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Research Article

Design, Implementation, and Evaluation of Flipped Classroom for Postgraduate Physiotherapy Students

Roshanak Honarpishe, Nastaran Ghotbi*, Shohre Jalaei

Department of Physiotherapy, School of Rehabilitation, Tehran University of Medical Sciences, Tehran, Iran.

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ABSTRACT

Introduction: Teamwork is an essential component of delivering successful physiotherapy services to patients; therefore, the education of physiotherapy students should be directed toward strategies that promote interaction between classmates. A flipped classroom (FC) is a pedagogical strategy that promotes active learning. The present study aimed to design, implement, and evaluate the FC for postgraduate physiotherapy students.

Materials and Methods: A total of 44 postgraduate general and sport physiotherapy students participated in this study from 2016 to 2019. Two theoretical courses were designed and delivered based on the FC approach. The data were collected using a questionnaire that contained 12 items based on the 5-point Likert scale. The data were analyzed using descriptive statistics, Mann-Whitney, and Fisher exact tests.

Results: The students' familiarity with FC was 2.52±1.51 (median=3). The total agreement with FC was 3.42±0.92 (median=3). Only 22.7% of the students reported no increase in motivation. Meanwhile, 71% of the students agreed with a blended classroom, while only 52% preferred to teach only with FC.

Conclusion: Most students preferred a blended classroom combining in-class and home activities. Also, the FC could augment the interaction and motivation of the students. Accordingly, FC is a valuable teaching strategy for postgraduate physiotherapy students.

*** Corresponding Author:**
Nastaran Ghotbi, PhD.
Address: *Department of Physiotherapy, School of Rehabilitation, Tehran University of Medical Sciences, Tehran, Iran.*
Tel: *+98 (21) 77533939*
E-mail: *nghotbi@sina.tums.ac.ir*

Introduction

Teaching techniques are constantly evolving to improve learning and increase the efficiency of education [1]. Although traditional teaching methods like lecturing are common, their effectiveness has recently been questioned [2]. Education should focus on involving and empowering students to enhance their critical thinking and interaction skills [3]. These changes are based on the studies that point out the greatest advantages of active learning over lecturing [3-5].

The flipped classroom (FC) model is a novel pedagogical practice that allows students to be aware of the contents of the course before the class [6, 7]. In other words, what is usually done in the classroom is replaced by homework; hence, the focus from the teacher shifts to the learner [1]. This method can involve students in activities and focus on higher learning outcomes. It can also boost various skills, such as creativity, critical thinking, communication, and collaboration [8]. These students will have the potential to apply the knowledge and skills they have learned to new areas [5].

In the flipped model, content is available outside the classroom, and class time is used to work on problems and advance concepts. This method encourages students to participate in learning with the support of classmates and teachers [9]. Technology is widely used to deliver content and material outside of the classroom in this model. A flipped method is a type of blended learning where in-class learning is integrated with online learning experiences [10]. A United States Department of Education meta-analysis showed that blended learning, such as FC, is more effective than face-to-face (i.e. lecture-based instruction) or online learning alone [11]. Although this method has become more popular recently, flipped class promotes active learning in medical education. Further research and studies are needed to encourage professors to change their teaching method to this model [10, 12, 13].

Physiotherapy curriculums are designed to teach professional skills before students begin clinical practice. Physiotherapists increasingly work in clinical settings, making autonomous decisions that may place increased demands on team-working abilities. They require higher-order thinking and knowledge transformation skills [14, 15]. The educational system should develop physiotherapists who can thrive in complex health systems [16]. Nonetheless, the teaching methods in this field mainly include traditional learning, which causes the weakness of students in the mentioned fields. A review of digital technology applications in the education of graduate and undergraduate students in physiotherapy and occupational therapy noted that combining face-to-face classes with digital technology is the most effective method, which is why the popularity of FC is increasing. However, acceptance of teaching this method by professors and students is also necessary [17]. Nevertheless, educational interventions that combine digital technology and active learning have been little investigated within physiotherapy education, and little is known about implementing flipped learning in physical therapy [11, 15]. To our knowledge, the design and delivery of FC in physiotherapy courses in Iran, a developing country, has not been evaluated. Accordingly, we intended to design and implement FC for postgraduate physiotherapy students and evaluate students' viewpoints regarding this method. We hope this study will encourage physiotherapy instructors to develop and expand their teaching approach.

Materials and Methods

The participants included postgraduate general and sports physiotherapy students at the School of Rehabilitation, Tehran University of Medical Sciences. This study was conducted in four consecutive years. The courses participants took included "pathophysiology of the neuromuscular system" and "physiological principles of exercise therapy" for general and sports physiotherapy, respectively. These were presented as theoretical courses which the same instructor taught. The study had three main components. The first was designing, which focused on preparing the course's content and a platform to encounter information before the class. Then, the process of putting the design into effect was considered implementation. The final part evaluated this teaching method based on the student's perspective [18].

Study design

Initially, the course plan of each course was written based on an approved curriculum. Then, the course contents of sessions were prepared based on the reference texts and related recent articles. The contents are uploaded to the university's learning management system (LMS) in PowerPoint and PDF files.

The main topics of FC for general physiotherapy students included neuromuscular junction normal physiology and pathophysiology, myasthenia gravis pathophysiology, multiple sclerosis, and stroke pathophysiology. The FC contents for sport physiotherapy students included flexibility exercises physiology, types of tissue

adaptations and competition in adaptation, mechanical and physical properties of tissue, neurophysiological basis of stretching exercise, and evidence-based parameters of stretching techniques.

Before the first session, the FC approach was introduced to the students, and the necessary explanations about their duties were clearly explained. Home activities (i.e. assignments) were defined as studying LMS contents and reading the related topics in the reference texts. Electronic contents were uploaded on LMS at least one week before each class session to ensure ample time to study. Each semester was held in 10 sessions.

Study implementation

The students of two cohorts of postgraduate physiotherapy students admitted to the school of rehabilitation who had taken "pathophysiology of the neuromuscular system" and "physiological principles of exercise therapy" courses participated in this study.

A quiz took place at the beginning of each session to ensure that students read the course content. It consisted of 5 descriptive questions to estimate the student's perception of the topics. After finishing the quiz, the instructor asked the students to discuss with each other the issues that they did not completely understand. The instructor's role was as a facilitator, encouraging the students to participate in the discussions. Also, the instructor answered the questions that none of them had learned. At the end of the class, the instructor briefly taught the ambiguous topics. Although the 2-h course was considered for each session, no limitation was put on the duration of the course. The aim was to discuss and cover all the assigned content.

Study evaluation

At the end of the semester and before the final exam, the students filled out an anonymous questionnaire of 12 items scored based on a 5-point Likert scale.

Four items of the questionnaire were about the role of FC in learning, students' interaction, increasing motivation, and the student's willingness to use it. These items directly evaluated the students' agreement with this teaching method. Three items were about the quiz and its allocation score to the final exam grade. Three items were about the previous familiarization with the FC and the willingness to teach with lecture alone or in combination with the FC. And the two remaining items were related to educational activities at home. All students participated voluntarily and signed an informed consent form.

Statistical analysis

The data were analyzed using descriptive and inferential statistics, such as Mean±SD. The Mann–Whitney U nonparametric test was also used to compare students' grade point average (GPA) in two fields. The Fisher exact test was applied to determine associations between the score of each item and the field of study. The IBM SPSS statistics software, version 26, was used for the analysis. Meanwhile, the level of significance was set at $P<0.05$.

Results

A total of 44 master of science general and sport physiotherapy students participated in this study from 2016 to 2019. Of these, 32 (23 female and 9 male) were postgraduate students in general physiotherapy, and 12 (9 fe-

Table 1. Demographic profile of the students (n=44)

Variables		General Physiotherapy	Sport Physiotherapy
Gender	Male	9	3
	Female	23	9
Academic year	2016	8	6
	2017	8	0*
	2018	7	6
	2019	9	0*
Total		32	12

*Sport physiotherapy students did not participate in the study in 2017 and 2019.

Table 2. Questionnaire items

No.	Subject
1	I was familiar with this teaching method.
2	This teaching method increased my learning.
3	This teaching method increased my interaction with my classmates.
4	This teaching method increased my motivation.
5	Home activities enhanced my learning.
6	Class discussions were related to home activities.
7	Class quizzes were useful.
8	Allocating 25% of final exam grade to class quiz scores is suitable.
9	Allocating 50% of the final exam grade to class quiz scores is suitable.
10	I prefer this teaching method.
11	I prefer a lecture method.
12	I prefer a blended method.

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male and 3 male) were in the sport physiotherapy field. Since the student's participation was voluntary, sports physiotherapy students did not participate in the study in the two academic years of 2017 and 2019. The demographic characteristics of students based on gender and academic year are presented in Table 1.

The questionnaire items are presented in Table 2.

Figure 1 shows the students' agreement with FC (items 2 to 5). Each item was classified into low, moderate, and high. The high level indicates both agree and strongly agree (scores 4 and 5), and the low indicates both strongly disagree and disagree (scores 1 and 2). The results

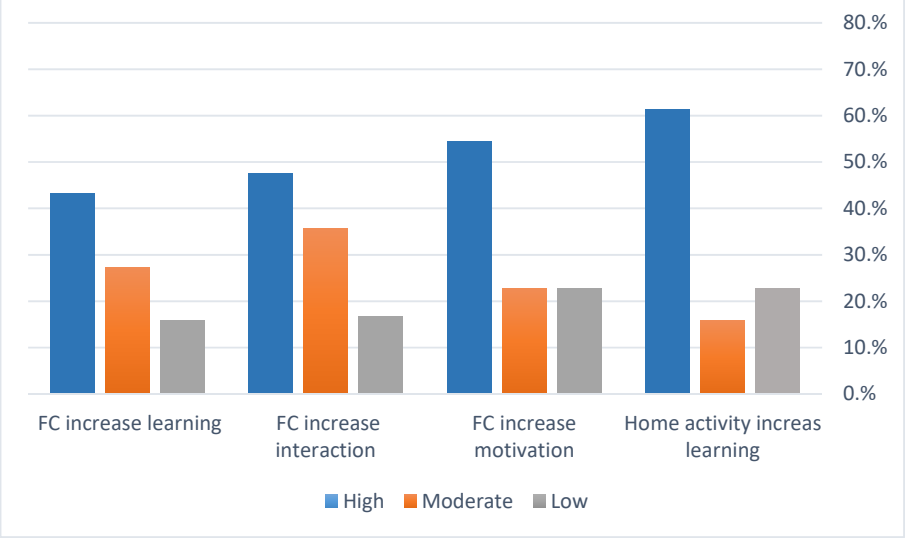

Figure 1. Students' agreement with FC summarized by frequency (percentage)

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FC: Flipped class.

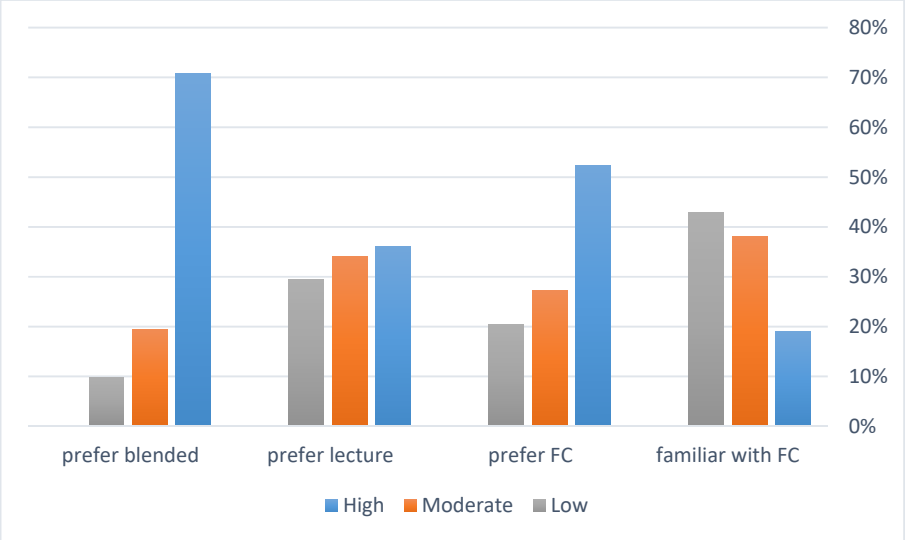

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Figure 2. Students' familiarization with FC and their preferred teaching method summarized by frequency (percentage)

FC: Flipped class.

showed that 22.7% of the students reported no increase in motivation, while 54.5% mentioned an increase in motivation.

71% of the students agreed with a blended classroom, while 52% preferred to teach only with FC (Figure 2). About 42.9% of the participants were not familiar with FC. The students' familiarity with FC was 2.52±1.51(median=3). The total agreement with FC was 3.42±0.92 (median=3).

Items 2, 3, 4, and 10 directly related to the students' agreement with FC; therefore, the summation of these items was calculated. This new variable's Mean±SD was 3.42±0.92, and the median was 3 in total students. Then, this variable was compared between general and sport physiotherapy students (Table 3). The Mann-Whitney U test showed no significant difference between students' agreement in two groups (P>0.05).

The Mean±SD in all students for items 10, 11, and 12, which reflect the students' preference for the teaching method, were 3.63±1.60, 3.13±1.63, and 4.21±1.33, respectively.

Students' GPA in two groups was compared with the Mann-Whitney test. The GPA of general physiotherapy students was significantly higher than sports physiotherapy (P=0.004, U=64). Then, the scores of items 1, 5, 6, 7, 10, 11, and 12 were converted into two scales: Low (scores 1 and 2) and high (scores 4 and 5). Eventually, the Fisher test was used to evaluate associations between the score of each item and the field of study. The results

Table 3. Students' agreements to flipped classroom

Physiotherapy Fields	Descriptive Statistics	Item 2	Item 3	Item 4	Item 10	Summation (2+3+4+10)
General physiotherapy	Mean±SD	4.06±1.34	3.77±1.33	3.81±1.59	3.87±1.53	3.58±0.72
	Median	5	3	5	5	4
Sport physiotherapy	Mean±SD	3.17±1.80	3.18±1.89	3.16±1.80	3.00±1.48	2.97±1.26
	Median	3	3	3	3	3
P		0.154	0.314	0.378	0.086	0.553

SD: Standard deviation.

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Table 4. Frequency and the results of the Fisher test

Variables		Items													
		1		5		6		7		10		11		12	
		Low	High	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High
General	Count	16	6	5	23	2	18	3	20	6	20	10	11	2	24
	Expected count	15.2	6.8	7.6	20.4	4.3	15.7	6.9	16.1	7.3	18.7	9.4	11.6	3.2	22.8
Sport	Count	2	2	5	4	4	4	6	1	3	3	3	5	2	5
	Expected count	2.8	1.2	2.4	6.6	1.7	6.3	2.1	4.9	1.7	4.3	3.6	4.4	0.8	6.2
Total		18	8	10	27	6	22	9	21	9	23	13	16	4	29
P		0.56		0.041*		0.038*		0.190		0.697		0.314		0.001*	

*Significant.

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showed that items 5, 6, and 12 were statistically different between the two groups (P<0.05) (Table 4).

Discussion

This study aimed to design, implement, and evaluate FC for postgraduate students at the Faculty of Rehabilitation, Tehran University of Medical Sciences. It was conducted for four consecutive years among physiotherapy students.

There are several opinions about an FC model's design and implementation strategies. Still, the critical point is to make the class content available before the class and emphasize studying the content [19, 20]. Online environments provide flexible schedules for learners to study the resources provided by the professor [21]. This study used the LMS of the Tehran University of Medical Sciences. Nearly 61% of the students positively thought access to pre-classroom educational content (item 5) was an advantage of this method and has augmented their learning abilities. However, FC limits presenting the content of the courses before the class. In addition, the student's active participation in the learning process plays an important role [22]. Virtual environments are more engaging for the new generation, while having access to the class contents leads to more time assignments for students' participation in class. Tune et al. suggested that taking the exam at the beginning of the class will, to some extent, guarantee the study of course contents [20]. The same strategy was used in our study.

A systematic review of medical education showed that the flipped classroom method is a promising pedagogical approach that increases learners' motivation [23]. Communication skills and cooperation are crucial in modern rehabilitation systems [24]. The results showed that students of this research somehow agreed on the effect of this method in increasing motivation and strengthening the interaction between themselves and classmates. This was in line with the studies that showed that FC has the potential to improve personal communication [11, 15].

The average scores of some items expressed as "neither agree nor disagree" in the questionnaire, particularly in general physiotherapy, might be because graduate students, especially in medicine, have already developed successful learning strategies. Therefore, asking them to choose a new learning paradigm is challenging [13, 15]. In addition, our results also suggest that the majority of students preferred blended teaching methods (item 12 of the questionnaire). This finding was inconsistent with another study that showed some students would rather have systematic classes, and many students found a combined teaching method to be more beneficial [25, 26]. The quality of discussions and the heavy workload were the students' main reasons for preferring the traditional models [27].

On the other hand, up to 80% of the students reported low or moderate familiarity with the flipped learning model (item 1), and this item had the lowest scores among others. These results were consistent with the study, which showed that raising the awareness of students and professors was an essential factor in the success of this method [28].

Since this is the first study of the FC approach in the field of physiotherapy in Iran, the instrument's reliability in assessing participants' perspectives regarding FC

was not evaluated. However, this instrument was developed based on available literature and expert opinion. In addition, the lack of a control group is a limitation of the present study. It is essential to point out that only two limited courses were included in this study, which may limit the generalization of the result. However, this research could help instructors who want to alter their teaching methods to improve higher learning levels in physiotherapy students.

Ethical Considerations

Compliance with ethical guidelines

All the students who participated in this study signed the informed consent form.

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Authors' contributions

All authors equally contributed to preparing this article.

Conflict of interest

The authors declared no conflict of interest.

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References

[1] Brewer R, Movahedazarhouligh S. Successful stories and conflicts: A literature review on the effectiveness of flipped learning in higher education. Journal of Computer Assisted Learning. 2018; 34(4):409-16. [DOI:10.1111/jcal.12250]

[2] Gilboy MB, Heinerichs S, Pazzaglia G. Enhancing student engagement using the flipped classroom. Journal of Nutrition Education and Behavior. 2015; 47(1):109-14. [DOI:10.1016/j.jneb.2014.08.008] [PMID]

[3] Day LJ. A gross anatomy flipped classroom effects performance, retention, and higher-level thinking in lower performing students. Anatomical Sciences Education. 2018; 11(6):565-74. [DOI:10.1002/ase.1772] [PMID]

[4] Andrews TM, Leonard MJ, Colgrove CA, Kalinowski ST. Active learning not associated with student learning in a random sample of college biology courses. CBE-Life Sciences Education. 2011; 10(4):394-405. [DOI:10.1187/cbe.11-07-0061] [PMID]

[5] Michael J. Where's the evidence that active learning works? Advances in Physiology Education. 2006; 30(4):159-67. [DOI:10.1152/advan.00053.2006] [PMID]

[6] Uzunboylu H, Karagozlu D. Flipped classroom: A review of recent literature. World Journal on Educational Technology: Current Issues. 2015; 7(2):142-7. [DOI:10.18844/wjet.v7i2.46]

[7] Arnold-Garza S. The flipped classroom teaching model and its use for information literacy instruction. Communications in Information Literacy. 2014; 8(1):7-22. [DOI:10.15760/comminfolit.2014.8.1.161]

[8] O'Flaherty J, Phillips C. The use of flipped classrooms in higher education: A scoping review. The Internet and Higher Education. 2015; 25:85-95 [DOI:10.1016/j.iheduc.2015.02.002]

[9] Tucker B. The flipped classroom. Education Next. 2012; 12(1):82-3. [Link]

[10] Abeysekera L, Dawson P. Motivation and cognitive load in the flipped classroom: Definition, rationale and a call for research. Higher Education Research & Development. 2015; 34(1):1-4. [DOI:10.1080/07294360.2014.934336]

[11] Galway LP, Corbett KK, Takaro TK, Tairyan K, Frank E. A novel integration of online and flipped classroom instructional models in public health higher education. BMC Medical Education. 2014; 14:181. [DOI:10.1186/1472-6920-14-181] [PMID]

[12] Betihavas V, Bridgman H, Kornhaber R, Cross M. The evidence for 'flipping out': A systematic review of the flipped classroom in nursing education. Nurse Education Today. 2016; 38:15-21. [DOI:10.1016/j.nedt.2015.12.010] [PMID]

[13] Ødegaard NB, Myrhaug HT, Dahl-Michelsen T, Røe Y. Digital learning designs in physiotherapy education: A systematic review and meta-analysis. BMC Medical Education. 2021; 21(1):48. [DOI:10.1186/s12909-020-02483-w] [PMID]

[14] Hurst KM. Using video podcasting to enhance the learning of clinical skills: A qualitative study of physiotherapy students' experiences. Nurse Education Today. 2016; 45:206-11. [DOI:10.1016/j.nedt.2016.08.011] [PMID]

[15] Røe Y, Rowe M, Ødegaard NB, Sylliaas H, Dahl-Michelsen T. Learning with technology in physiotherapy education: Design, implementation and evaluation of a flipped classroom teaching approach. BMC Medical Education. 2019; 19(1):291. [DOI:10.1186/s12909-019-1728-2] [PMID]

[16] Rowe M. A critical pedagogy for online learning in physiotherapy education. In: Gibson BE, Nicholls DA, Setchell J, Groven KS, editors. Manipulating practices: A critical physiotherapy reader. Akersgata: Cappelen Damm Akademisk; 2018. [Link]

[17] Olivier B, Verdonck M, Caseleijn D. Digital technologies in undergraduate and postgraduate education in occupational therapy and physiotherapy: A scoping review. JBI Evidence Synthesis. 2020; 18(5):863-92. [DOI:10.11124/JBISRIR-D-19-00210] [PMID]

[18] Sinouvassane D, Nalini A. Perception of flipped classroom model among year one and year three health science students. International Journal of Information and Education Technology. 2016; 6(3):215-8. [DOI:10.7763/IJIET.2016.V6.687]

[19] Chu L, Sun SH. The application of flipped classroom in pediatric physical therapy. Physiotherapy. 2015; 101:e252. [DOI:10.1016/j.physio.2015.03.433]

[20] Tune JD, Sturek M, Basile DP. Flipped classroom model improves graduate student performance in cardiovascular, respiratory, and renal physiology. Advances in Physiology Education. 2013; 37(4):316-20. [DOI:10.1152/advan.00091.2013] [PMID]

[21] Ellaway R, Masters K. AMEE Guide 32: E-Learning in medical education Part 1: Learning, teaching and assessment. Medical Teacher. 2008; 30(5):455-73. [DOI:10.1080/01421590802108331] [PMID]

[22] Hamdan N, McKnight P, Mcknight K, Arfstrom K. A white paper based on the literature review titled a review of flipped learning. Flipped Learning Network. 2013; 1-16. [Link]

[23] Chen F, Lui AM, Martinelli SM. A systematic review of the effectiveness of flipped classrooms in medical education. Medical Education. 2017; 51(6):585-97. [DOI:10.1111/medu.13272] [PMID]

[24] Beidokhti MH, Moradi N. Assessment of satisfaction of rehabilitation students with clinical education quality in Ahvaz University of Medical Sciences. Journal of Modern Rehabilitation. 2018; 11(4):251-7. [Link]

[25] Lillejord S, Børte K, Nesje K, Ruud E. Learning and teaching with technology in higher education-a systematic review. Oslo: Knowledge Center for Education; 2018. [Link]

[26] Moffett J. Twelve tips for "flipping" the classroom. Medical Teacher. 2015; 37(4):331-6. [DOI:10.3109/0142159X.2014.943710] [PMID]

[27] Zhao Y, Ho AD. Evaluating the flipped classroom in an undergraduate history course. HarvardX Research Memo. 2014; 1-48. [Link]

[28] Sanagoo A, Araghian Mojarad F, Jooybari L. [Flipped classroom: A new and appropriate teaching method for the research course (Persian)]. Iranian Journal of Medical Education. 2015; 15:442-3. [Link]