

## Teaching critical thinking across the curriculum: a main competency for medical students at Tehran University of Medical Sciences

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### ABSTRACT

**Introduction:** There is a significant tendency to strengthen critical thinking skills as an essential component of the health care team members' performance. This study aims to describe the process of teaching of critical thinking as a longitudinal integrated course at Tehran University of Medical Sciences.

**Methods:** In the design phase, the taskforce codified the first draft of the program. After Two-hour sessions with participation of second-year medical students was held as pilot phase of the program. Each session included pre-reading of the contents, conducting mini interactive lectures, solving worksheets, summarizing the golden points and providing feedback. Finally, survey forms were provided to students to determine satisfaction.

**Findings:** Total number of 159 medical students participated in this study (%48.2 female and %51.8 male). Findings show that 47.1% of students stated that the relevancy of prepared texts was good. In regards to coordination of the worksheets with educational content, 68.3% completely agreed and 62.6% of students agreed on the fact that thoughts were challenged by them.

**Conclusion:** the results of the study showed that using interactive methods such as question and answer technique, small group teaching strategies, worksheet, etc. could be useful to learn critical thinking skills.

**Keywords:** longitudinal theme, critical thinking, undergraduate medical curriculum

## 1. INTRODUCTION

In the modern world, the main issue of education is improving students' skills, not the acquisition of more information. This enables them to analyze and then apply the existing information (Gelder, 2005). Therefore, it is necessary for medical students to have special skills as an aid in coping with information age (O'Neill & Dluhy, 1997). Critical thinking, the ability to think clearly and rationally about what to do or what to believe, is essential for medical practice (Sharples et al., 2017).

Critical thinking is described as the ability to pose a discriminating question in order to find better ideas and solutions (Scott, Markert, & Dunn, 1998). The critical thinking process basically consists of collecting appropriate information, precisely assessing the information and using it to come to a conclusion (Ross et al., 2016). Critical thinking has been proved to be an influential factor in routine medical practice such as choosing treatment plans, making accurate diagnosis and reducing medical errors (Chan, 2016). In the meantime, it is very important for medical students to be able to use critical thinking skills during their medical practice and provide appropriate care for patients. Therefore, it is considered that we place the critical thinking course in their teaching curriculum. (Huang, Newman, & Schwartzstein, 2014).

A look at the process of reform of the medical curriculum in the recent years indicates a tendency to strengthen critical thinking skills as an essential component of the performance of the health care team members (Ku, 2009; Simpson & Courtney, 2008; Tanner, 2006). The importance of this

issue increases when promotion of such skills is regarded as a considerable factor in the professional success of medical students (Gambrill, 2006). Furthermore, improvement of critical thinking skills is regarded as one of the supported global objectives in most medical schools. Therefore, accreditation agencies around the world have considered the acquisition of these skills as a requirement to assess the ability of health care team members (Peach, Mukherjee, & Hornyak, 2007; Simpson & Courtney, 2008). To this There is no doubt that critical thinking courses are important in the medical curriculum; however, the results of some studies indicate that there is not enough program for teaching such skills to medical students (Birgegård & Lindquist, 1998). It is obvious that acquisition of these skills requires making major changes in teaching strategies and deliberation of contents (Hasanpour et al., 2006).

Different theoretical perspectives exist regarding teaching critical thinking skills in curricula. Investigators' approach toward the education of such thinking skills is derived from the viewpoint that they have regarded teaching of these skills as a general educational subject or as a subject integrated with specific knowledge contexts (Thompson, 2011). Solon believes that students are most likely to benefit from learning these skills when they are delivered through specific educational modules within their curriculum (Davies, 2006; Solon, 2001). Thus, this study presents the experience of Tehran University of Medical Sciences in teaching critical thinking as a longitudinal integrated theme in undergraduate medical curriculum.

## **2. CONTEXT**

This study was performed at Tehran University of Medical Sciences (TUMS), School of Medicine. The undergraduate medical curriculum at TUMS is divided into four phases: basic sciences, pathophysiology, clerkship, and internship. Since 2006, TUMS started to develop and implement a renewal curriculum for undergraduate medical education. The principal feature of the revised curriculum is to take more attention to integration of bio-psycho-social subjects as crosscutting themes for training physicians who are competent in different areas. These areas include: “clinical skills”, “communication skills”, “patient management”, “personal development”, “professionalism and medical ethics”, “decision-making, reasoning and problem-solving”, “prevention and health promotion” and “role of the physician in healthcare system”.

Many competencies of the medical graduates require practice and ongoing educational activities; they cannot be acquired by specific courses in limited hours. Therefore, we prepared some longitudinal integrated themes in the medical curriculum. Longitudinal themes of decision-making, reasoning and problem-solving has been considered as one axes of integrated subjects in undergraduate medical curriculum and students are in touch with them throughout their course. In this regard, for the first time at TUMS, teaching critical thinking as a module was provided in basic sciences course as a part of longitudinal theme of decision-making, reasoning and problem solving (Soltani et al., 2017).

## **3. MATERIAL AND METHODS**

### **3.1. Codifying the educational program**

In the design phase, the Evidence-Based Medicine Center formed a committee consisting of medical specialists, general practitioners as well as medical educationists. This committee subsequently codified the first draft of the program a year before the beginning of the classes in order to advance the design phase.

Before providing the critical thinking program, we ran a comprehensive search to find similar critical thinking education models in the world’s leading universities. All the relevant models were discussed in weekly meetings of the committee. Considering the possibility of implementing the presented models, the compilation method was finally designed for teaching critical thinking in undergraduate medical curriculum. The model was combination of active learning strategies, practice worksheets and pre-reading texts. The program was undertaken based on Harden’s ten questions. Afterwards, a group of faculty members of basic and clinical sciences as well as related authorities and a number of students evaluated the draft of the codified program in a seven-hour workshop. The Program was adopted after the final approval of program-planning committee.

### **3.2 Preparation of material**

Material, as a basis for education and evaluation, included personal and group worksheets, pre-reading texts, slides and program’s evaluation forms. During the educational process according to the feedbacks received from the students, the

committee applied necessary revisions of the syllabus.

### **3.3 Pilot and preparatory sessions for facilitators**

Two-hour sessions with participation of second-year medical students was held as pilot phase of the program. Educational material including pre-reading texts, personal and group worksheets, program's evaluation forms and the necessary revisions were implemented during these sessions. During the pilot sessions, facilitators practiced to attend small groups according to the guidelines.

### **3.4 Implementation of the program**

One hundred fifty nine medical students of the basic sciences course involved in the critical thinking program during 2011-2014. Teaching practices adhered to a fixed pattern in all sessions and included pre-reading of the contents, conducting mini interactive lectures, solving worksheets, summarizing the golden points and providing feedback. Prior to the sessions, pre-reading texts related to the topics of the session were available for the students through the website. At the beginning of the sessions, the instructor presented the contents using a mini interactive lecture as well as question and answer technique. Subsequently, depending on the objective of each session, students responded to the worksheets individually or in small groups of six to seven people. Facilitators responded to students' questions as well as conducting group discussions, in the process of solving the worksheets. , At the end of each session, instructor summarized the golden points and

feedbacks from the worksheet responses, for the students.

### **3.5 Program evaluation**

The program planning committee provided a satisfaction survey form, to determine the level of students' satisfaction with the educational program. This form had 14 questions about instructors, facilitators and educational materials. It was prepared based on previous studies and the program goals. Faculty members of medical education and evidence-based medicine validated the content of the form.

## **4. RESULTS**

In this study, we conducted a critical thinking program and placed it in undergraduate medical curriculum. This program was accomplished in 46 hours divided in 18 sessions during 4 semesters. Table 1 provides the details about number of the sessions per semester and related contents.

Of 159 medical students participating in our study, 48.2 percent were female. Mean age of the participants was 18.32 years (from 18 to 21). Students received materials before the class. They were educated about critical thinking components, different types of cognitive fallacies and errors, standards of thinking, principles of scientific reasoning and presentation.

Table 2 shows the details of program evaluation results. As we can see, the most satisfaction level is about the instructor's ability to manage the session and teach contents (83%) and use practical examples (79.4%)

**Table 1: Details of content and hours of the critical thinking program**

Semester	Content of sessions	Number of sessions	Hours
First	Introduction, critical thinking components	Seven sessions	14
Second	Different types of cognitive fallacies and errors	Seven sessions	14
Third	Standards of thinking	Two workshops and 2-hour session	10
Fourth	Principles of scientific reasoning and presentation	Two workshops	8

**Table 2: Survey of students' opinion about critical thinking program**

Row	Questions	Completely agree	Agree	Neither agree nor disagree	Disagree	Completely disagree
1	Purpose of the program was perfectly clear to me	29.2	42.3	15.4	6.9	6.2
2	the quantity of the presented information were appropriate	32.6	44.2	12.4	6.2	4.6
3	The assigned time was sufficient	24	39.5	19.4	12.4	4.7
4	Instructor had the necessary abilities to conduct sessions and teach syllabus contents	48.8	34.2	8.5	5.4	3.1
5	There was a suitable coordination between the instructor and facilitators in the teaching process	34.4	39.8	15.6	6.3	3.9
6	The instructor properly used practical examples and tips for better understanding of the contents	47.6	31.8	9.5	7.1	4
7	The instructor managed sessions interactively with the participation of students, by using techniques such as question and answer	37.3	35.7	15.9	6.3	4.8
8	The facilitators had the skills to guide group discussions	13.7	31.7	43.9	9.4	1.3
9	The facilitators had the ability to communicate with the students	20.1	43.9	33.8	2.2	0
10	Worksheets were appropriate for challenging thoughts	31.7	30.9	25.9	7.9	3.6
11	There was coordination between educational content and worksheet questions	23.0	45.4	27.3	1.4	2.9
12	Provided texts were motivating for learning and applying the contents	18.8	27.5	34.1	13.8	5.8
13	In general, I consider the education given in this program appropriate and useful	35.0	40.7	10.6	7.3	6.4
14	I would like continuing the program	41.8	23	14.8	9	11.4

Other questions related to instructor had also more than 70 percent positive response. The majority of students were satisfied with the coordination between facilitator and instructor (74.2%) and the assigned time to each session (63.5%). Although satisfaction with the quantity of the presented information was high (76.8%), the provided text did not seem to be fulfilling (46.3%). The participants were also oriented about the purpose of this educational program (71.5%). While the satisfaction level was higher than 60% in 12 items, students were neutral with the ability of facilitators to guide group discussions and the motivation quality of the provided texts.

## 5. DISCUSSION

This study presents the experience of Tehran University of Medical Sciences in teaching critical thinking as a longitudinal module in the undergraduate medical curriculum. Studies proved that other medical schools around the world also have considered promotion of teaching critical thinking skills to medical students. (Cox, Irby, & Bowen, 2006; Scott et al., 1998). This is consistent with the results of our study. Abrami et al. (2015) indicated that there are effective strategies for teaching CT skills, both generic and content specific, and CT dispositions, at all educational levels and across all disciplinary areas (Abrami et al., 2015).

The results of this study suggest that students were highly satisfied with the overall quality of the implemented program and the greatest satisfaction was about the ability of instructor to manage the sessions. In similar studies, the instructor's role has

been pointed out as a key element in the process of teaching critical thinking skills (Astleitner, 2002). From the viewpoint of Paul and Elder, good instructors facilitate the conditions for learning critical thinking skills by using practical examples and providing learning activities related to what students are likely to be exposed to in the future (Paul & Elder, 2001). Likewise in our study, the students admitted that the instructor had been able to provide them with a better understanding of the topics by presenting practical examples, and also believed that the use of various teaching techniques by the instructor had provided an opportunity for more interaction among them during sessions. These findings further support the idea of using various teaching methods in medical curricula to improve critical thinking skills (Drummond, 2012; Kowalczyk, 2011; Tiwari, Lai, So, & Yuen, 2006). A look at the previous studies suggests that although there is no unique method to teach critical thinking skills. However, the use of teaching methods such as reflection, inquiry, questioning and self-directed learning that engage students in the learning process can help to strengthen these skills in the students (Gul et al., 2010; Margery Duffey, 2000). Based on the results of the study, it appears that the question/answer technique not only acts as a mental stimulant to attract students learning, but also can be effective in the transmission of attitudes and critical thinking skills through modeling.

In addition to the emphasis on the role of instructor in providing incentives of learning, several studies have pointed out to the important role of facilitators in team

working (Azer, 2005; Michaelsen, Parmelee, & McMahan, 2008). Accordingly, in this study, we tried to provide the facilitators with necessary education by giving them feedback on the pilot sessions in order to prepare them to learn how to conduct small groups before attending classes. However, the lowest satisfaction level in the participating students was related to the ability of the facilitators in managing small groups. This could be partly attributed to the first experience of the program or to the fact that large number of students required the facilitators to rotate among the various groups. Nevertheless, it seems that it might be helpful to hold complementary courses to increase preparation of the facilitators and to encourage them to rethink their performances.

Since learning knowledge without having the ability to apply it would be a futile effort (Ekahitanond, 2011), in several studies, class assignments and tests have been mentioned as an approach to practice the educational subjects more deeply (Mandel, Goff, & Lentz, 2005). Maudsley in her study, has insisted on providing opportunities for medical students in order to encourage them to self-assessment, apply the new knowledge and work in small groups to facilitate learning critical thinking skills and develop responsibility in the process of education (Maudsley & Strivens, 2000). Therefore, in our study, personal as well as group worksheets were used in each educational session and from the viewpoint of students, use of class worksheets immediately after instructor's lecture provided grounds to practice the principles of critical thinking skills. Hence, it appears

that the use of class assignments could be effective in challenging students' knowledge and development of their critical thinking skills. However, due to the difficulty of scoring personal worksheets of many students, in the following sessions, learners' performances were evaluated through designing more complex scenarios by group worksheets.

Evidence also suggests that students who spend more time for learning independently are more likely to learn lessons more deeply (Mattick & Knight, 2007). In our study, we tried to present the pre-reading texts to the students before attending classes in order to provide them with grounds for learning the educational subjects independently. However, it was observed that in practice, many students failed to pre-read the educational contents and did not have the necessary preparedness to acquire new lessons, which might have been derived from the fact that students had not been accustomed to pre-read the educational contents and the pre-reading contents might have been uninteresting or impractical. To overcome this challenge, we offered mini lectures during sessions to have an overview of the contents mentioned in the pre-reading texts.

## **6. CONCLUSION**

The results show that using interactive teaching methods such as question/answer technique, small group teaching strategies, worksheet, etc. throughout the curriculum has caused the students to have a positive attitude toward learning critical thinking skills and a desire to continue the education of these programs during their course. Based

on results obtained from our study, use of active learning strategies to engage students in the acquisition of knowledge and implementation of group worksheets and use of trained facilitators to lead small group learning are recommended.

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#### **CONFLICT OF INTERESTS**

Authors declared no conflict of interests.



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