Comparison of the effects of vid-cast and lecture-based training courses on burn knowledge among medical interns at the Motahari burn hospital

Maryam Roham1, Zohreh Sohrabi2, Shoaleh Bigdeli2, Afsaneh Dehnad3*, Zohreh Hosseinzadeh2

1 Anti-microbial Resistance Research Center, Iran University of Medical Sciences, Tehran, Iran
2 Center for Educational Research in Medical Sciences (CERMS), Department of Medical Education, School of Medicine, Iran University of Medical Sciences (IUMS), Tehran, Iran
3 Department of English Language, School of Health Management and Information Sciences, Center for Educational Research in Medical Sciences (CERMS), Department of Medical Education, School of Medicine, Iran University of Medical Sciences (IUMS), Tehran, Iran

Introduction

One of the most important objectives of the education system is to familiarize the learners with up-to-date knowledge by using appropriate and effective teaching methods that will motivate and enhance the teaching and learning processes. Therefore, there is a need to revise traditional teaching methods and implement new methods in the educational system.1-5 Technology advancements, the speed of knowledge advancement, and the need for cost-effective teaching methods have drastically changed teaching methods.6 Some studies have shown that face-to-face and electronic teaching methods, namely blended learning, have better outcomes than either method alone.11-14 In addition, some studies report that the outcome of e-learning is equal to face-to-face teaching methods and thus might be preferable due to the advantages mentioned above of e-learning.10-16

Currently, the mainstream teaching method in medical education is the lecture-based method. However, increased lifelong learning.7-9 Time saving, a reduction in commuting costs, and flexibility in learning anywhere and anytime are among the advantages of e-learning.10 Some studies have shown that face-to-face and electronic teaching methods, namely blended learning, have better outcomes than either method alone.11-14 In addition, some studies report that the outcome of e-learning is equal to face-to-face teaching methods and thus might be preferable due to the advantages mentioned above of e-learning.10-16

Currently, the mainstream teaching method in medical education is the lecture-based method. However,
improving the quality of medical students’ education is unlikely without reforming teaching methods. New techniques accompanied by technology, particularly electronic equipment, and software, allow medical educators and learners to reach teaching and learning objectives anywhere and anytime more efficiently. The application of modern teaching methods can facilitate the learning process and promote learning motivation as well. 35-37

By considering students as active participants, e-learning can revamp various forms of education in the 21st century and, according to some research studies, increase learning by 20% to 30% compared to traditional classroom teaching methods. 20

Interactive electronic content not only makes learning possible but also gives the learner more control over their own learning process. 21 It has been reported that using electronic methods to train people working in the field of health community is more common in developed countries. 22-24 Presently, curriculum planners in Iran are paying more attention to the use of information technology (IT) in different fields of education. 23

The quality and effect of e-learning with interactive content have not yet been comprehensively and adequately evaluated. 25 There are few studies on the effects of modern technologies and interactive multimedia on learning. Thus, if there is insufficient information about the capacity and impact of these approaches, their use in teaching can be challenging. 26 Vid-casts provide clear and significant benefits to medical students. 27 Research among various medical students has shown that using vid-cast has sound effects on their learning. 28,30

A vid-cast is a video clip designed to be viewed on portable devices; it uses RSS syndication for delivering material to users. The purpose of a vid-cast is to implement the two main features of e-content; flexibility and interactivity. 31 Vid-cast in e-learning classes may face the interaction problem between the instructor and learner. In lecture-based classes, the learner can ask a question and receive an instant response, but this is not the case in e-learning courses where a vid-cast is used. However, this gap can be addressed by an interactive vid-cast facilitating communication between instructors and learners who are actively engaged in learning. 32

Incidences of burn mortality and disability resulting from burns are high in Iran. 33,34 A study conducted in the United Kingdom found that only 13% of medical schools offer to burn infection and care courses to their medical students, with a particular focus on lectures and often in lectures on burns. This suggests some shortcomings in burn care training courses, and there is a demand for training medical students concerning this issue. 35 Another study in public health in the State of São Paulo showed that students lacked enough information about burns. 36 Typically, there is no ward for providing care services to patients with burn injuries in educational hospitals in Iran. These patients are usually hospitalized in separate health facilities and there are few such centers/facilities for providing services to these patients. 35 Moreover, the courses on burn are short time courses which are not obligatory in rotations, and not many of interns take this course and if they do it is a very short time course. Therefore, they are not familiar with the management of patients with burn injuries while they encounter such patients after graduating from medical schools. An e-learning course on burn injuries can be beneficial for interns and can cover a large number of interns across the country. 36

Burn care training is one course offered for medical students in Iran during their internship in medical schools. To the authors’ best knowledge, there has not yet been any e-learning training course on burn offered in Iran for medical students. The reason that the participants of the study consisted of both Tehran and Iran university of medical sciences was that Motahari hospital was the only center offering this course in Tehran province. There are few centers, if any, offering this course in medical universities in Iran. The findings of this study could contribute to the inclusion of this course in the form of e-learning in the current medical curriculum. Therefore, it could be offered to all the medical students in all the medical universities in Iran. This study aimed to compare the effects of lecture-based and e-learning via a vid-cast with interactive content on burn training on the knowledge of interns attending a training course on burn care.

Materials and Methods

This quasi-experimental study was performed as a pre-post non-equivalent double group and evaluated the effects of two teaching methods of lecture and vid-cast via interactive electronic content on medical students’ learning. As Motahari hospital is the only center offering burn training course and only 50 students enroll in each course, we could not have random sampling. The participants were all medical students from Tehran and Iran university of medical sciences (50 students) assigned to take the burn training course at Motahari burn hospital in 2018. The participants were 50% (25) female and 50% (25) male interns. First, the list of students enrolled for the course was obtained from the education office of the hospital. Due to the small number of students, census sampling included all in the study. They were then divided into two teaching groups, lecture-based and vid-cast, using systematic random sampling. In the lecture group, 56% of the participants were male, and 44% were female; in the vid-cast group, 44% were male, and 56% were female. Medical students were included if they were interns referred to Motahari burn hospital of Iran University of Medical Sciences (IUMS) to undergo a rotation of burn training course in June 2019. Interns were excluded from the study if they could not complete their training course for whatever reason.
The regular lecture method was used for the control group (n = 25); for the intervention group (n = 25), training was delivered through vid-cast with interactive electronic content prepared by Storyline version 3. The interns in the intervention group were given a flash memory stick containing the training file with a vid-cast prepared by the instructor using Storyline software 3. The length of the vid-cast was about an hour on the topic of burn infection training (clinical signs, diagnosis, and treatment of burn infection) as well as educational links related to the topic. The file had the instructor’s voice on the slides, audio files, subject-related tutorials, and exercises with multiple-choice questions. The content was based on the curriculum accredited by the Iran Ministry of Health, Treatment and Medical Education. The final content was reviewed by a faculty member of the medical education department and two faculty members of the infectious diseases department where the course was offered. Changes were made on the basis of their comments. Due to the interactivity of the software, which allows the user to skip some parts, repeat specific parts, and use hyperlinks of multimedia, Storyline (version 3) software with interactive capability and HTML5 output was used to produce the vid-cast. The instructor prepared the content in the form of slides; her voice was recorded and then synchronized with the slides with the help of an instructional designer at the Virtual Education Center (VEC) at IUMS. The design was based on the e-content approved by the VEC and available on its site. Finally, a multimedia vid-cast in the form of web-based content with SCORM standards was prepared. (SCORM, which stands for Shareable Content Object Reference Model, is a set of technical standards for eLearning software products. SCORM tells programmers how to write their code so that it can “play well” with other eLearning software. It is the de-facto industry standard for eLearning interoperability.) Afterward, the interns without regularly attending classes were asked to take the test. The test mean scores in the vid-cast group was statistically significant (P = 0.001; Table 1).

Based on the results of the independent t test before the training intervention, there was no statistically significant difference in pre-test scores between the study groups. The pre-test mean score for the lecture group was 8 ± 2.36 and 7.6 ± 2.79 for the vid-cast group; this difference was not statistically significant (P = 0.588). This indicates that the two study groups did not differ in their level of knowledge and were similar before the intervention (Table 2).

In the mean comparison of the pre- and post-tests in the lecture group and concerning the distribution normality of the pre- and post-test variables based on the Kolmogorov–Smirnov test, the paired t test was used to compare the scores before and after the lecture-based method. The mean score of the pre-test before the training intervention was 8 ± 2.36 and 14.2 ± 1.63 after the intervention; based on the paired t test, this difference was significant (P < 0.001; Table 3). According to the results of Table 4 and based on the paired t-test, the difference between the pre-and post-test mean scores in the vid-cast group was statistically significant (P < 0.001).

Based on the results in Table 5, the post-test score was 14.92 ± 1.63 in the lecture group and 17.24 ± 2 in the vid-cast group; this difference was statistically significant based
In our study, the mean of post-test scores (Mean ± SD) was 7.6 ± 2.79 for the vid-cast group and 4.7 ± 1.3 for the lecture group. The t-test results (t = 7.6 ± 2.79, P = 0.32) showed a statistically significant difference between the two groups. The vid-cast group performed better, statistically, than the lecture group.

Table 1. Comparison of demographic characteristics of the two groups

| Study groups       | Gender          |  | Age      |  |
|--------------------|-----------------|-----------------|-----------------|-----------------|
|                    | Female number (%) | Male number (%) | Mean ± SD | P value | Mean ± SD | P value |
| Lecture-based group| 11(%44)          | 14 (%56)        | 23.8±0.76     | 0.396     | 23.56±0.65 | 0.238   |
| Vid-cast group     | 14(%56)          | 11 (%44)        | 8 ± 2.36      | 0.87      | 17.24 ± 2  | < 0.001 |

Table 2. Comparison of the mean of the pre-tests in the study groups

| Study groups | Pre-test score Mean ± SD | t statistics | P value |
|--------------|--------------------------|--------------|---------|
| Lecture method | 8 ± 2.36                | 0.546        | 0.588   |
| Vid-cast method | 7.6 ± 2.79              |              |         |

Table 3. Comparison of pre-test and post-test mean scores in the lecture group

| Group       | Pre-test score Mean ± SD | Post-test score Mean ± SD | Mean differences | Mean ± SD | P value |
|-------------|--------------------------|---------------------------|------------------|-----------|---------|
| Lecture group | 8 ± 2.36                | 14.2 ± 1.63              | 6.92 ± 1.63      | < 0.001   |         |
| Vid-cast group | 7.6 ± 2.79              | 17.24 ± 2               | 9.64 ± 2.64      | < 0.001   |         |

Table 4. Comparison of the mean of pre-test and post-test scores in the vid-cast group

| Group       | Pre-test score Mean ± SD | Post-test score Mean ± SD | Mean differences | Mean ± SD | P value |
|-------------|--------------------------|---------------------------|------------------|-----------|---------|
| Vid-cast group | 7.6 ± 2.79              | 17.24 ± 2               | 9.64 ± 2.64      | < 0.001   |         |

Table 5. Comparison of the mean of post-tests in both study groups

| Study groups | Post-test score Mean ± SD | Mean differences | Mean ± SD | P value |
|--------------|---------------------------|------------------|-----------|---------|
| Lecture group | 14.92 ± 1.63            | -4.487           | < 0.001   |         |
| Vid-cast group | 17.24 ± 2               |                   |           |         |

Table 6. The comparison between the scores of the two groups by covariance

| Source          | Degree of freedom | F     | P value | Partial η² | squared |
|-----------------|-------------------|-------|---------|------------|---------|
| Corrected model intercept | 2     | 12.47  | 0.000   | 0.35       |         |
| Pre-test        | 1                 | 321.47| 0.000   | 0.87       |         |
| Group           | 1                 | 4.11  | 0.048   | 0.08       |         |
| Error           | 47                |       | 0.000   | 0.32       |         |
| Total           | 50                |       |         |            |         |

on the independent t test results (P < 0.001), suggesting that the vid-cast group outperformed the lecture-group.

As Table 6 shows, there was a statistically significant difference between the lecture and vid-cast groups, F (1, 47) = 22.79, P < 0.001, partial η² = 0.32. The vid-cast group performed better, statistically than the lecture group.

**Discussion**

According to the findings, the mean of the post-test scores for the vid-cast group was significantly higher than that of the group trained by the lecture-based method. In line with our findings, Aloraini compared the use of two methods of multimedia and lecturing and found that there was a significant difference in the knowledge level of the two groups (P = 0.05), and more learning took place in the multimedia group. 37

Similarly, Wahabi et al, performed a study on the effect of triage training through lecture and multimedia software on the learning of nursing students, where there was no meaningful statistical difference between the levels of learning through the two methods of lecture and multimedia software. However, the mean of the scores at the recall stage in the multimedia group was higher than those in the lecture group. 39 In our study, the mean of posttest scores of the vid-cast group was also higher than that of the lecture group, but the statistical difference in our study was significant. In a study performed by Zolfaghari et al, the effects of two methods of e-learning and lecture on the learning of nursing students were compared and the findings showed that the rate of learning in both methods was similar. 40

In addition, the results of this study confirmed the findings of a 2021 study by Chelsea Stundin et al., Which aimed to evaluate the results of a multimodal e-learning course for a group of first-year medical undergraduates. This study also concludes that multimodal e-learning can be a good way to improve learning outcomes and learning experiences for undergraduate medical students who do not have access to corpses. 41 Matheus Lemos Azi et al. Also conducted a study in 2022 to evaluate the effectiveness of an online course to orthopedic surgeons’ development to acquire the core competencies needed to prevent and treat fracture-related infections (FRI). In this study, an online questionnaire with 16 questions was created through six clinical scenarios. Participants were invited to answer the questionnaire before and after the course. At the end of the e-learning course, the mean evaluation score for the prevention, diagnosis and treatment of FRI surgery increased significantly. Finally, this study concluded that the e-learning course was effective and significantly increased the knowledge of the course users. This study also confirms the findings of our study. 42 The Noor M Alqudah study was conducted in 2020 to evaluate the e-learning experience among Jordanian university ophthalmologists. Stated in this study that E-learning is a type of education that uses information and communication technology to access online education and learning. The results of this study also showed that the e-learning experience was positive and most of the participants believed that e-learning will play a prominent role in the future of medical education, which will confirm the results of our study. 43

Contrary to our study’s findings, in a study performed by Akbarzadeh et al among medical students in electrocardiographic interpretation, the use of multimedia in teaching the students showed the same
The effect of a vid-cast training course on the knowledge of medical interns

In a study performed by Ramazani et al comparing three methods, lecturing, e-learning, and concept mapping, in nursing education, there was no statistically significant difference between the lecturing and e-learning groups. In a study by Healy et al comparing e-learning and lecturing among surgical assistants, the researchers found similar results in both groups. Differences in the findings of those studies might be due to differences in the topic of training (burns) and the difference between participants, who were medical interns in this study.

Limitations

This study has some limitations. First of all, we did not measure the participants' technology literacy level or their familiarity with the educational software used in the study, Storyline. Students in the lecture group may have had access to the vid-cast, even though we asked their counterparts to observe research principles.

Conclusion

The findings of our study showed a significant difference between two groups, lecture, and vid-cast, in post-test scores, where the scores of the vid-cast group were higher than the other group, suggesting that the learners who were trained by vid-cast outperformed the learners trained by the lecture in an in-person class. It is suggested that e-learning, especially with interactive content, be used as a supplementary or alternative method for training interns in burn infection and care training. Curriculum designers in medical education could use the findings of this study. However, further studies on other medical subjects could better consolidate the findings of this study.

Study highlights

- One of the most important objectives of the education system is to familiarize the learners with up-to-date knowledge by using appropriate and effective teaching methods that will motivate and enhance teaching and learning processes.
- The application of modern teaching methods can facilitate a learning process and promote learning motivation in the learner as well.
- This quasi-experimental study was conducted as a pre-post non-equivalent double group, and the effect of two teaching methods of lecture and vid-cast via interactive electronic content on medical students' learning was evaluated.
- It is suggested that e-learning, especially with interactive content, be used as a supplementary or alternative method for training interns in burn care. Curriculum designers in medical education could use the findings of this study.

Acknowledgments

The authors are grateful to all the study participants; without their collaboration, it was impossible to conduct the study. We extend special appreciation towards the faculty members who helped us verify the test's content validity and approved the scientific content of the vid-cast. We are also grateful to Mr. Hamed Shirazinejad, who helped us prepare the vid-cast, and Dr. Davood Rasouli, whose comments improved our study.

Authors' contribution

MR performed the experiment. ZS designed the study method. SHB and ZH contributed to the manuscript development. AD supervised the study and revised the manuscript.

Ethics approval

This study was a part of a master's thesis approved by the Vice-chancellor for Research and by the Ethics Committee of the Iran University of Medical Sciences with the code: IR.IUMS.FMEDREC.1399.074. The participants filled out and signed a consent form for participating in the study permitting publication of the relevant data in the form of an article.

Competing interests

The authors declare no conflict of interest.

Funding

The Vice-chancellor for Research funded this research at the Iran University of Medical Sciences with the code: 14203.

Reference

1. Esflamian H, Saeedi Rezvani M, Fatehi Y. Comparison of the effectiveness of teaching methods of group discussion and lecture on learning and satisfaction of students in teaching of religion and life courses in the secondary school students. Curriculum Planning Knowledge & Research in Educational Sciences. 2013;10(1):13-23. [Persian].
2. Mogharab M, Nateghi K, Sharifzadeh GR. Effects of lecture and team member teaching design on nursing students' learning and academic motivation. Mod Care J. 2013;10(3):173-82. [Persian].
3. Johnson JP, Mighton A. A comparison of teaching strategies: lecture notes combined with structured group discussion versus lecture only. J Nurs Educ. 2005;44(7):319-22. doi: 10.3928/01484834-20050701-06.
4. Senge PM. The Art and Practice of the Learning Organization. New York: Doubleday; 1990.
5. Jeffries PR. Technology trends in nursing education: next steps. J Nurs Educ. 2005;44(1):3-4. doi: 10.3928/01484834-20050101-01.
6. Fry K. E-learning markets and providers: some issues and prospects. Educ Train. 2001;43(4/5):233-9. doi: 10.1108/EUM0000000005484.
7. Haigh J. Information technology in professional education: why IT matters. Nurse Educ Today. 2004;24(7):547-52. doi: 10.1016/j.nedt.2004.07.008.
8. Reece I, Walker S. Teaching, Training and Learning: A Practical Guide. Business Education Publishers; 2006.
9. Yu S, Chen J, Yang KF, Wang TF, Yen LL. A feasibility study on the adoption of e-learning for public health nurse continuing education in Taiwan. Nurse Educ Today. 2007;27(7):735-61. doi: 10.1016/j.nedt.2006.10.016.
10. Munro RA, Rice-Munro EJ. Learning styles, teaching approaches, and technology. The Journal for Quality and Participation. 2004;27(1):26-32.
11. Boyle T, Bradley C, Chalk P, Jones R, Pickard P. Using blended learning to improve student success rates in learning to program. J Educ Media. 2003;28(2-3):165-78. doi: 10.1080/13581650320000153160.
12. Dowling C, Godfrey JM, Gyles N. Do hybrid flexible
delivery teaching methods improve accounting students' learning outcomes? Account Educ. 2003;12(4):373-91. doi: 10.1080/096392803000154512.
3. Rovai AP, Jordan HM. Blended learning and sense of community: a comparative analysis with traditional and fully online graduate courses. International Review of Research in Open and Distributed Learning. 2004;5(2):1-13. doi: 10.19173/irdoll.v5i2.192.
4. O'Toole JM, Absalom DJ. The impact of blended learning on student outcomes: is there room on the horse for two? J Educ Med. 2003;28(2):179-90. doi: 10.1080/135816503200016580.
5. King P, Hildreth D. Internet courses: are they worth the effort? J Coll Sci Teach. 2003;31(2):112-5.
6. Utts J, Sommer B, Acredolo C, Maher MW, Matthews HR. A study comparing traditional and hybrid internet-based instruction in introductory statistics classes. J Stat Educ. 2003;11(3):1-14. doi: 10.1080/10691980.2003.11910722.
7. Baghaie M, Atrkar Roushan Z. A comparison of two teaching strategies: lecture and PBL, on learning and retaining in nursing students. J Guilan Univ Med Sci. 2003;12(4):86-94. [Persian].
8. Safavi A. General Methods and Techniques of Teaching. Tehran: Moaser; 2008. [Persian].
9. Zebbarjadian Z, Nili-Ahmadzadeh M. A comparison of concept mapping and integration method impacts on third-graders of Karaj elementary schools (descriptive evaluation operator). Educ Psychol. 2012;8(26):83-104. [Persian].
10. Farshi M, Babatabar Darzi H, Mahmoudi H, Mokhtari Nouri J. Comparison of nursing care learning in air evacuation and transport by lecture and e-learning methods. J Mil Med. 2012;14(1):27-31. [Persian ].
11. Wright DN. Interactive multimedia dental education: the next five years and beyond. MedInfo. 1995;8:Pt 2:1305-7.
12. Anderson ET, Mercer ZB. Impact of community health content on nurse practitioner practice: a comparison of classroom and web-based teaching. Nurs Educ Perspect. 2004;25(4):171-5.
13. Mehrdad N, Zolfaghari M, Bahrami N, Elypoosh S. Learning outcomes in two different teaching approach in nursing education in Iran: e-learning versus lecture. Acta Med Iran. 2011;49(5):296-301.
14. Ruiz JG, Mintzer MJ, Leipzig RM. The impact of e-learning in medical education. Acad Med. 2006;81(3):207-12. doi: 10.1097/00001888-200603000-00002.
15. Khatony A, Dehghan Nayery N, Ahmadi F, Haghighi H, Vehvilainen-Julkunen K. The effectiveness of web-based and face-to-face continuing education methods on nurses' knowledge about AIDS: a comparative study. BMC Med Educ. 2009;9:41. doi: 10.1186/1472-6920-9-41.
16. Khayat A, Keshtkar A. A comparative study of multimedia and conventional education methods in undergraduate training in preclinical endodontics. J Res Med Sci. 2004;9(4):30-3. [Persian].
17. Rae MG, McCarthy M. The impact of voiccast utilisation upon student learning of physiology by first year graduate to entry medicine students. Journal of the Scholarship of Teaching and Learning, 2017;17(2):1-23. doi: 10.14434/jostol.v17i2.21125.
18. Bhatti I, Jones K, Richardson L, Foreman D, Lund J, Tierney AL, Burns RJR. The impact of vodcast utilisation upon outcomes in two different teaching approach in nursing education in Iran: e-learning versus lecture. Acta Med Iran. 2011;49(5):296-301.
19. Ali M, Willems G, Carles C, Elen J. Instructional multimedia programs for self-directed learning in undergraduate and postgraduate training in orthodontics. Eur J Dent Educ. 2003;7(1):20-6. doi: 10.1034/j.1600-0579.2003.00263.x.
20. Siavash Vahabi Y, DS, GS, et al. [Comparing the Effect of Triage Education in Lecture and Multimedia Software on Nurses Learning], Journal Of Critical Care Nursing, 2011; 41(1): 7-12. [Persian]
21. Zolghadri M, Mehrdad N, Parsa Yekta Z, Salmani Baronagh N, Bahrami N. The effect of lecture and e-learning methods on learning mother and child health course in nursing students. Iran J Med Educ. 2007;7(1):31-9.
22. Studden C, Zakani S, Martin A, Moodysey S, Jacob J. Replicating anatomical teaching specimens using 3D modeling embedded within a multimodal e-learning course: pre-post study exploring the impact on medical education during COVID-19. JMRI Med Educ. 2021;7(4):e30533. doi: 10.2196/30533.
23. Azi ML, Kojima KE, Pesântez R, Carabelli G, Borens O, McFadyen I, et al. Effectiveness of an Online Course on Fracture-Related Infections. J Eur CME. 2022;11(1):2024682. doi: 10.1016/j.bjra.2021.14083.2021.024682.
24. Alqudah NM, Jammal HM, Saleh O, Khader Y, Obeidat N, Alqudah J. Perception and experience of academic Jordanian ophthalmologists with e-learning for undergraduate course during the COVID-19 pandemic. Ann Med Surg (Lond). 2020;59:44-7. doi: 10.1016/j.amsu.2020.09.014.
25. Alkharazeed F, Kazemi Arhat B, Alizadeh A, Alkharazeed AH. The efficacy of web-based multimedia education of normal electrocardiogram in junior and senior medical students. Res Dev Med Educ. 2012;11(2):77-9. doi: 10.5681/rme.2012.016.
26. Ramazani J, Hosseini M, Ghaderi M. Comparing the effects of lecture, e-learning and concept mapping on pediatrics nursing teaching. Iran J Med Educ. 2017;17(28):261-9. [Persian].
27. Healy DG, Fleming FJ, Gilhooley D, Felle P, Wood AE, Gorey T, et al. Electronic learning can facilitate student performance in undergraduate surgical education: a prospective observational study. BMC Med Educ. 2005;5:23. doi: 10.1186/1472-6920-5-23.