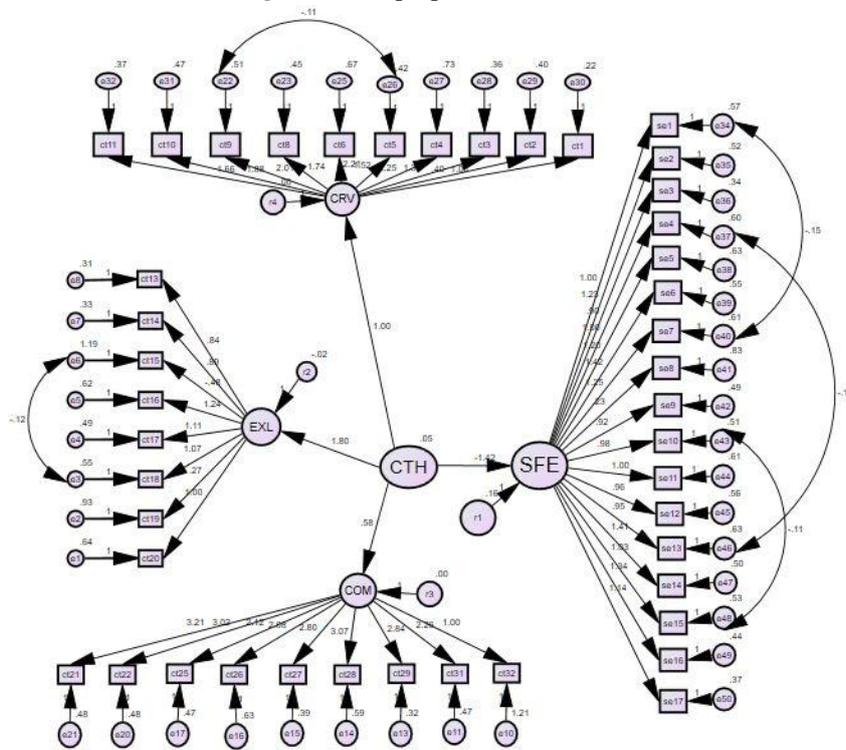


Figure 2. The paths between the components in the final model

CTH: Critical thinking SFE: Self- efficiency CRV: Creativity COM: Commitment ELQ: Eloquence



Discussion

This study was conducted to answer this question: How does a nursing or medical student's critical thinking level affect his/her self-efficiency. To answer this, the researcher surveyed 337 students of Qazvin University of Medical Sciences through Ricketts critical thinking and general self-efficacy questionnaires. Findings indicated that students' critical thinking and self-efficacy levels are low, and at the same time, there was an inverse relationship between critical thinking and self-efficacy which was statistically significant. Each dimension of critical thinking including creativity, commitment, and eloquence inversely affects self-efficiency. This is contrary to the research literature (17-19). Probably it is due to the defective educational system which moves students away from critical thinking. In this system, rather than understanding and analyzing, memorizing is encouraged. Professors are at the top of the educational hierarchy, and students are expected to be obedient and practical (20). Critical thinking in such an educational system is immediately suppressed and students are not allowed to go beyond teacher-centered frameworks. Such an approach causes critical thinking to be immediately accompanied by a decrease in self-confidence and self-criticism. To overcome this problem, nursing and medical educators should improve professional knowledge of students by increasing students' self-confidence, making them interested in studying, developing students' core skills, and encouraging them to collaborate in groups. Educators need to pay more attention to increase students' willingness to trust critical thinking for solving problems (21). To enhance student's critical thinking and reflection, professors should promote Socratic question. In order to develop student's self-efficacy, professors should focus on its sources (including success in performance, experience, and emotional arousal) (20). Contrary to the present study, Motaghi et al. (22) reported that critical thinking variables including creativity and mental engagement affect Isfahan medical student's self-efficacy. Regarding

the critical thinking components, people who pay attention to all aspects in the decision-making process, act without prejudice and judgment, have a fair view (cognitive maturity), and are not content with one solution (creativity dimension). They have high self-efficacy. Another Iranian study showed that strengthening critical thinking variables caused an increase in medical student's self-efficacy. The correct application of critical thinking skills increases self-efficacy (23). Students are not informed about their self-efficacy level just through academic performance. Therefore, motivational interventions should be done in a planned manner. External motivation should not be considered alone because it might have a negative effect on internal motivation (24). According to a study conducted by Baaij et al. (25), Clinical experience has a significant effect on self-efficacy. This leads to achieving clinical competencies. In the next stage, self-efficacy is formed and developed. But, the complicated clinical experience may have an adverse effect on self-efficacy. There are skills such as mastery goal which enhance self-efficacy (26). Furthermore, nurses' communication abilities have a positive effect on self-leadership and self-efficacy (27). Critical thinking has a great effect on problem-solving and decision-making. It is one of the main factors affecting nurse's proper functioning. These can be developed by training courses about social problem-solving. Also, self-awareness, rich basic knowledge, academic education increases problem-solving skills and effective decision-making. Support and advice from professors can be helpful (28, 29). Traits including creativity, wise consideration of all visions before decision making, systematic approach, and values such as fairness, impartial judgment skill, desire to acquire real knowledge and active thinking improve critical thinking skill level (30). Problem-based learning should be included in the nursing curriculum. Students also should learn to analyze, criticize, and reason during the case study in teamwork (31). Promoting educational strategies such as information literacy develops nursing and medical



student's critical thinking. This strategy also helps them in problem-solving and creative thinking. Knowledgeable people can be creative thinkers, and their confidence in their abilities would increase (32). Critical thinking and self-efficiency are basic competencies for nursing and medical students and graduates. Nurses with a high level of critical thinking and self-reflection increase clinical care quality and patient safety (31, 33). Self-efficacy also affects physical and mental health. In fact, it is a cognitive factor related to both work (for instance, job burnout) and physical health. People with a low level of self-efficacy are not able to show their abilities and lose interest in work. Finally, it leads to a decrease in physical health (34, 35). Thus, students' skills should be improved. Medical and nursing students are expected to understand alternative possibilities and solutions and then choose the appropriate action. Training for increasing cognitive skills should be included in nursing and medical curriculums. In addition, professors and qualified educators should encourage students to analyze their cases corporately. Developing self-efficiency and critical thinking as well as reducing their negative correlation should be prioritized. They can upgrade to a point where no negative relation occurs between them. Some programs, for instance, taking part in group discussions, are recommended.

There were some limitations in this study such as: 1) data collection in a self-report manner, 2) data collection with just one tool (questionnaire) that may drive students to give unrealistic answers for various reasons, 3) medical interns and residents reluctant to participate in data gathering process due to the large workload during the Covid-19 pandemic, 4) the possibility of mental attitudes and memory biases. This research shows medical science education practitioners that in addition to critical thinking skill courses, they need to consider other psychological capitals that enhances self-efficacy.

Conclusion

Overall, findings demonstrate the inverse impact

of critical thinking on self-efficacy. It also informs professors, policymakers, and managers about the positive effects of improving the critical thinking and self-efficacy level of medical and nursing students. Higher education authorities and planners are advised to strengthen critical thinking among students, especially medical and nursing students, and to include it in educational programs. This is because the future physicians and nurses will change the health system's prospects, leading to better problem-solving performance and self-efficacy. The conventional system is not suitable for improving these two skills and needs to be changed and revised. On the other hand, it is possible to facilitate the transfer of this skill to students by enriching critical thinking in faculty members. To develop students' self-efficacy, university departments can focus on issues such as performance success and emotional arousal which are sources of self-efficacy. The use of simulation scenarios will greatly help improve the self-efficacy of medical and nursing students, resulting in safe patient care. Experienced physicians and nurses can intervene and encourage students to feel self-efficient because of their high self-reflective insight. This increases students' willingness to think in a critical manner about clinical care. The authors suggest developing an educational model to promote critical thinking for medical and nursing students. A systematic review of factors inhibiting and enhancing critical thinking and self-efficacy can also be useful.

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Conflict of interests

The authors declared no conflict of interests.

Authors' contributions

Khosravizadeh O and Maleki A designed research; Hashtroudi A, Vosoughi P, and Kohan Sh conducted research; Ahadinezhad B analyzed data; and all authors wrote the paper. Maleki A had primary responsibility for the final content. All authors read and approved the final manuscript.



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