

Effective methods in medical education: from giving lecture to simulation

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ABSTRACT

Effective relationship between education and practice is of great importance for medical graduate students. Obviously, graduates of medical sciences should be familiar with the practical application of theoretical knowledge, clinical actions and encounter with patients. Along this, continuing medical education (CME) programs are introduced and implemented in the field of medical education throughout the world. Continuing medical education includes activities aimed at preserving and developing the knowledge, skills and professional performance of medical team members being in line with providing better services to patients, community or profession. The ultimate goal of continuing medical education programs is to improve the quality of patient care through professional training. However, improving the quality of learner's education is not possible without the transformation of methods and teaching techniques. The use of innovative educational methods in the process of continuing education in different countries leads to favorable outcomes which can be very effective for other countries. In this research, the common and effective methods of medical education are introduced by reviewing the contexts of medical sciences. These methods include lectures, collaborative patterns, group discussions, problem solving, e-learning, clinical education, evidence-based medicine, and medical-based simulations. According to the aforementioned methods, three methods of clinical education, evidence-based medicine and medical-based simulations are specific to medical science, and the rest of the methods are common with other disciplines.

Keywords: Medical education, Techniques and methods, Clinical medicine, Evidence-based medicine, Medical-based simulations

Introduction

Nowadays, in every country, education and training are of particular importance due to their role in various scientific, cultural, social, political and economic fields. If the basis of education is transferring knowledge and awareness, and if knowledge is also known as information, then it will be necessary to pay attention to the transfer of information to appropriate skills ^[1]. Education is a process that leads to

learning, and learning changes behavior, attitude, and the way of thinking. Given this impact, education should be considered seriously ^[2].

An important goal of medical education should be to educate students about teaching, personal improvement, self-esteem and social development related to social sciences and humanities; in addition, it should aim at helping their fellow citizens effectively. Education is a complex process, especially for medical sciences, whose graduates prepare for the patient's bedside. The main goal of medical education is to empower and educate personnel who have the knowledge, attitudes and skills necessary to maintain and promote the community.^[3]

Universities of Medical Sciences, in addition to providing health services to the people, have an important role in educating skilled and specialized human resources in different sectors of society. This requires that medical education be continuously reviewed and remedied by deficiencies in its promotion. The proper conduct and management of educational programs in the age of information and communication can, on the one hand,

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make the learners more up-to-date and on the other hand, create a qualified physician as a result of the medical education system leading to greater health of the community.^[4]

Medical education includes three groups of physicians. Medical students, medical graduates and practicing doctors who have their own clinics. The ultimate goal of medical education is to provide the community with professional, skilled and well-trained physicians whose priority is to take care of patients; doctors are also committed to maintaining and developing their experiences throughout the lifelong vocational profession.^[5]

Medical education has many modern teaching techniques including face to face lecturing which is a master-based approach to simulation-based medical education.^[6] Given the significant advances in various educational methods, the use of modern methods in student education is essential. In modern educational methods, the goal is not just students' learning, but attention should be paid to dynamism, creativity, talents, and students' thinking.^[7] Considering the importance of medical education and lifelong education for doctors, this study aimed at first defining the life-long training of physicians and then explaining the most important, popular and effective methods of medical education.

Continuing education in the medical community

Life-long education and throughout one's life is the basis of continuing medical education. Without achieving continuing medical education and continuing professional development, achieving goals such as lifelong education and excellence in medical education will not be possible. There are several definitions for this term in the educational literature: "All life-long learning activities aimed at improving knowledge, skills and the competence of individuals that are flexible, diverse and accessible at multiple locations and times." Nowadays, the definitions of continuing medical education as well as continuing professional development are associated with concepts such as learning throughout life or lifelong learning. Life-long learning focuses on formal education (holding a course and assessment with a test and end-of-course certification), and informal education (training while working with expected educational outcomes). Considering the nature of continuing medical education and its continuous development, perhaps, it can be regarded as a kind of lifelong learning; on the other hand, lifelong learning, being effective for physicians, is continuous and endless.

In this type of education, the community and physicians are learning collaboratively and continuously. Considering these concepts, continuing medical education and professional development are both considered lifelong learning. Life-long education is described by several techniques such as continuing education, self-directed learning, self-learning approach, self-initiating learning, active learning, and field-dependent learning.^[8]

Continuing medical education refers to educational activities that are used by a member of the medical community to maintain, develop, or promote knowledge, skills, professional

performance as well as communication in the delivery of services to patients in the community or profession.^[9]

Continuing education of medical community refers to post-graduate activities that are developed to enhance the knowledge, professional skills, or promote the quality of the medical activities.^[10] Continuing medical education is defined as educational activities that help maintain, develop and enhance the professional knowledge, skills, and practices as well as the communications that a physician uses in serving patients, his community, and his careers. Continuing education is vital for all health care providers in order to expand knowledge and new techniques and provide new directional guidance.^[11]

Medical Education Methods

Lectures:

Lecturing is a traditional teaching method. In the lecturing method, professor speaks more or less in class without interruption. Students listen to the professor's notes or copy them; then, they think about his/her words, but they do not talk to him. Ultimately, a few questions and answers may be exchanged between students and the professor; however, these questions and answers are meant to clarify the point and are not discussed.^[12] Usually, in the traditional method, most students do not refer to more resources, including reference books and magazines, because there is no incentive to do so, and on the other hand, due to the large amount of material to be learned, the opportunity to use other resources for students is rare. The traditional method of lecture has advantages and disadvantages for both students and professors; one of the advantages of this method for professor is that in this method, only one time, in the early years of teaching, he collects the material from various books and other sources, and in the following semester, the same stuff is usually repeated; therefore, the professor only extracts the main and general material from the sources and only adds new items or removes the content in some cases.

One of the advantages of this method to students is that, in this way, a large amount of content is taught to students, which, in contrast to other educational methods, is not comparable to other methods in terms of the volume of knowledge. In addition, in the lecture method, the student learns only a so-called full and brief pamphlet, and before the exam, students can be able to gain an acceptance mark by reviewing it once. One of the drawbacks of the traditional method for professors is that throughout the teaching hours only the professor is focused and the responsibility of the entire class's time is on him, while the students are only recorders and do not have any contributions to teaching; one of the drawbacks of the lecture method for students is that students in this way have to attend classes for which they sometimes are not ready for various reasons and are only presenting themselves in the classroom; perhaps, at other times of the day, the student has a lot more preparation to learn, but it is not possible for him to attend the class in such times of the day.^[7]

Group discussion:

In many studies, it has been acknowledged that therapeutic approaches in groups have a good impact on the amount of learning. This method has a profound effect on students' deep learning. This method is more successful than the lecture method; in general, the use of the discussion method in small groups, in contrast to the lecture method, has some advantages such as active and profound learning compared to lecturing, as well as more satisfaction of students; however, the existence of such benefits depends on several factors. These factors relate to the field of implementing the method, which includes the lesson plan, teacher and other factors. Some of these factors have contributed to the success of the group discussion method over the lecture. The method of discussion in small groups is more influential than the traditional method of lecturing in terms of learning, interest and satisfaction of students, as well as encouragement to participate in discussions^[7]. The method of discussion has different types:

The controlled discussion by professor: In this method, the student issues a question or subject, and then the professor answers it. This conversation will continue between the student and the professor and then between the students as long as the professor allows it.

Free discussion: In this model, the professor begins a discussion by a question or statement and asks the students to participate in the discussion. **Group discussion:** it is a deliberate and systematic dialogue about the subject matter of all participants. The professor conducts group discussion.^[13]

Hopkins *et al.* (2018) refer to group discussions as "flipped classroom." In such classes, before attending the class, learners study what they need and then practice it in a working group, collaborative discussion, case discussion, applied and hybrid discussion; the students challenge the problem and solve it through thinking. Thus, students can independently assess their knowledge, and class' time will be saved for teaching lessons, group discussions about treatment choices, and responding to questions; therefore, these classes will be a major stage in trusted professional activities and goals based on the merits of physicians.^[14]

Collaborative Learning Model:

One of the successful models in attracting students' participation is cooperative educational model being of social patterns; it can be implemented in different manners. One of the most common ways of implementation is the teaching of team members based on two hypotheses: firstly, each member of the team studies a different part of the subject that needs to be learnt; secondly, any student can teach the members of his/her team; therefore, each member is both a teacher and a student. Collaborative learning creates a positive empathy between the members, it creates responsibility and personal accountability and strengthens social and communication skills. A collaborative learning model involves working with peers to produce a group product; it often creates a sort of labor's division among the collaborators of the group, provided that they combine collective goals with their own responsibility. This means that each member of the group is responsible for

his/her contribution to the goals of education. All students know that every member of the group may be required to answer each of the questions, or they may be tested about what they have been learnt, individually. Activities that are used in form of collaborative learning should match these practices.^[15]

Problem Solving Method:

The method of solving the problem improves the student's inner motivation and increases the quality of sustained learning and training. Problem-based learning is effective in educating and keeping track of physicians. The use of methodology based on problem solving has created and increased the motivation and interest of physicians deepening their learning. Considering the effect and sustainability of this educational model, it can be used in various fields of educational, research, management and medical clinics.^[3] Problem-solving teaching is one of the new teaching methods that is implemented in many universities of the world and in many medical disciplines such as nursing, midwifery, dentistry, and medicine.

In this new educational strategy, the student faces a problem raised by the professor and must solve it based on the required skills and knowledge as well as his own experiences and the study of the related issues. In problem solving methods, education is based on the expression of an issue or a disease, its definition, discussion and thinking. In this case, students are divided into groups participating in the discussion of the subject, use research as materials needed to solve it, and discuss the related questions.^[16]

Electronic learning:

E-learning is any kind of learning or education that is supported by the electronic method including the Internet, satellite, television and other related subjects, which enhance and support training and learning between the teacher and the learner, using electronic contents.^[6] This method is one of the most important methods of modern education. The value of e-learning is that it allows students to use the information they want calmly and in their free time, in their place of residence and create a virtual classroom for themselves^[7]. Earning a variety of skills, including e-learning, can make it possible for students to use new knowledge; in addition, medical schools rely on the use of such skills and knowledge. Virtual or electronic education has created a new approach in the field of education and learning and provides the opportunity to learn in every field, time and place and for anyone in a lifelong manner.^[4] Podcasts, educational websites, patient virtual simulations, interactive multimedia education, and continuously problem-based learning are examples of e-learning.^[14]

The impact of e-learning in the clinical field is an issue that has always been taken into account by educational authorities; however, in terms of face to face contact of patient and physician, less attention has been paid regarding the diagnosis of the disease, although electronic tools have now come to the aid of students. Correct integration of educational system, therapeutic issues and e-learning in clinical hospitals and clinical training of interns and residents, requires more attention of professors in terms of simultaneous practice and education.

With the expansion of the World Wide Web, the use of e-learning in medical education increased significantly and created a potential for education, providing an effective learning environment with immediate feedback related to the content of education.^[4] At present, e-learning is being used in many universities of the world to develop and improve medical education; although computer simulations and smart robots are widely available with clinical skills and have contributed greatly to the development of medical education, virtual image, even with highly modern medical technology, cannot model medical education properly. The development of these technologies, as a complement to the current curriculum, has been highly welcomed by students and some medical professors. The reason for this is that medical education, in particular the clinical education, is somewhat impossible without the patient's direct experience and disease in real environments. In basic medical sciences, which is mostly held by group education, network education, as a complementary training, has contributed to improving the quality of learning and has been effective in increasing clinical skills.^[4]

Clinical education:

Clinical education is one of the most important parts of the training of physicians, which forms a major and vital part of educating skilled and professional people; the value of an ideal clinical education is in the role played by personal and professional development as well as clinical skills of students. In this regard, the promotion of clinical education is one of the main concerns of medical education science.^[17] Studies conducted in medical colleges have shown that clinical education is an essential part of education in medical sciences, without which it would be difficult or impossible to educate competent people. The main concern of medical education's authorities, both in Iran and outside of it, is to provide all medical students with theoretical knowledge as well as the field of work experience.^[4]

In medical education, courses are divided into two parts: Basic Sciences and Clinical Sciences. One of the important issues of medical education in the country is the effective communication between basic and clinical education. Among the continuous stages of medical education, internship or clinical education is the most important stage in which students enter the practical stage leaving the theoretical stage behind and feel as future physicians; the more is the practical and scientific point of view of medical students, the better they are prepared to enter this stage and the better they will be able to carry out their duties regarding the treatment of patients. Basic sciences have a theoretical aspect; however, they are necessary for the clinical education in the hospital environment and treatment of patients; in fact, the therapeutic arenas of the educational hospitals vary greatly in comparison with other fields of education. Students in an educational hospital can enjoy the full potential of the patient's presence in promoting their knowledge; but, at the same time, they must learn the art of using this therapeutic and educational background. Educational hospitals that integrate medical education and treatment of

patients should also be combined with e-learning, in order to educate students in an actual and updated manner.^[6]

Evidence-Based Medicine:

Evidence-based medicine is one of the new approaches for physicians to combine clinical experience with the best available evidence to enable them to make accurate, informed, and fair decisions about their diagnosis and therapeutic decisions. In the world of information and communication, where human data is increased more rapidly each day, the ability to criticize, recognize and select the best evidence and scientific documentation is important. Given the scientific nature of medicine with the modernization of science on the one hand, and the advent of technology on the other hand, the importance of this matter becomes twofold. Thus, doctors are increasingly involved with understanding and criticizing modern medical literature. Medicine and clinical decision making need to be able to recognize, analyze, refine, and deduce the correct medical knowledge from the mass of generated information. Today's doctors treat patients in a situation where the amount of evidence is doubled in a few months. A committed physician who wants to keep up with the up to date knowledge must choose among medical evidence from thousands of articles published each year in hundreds of reputable medical journals; such an important decision is not feasible without knowledge and skills in identifying and grading the evidence in terms of credibility and validity.^[18]

In the process of medicine, including the diagnosis, analysis and treatment of a disease, a physician is bound to make decisions and choices. In a clinical decision-making, a set of factors influence the type and the quality of doctors' choice; such as signs and symptoms of a disease, medical content knowledge, previous experiences, patterns that a physician has learnt from his/her own professors, or even speculation, emotions and immediate feelings; but, considering the importance of decisions, medicine and its effects on the health and quality of life of patients, what is the best way to identify and analyze the problem and make a decision? Or which information sources as clinical experiences, reference books or the latest medical articles may provide the basis for the best clinical decision-making? According to experts, good physicians use both clinical experience and the most appropriate documentation and evidence for scientific support and confirmation of their experiences, and none of these two sources can alone address the complexity of medical decisions regarding the patients; Because the mere use of research evidence without getting the benefit of sufficient clinical experience increases the complications of diagnostic and therapeutic activities; in addition, the emphasis on experience and the lack of using the best and most recent evidence sometimes leads to the use of methods for diagnosis and treatment that have been there for many years or have negative consequences on patients.^[19]

By definition, evidence-based medicine means the combination of the clinical experience of a physician with the best available evidence; in other words, evidence-based medicine is the application of the best objective evidence for accurate,

informed, and fair decision-making for patients. This approach to medicine attempts to improve the quality of clinical decision-making by enhancing the ability of questioning, searching skills, selecting the best available evidence and documentation, critically evaluating them, applying the results of analysis and criticizing evidence, improving objectivity of decisions based on valid and up-to-date scientific evidence, reducing the impact of mistakes due to subjective judgment, obsolete information or linear and non-critical inferences of medical knowledge; furthermore, evidence-based medicine is a powerful educational tool or strategy that provides a lifelong learning environment for students and learners who can compensate for the gap between theory and practice in medical science to achieve the highest quality.

Medical students now need more than ever to be able to apply the knowledge they need in diagnostic and therapeutic decision making using a wide range of published articles; thus, they must have the ability to criticize the validity of resources and data and analyze them.^[19] Evidence-based medicine is the standard used by pediatricians to provide optimal clinical care. Evidence-based education requires that an educator be up-to-date on the current literature on educational strategies.^[20]

Simulation based medical education

Improving the quality of higher education is one of the approaches taken into account in many higher education systems in the last decade. On the one hand, medical education is inevitably needed to change in order to be in a position to respond to the rapid changes in medicine, and must use the new educational methods; one of these methods is simulation based education. Simulation is the method by which an artificial or subsidiary experience arises that engages the learner in an activity that reflects the real life conditions without the dangerous consequences of a real situation. Simulation-based learning has the potential to engage in behaviors in areas similar to actual performance. In simulation, real-world elements are simplified and applied in the classroom; in other words, it attempts to approach elements in a manner that they are more similar to real situations so that the learned concepts and solutions can be transferred to the real world.^[21]

The Simulation-based medical has been invented and spans four decades in the field of safety assessment and training. This is a method of advanced clinical education. Simulation based education focuses on improving apprenticeship skills and evaluating them in clinical skills and techniques, knowledge, communication, teamwork, and the practice of resuscitation code performance^[22]. Types of educational applications to achieve these goals include surgical training sessions or practical training methods. The development of simulators, such as mechanical mannequins with the ability to analyze anatomy and human physiology, is an essential tool in medical education today. Learning, thus, plays an effective role in reducing costs, improving learning, the experience, the comfort of education, and patient safety.^[23]

Clinical simulation is a learning strategy that influences professional abilities and skills. It is a strategy that has the

potential to be improved and advanced in comparison to other methods. This method is an interactive orientation towards the actual medical education being a modern self-study teaching method and group work. Through a realistic scenario, it has a huge effect on increasing in therapeutic experience without any risk regarding the health and well-being of actual patients. Clinical simulations help provide better medical education. Simulation is not a technique; it is a learning strategy that simulates the transition from theory to practice and, as a result, leads to the actual practice of medicine.^[24]

Conclusion

Summing up the results, the method of discussion in small groups is more influential than the traditional method of lecturing in terms of the level of learning, interest and satisfaction of students, encouragement for participation in discussions and dialogues; thus, with the tremendous advances that have taken place in the information systems of today's world; this issue is exposed to changes day by day or every hour. Educational methods that are solely teacher-centered and based on prior knowledge of instructors do not meet the needs of today's students and instructors should use new methods of teaching.^[7]

Traditional teaching practices such as teacher-centered classes - for a large number of students- are time consuming, costly and hard to train. In e-learning, learners have 24-hours access to training courses, they study at their own pace, don't need to go to classes, do not interfere with the work schedule of physicians; in addition, the time of learning is reduced by 25 to 30%; needless to mention that, e-learning saves teachers' time, educational activities and training costs, because in this way, the materials are edited once and used repeatedly in different places; numerous studies have shown that e-learning is at least as effective as traditional teaching and sometimes even more efficient and more conducive to learners.^[25]

Problem-solving training is a challenge to education. A collaborative pattern and group discussion are group tutorials. The mentioned methods, except for clinical, evidence-based medicine and medical-based simulations, are specialized for medical teaching; however, other educational methods are common to all academic disciplines.

The purpose of educational technology is to facilitate learning and improve performance. In this regard, educational simulations will well serve this goal. The application of simulation is more effective when basic principles and concepts are taught by other methods and then used to simulate practical skills. If the guidance is given to the student during the simulation training, the result will be better. In general, it should be mentioned that the use of simulations is more effective when used in conjunction with traditional methods; that is to say, simulation is complementary to traditional methods; also, patient safety and ethical issues related to it, are the main reasons for the use of simulations for training health professionals.^[21]

In a summing up of related researches, Talebi *et al.*, (2010) concluded that the best educational model for medical students is the use of modern education such as e-learning and simulation alongside traditional methods such as lectures and group discussions that in fact, are a combination of traditional methods and modern methods. The best pattern for training is the

combination of the following:

Pre-study (abbreviated by P): This method that refers to the study of the text before the class.

Computer Mediated Communication (abbreviated by C): This is the same method based on computer and Internet or e-learning.

Quiz (abbreviated by Q): This is a pre-study method for each session in order to conduct

Group Discussion (abbreviated by G): This method is the issuing of question or an important concept extracted from pre-study and group discussions of the classroom.

The combination of the above methods results in PCQG learning model which is an emerging and effective method being suggested to medical students.

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