Medical Education

Alternative Learning Strategies

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It is high time that the contemporary educational theory is applied to undergraduate medical educational requirements. This assumes more importance in context of acquiring professional knowledge, critical thinking, problem solving and life long professional learning(1). People are disap-pointed with traditional education because too many students memorize, forget, fail to apply or integrate knowledge and resist further learning(2).

Classroom Teaching: The Traditional Teaching Tool

Classroom lecture based teaching, remains the most widely used tool that by itself may not be conducive for constructive learning. In the traditional approach, the teacher is the key figure. Individual students have little control on what, where and how they learn. They remain dumbfounded when confronted with questions such as 'why should they learn?' The implicit theory in classroom teaching is that knowledge is transmitted from the individual who has the knowledge to the group of learners who take that knowledge. This can be compared to the flow of electrons from one point to another kept at a marked potential difference, or pouring water into an empty bucket. The learning is acquired in a passive manner; its pace is set by the teacher and does not take into account the heterogeneity of the learner group. The teacher sets the learning objectives and selects learning resources. A student is given little opportunity or encouragement to have an in-depth knowledge of the subject.

Need for Alternative Learning Methods

Learning is both an emotional and intellectual process resulting in a change or modification in the way of thinking, feeling and doing. Learning begins with a new experience. When and where one gets the new experiences and how often these are repeated, is referred to as learning opportunities. Learning is facilitated by an atmosphere that encourages openness of mind, emphasizes personalization, accepts that difference is desirable, tolerates imperfection, enhances self belief, facilitates discovery and permits confrontation, and self-evaluation. Learning is better when it progresses from an observation to reasoning, from individua-lization to generalization, and from orthodoxy to an abstract concept(3).

Learning by medical students is dominated by tradition and intuition, which is not always justified(4). Unlike a bucket, the human mind does not fill up in a passive nature. Even if the students acquire the knowledge, they may not be able to apply it in a different setting. The learning should occur in the same environment or context where it is supposed to be applied. The emphasis should be on what the student learn, rather than what teachers teach. Also, there is a strong need to have a judicious use of evidence in current medical education. All this can be brought about by incorporating alternative active learning strategies aimed at proper transfer of knowledge, skill acquisition and practice, and bringing healthy change in attitudes. An experienced provider is a great asset in supervising or facilitating such processes that may ultimately prove to be more motivating and contextual.

Few of the important and feasible alternative learning strategies are addressed in this article, namely:

(*i*) Group based learning

(*ii*) Self directed, self paced and self guided learning

(*iii*) Problem based learning

(*iv*) Task based learning

(*v*) Computer assisted learning

Group Based Learning

Small group discussion is a learning activity, in which about 8-10 students interact with each other in order to facilitate active learning by each individual(3). The learning objectives need to be clearly defined and use of different resource materials is encouraged. All the members of the group should know each other well. A facilitator and/or a group leader may or may not be involved. We feel that it is better to have a leader from those in the group who assumes the role of a moderator, is aware of the group dynamics, and does not end up dictating terms. The facilitator or the group leader may provide the necessary stimulus to elicit alternative judgements from the participants and evoke a discussion. Firing up the group's imagination is necessary by the facilitator. A guide for facilitator of critical thinking is summarized in *Table I*(1).

Table I

Strategies for the Group Facilitator(1)

- Affirm learners' self worth and motivate them

- Listen attentively and show support

- Reflect and mirror the ideas and actions of the group

- Promote and introduce new methods for critical thinking

- Regularly evaluate the process

Process

The group leader introduces the topic and encourages each member to state his/her views and to listen carefully to others' views. The group should not arrive at a decision before all the possibilities have been explored. The discussion is kept related to the topic, balanced and orderly. Interruption of one member by other is kept to minimum. The remarks should be directed to the group and not always to the group leader or a particular member. At the end of discussion, an attempt should be made to summarize and pull together various ideas. The group should provide a relaxed atmosphere.

Advantages

This method appears to be the most practical and least resisted of the alternative strategies. It can be easily merged with existing learning strategies and does not require any formal training. Brainstorming, while possible in isolation, is best learned and applied in a group. Group based learning fosters critical thinking, and improves and promotes clinical judgement(5,6). Group work considers alternative solutions derived at by focusing at the process of learning and not the results thereof. The participants learn from each other and their interaction adds to the richness and depth of learning experience. Group based learning inculcates a sense of cooperation that is essential to the overall educational development of students.

Limitations

However, group based learning is fraught with several limitations in the sense that there is a limit to the minimum and maximum number of participants; it may be difficult for the facilitator to accommodate each participant's learning style; an inexperienced group relies heavily on the leader/facilitator. Small group discussion is likely to be time consuming specially in a batch of 180-200 students. Some of the topics that require simple memorization of facts may not be suitable for group discussion. It is evident that the group based learning can not be solely relied upon and other strategies as discussed below also need to be incorporated in the curricula to provide a wholesome learning experience.

Self-directed, Self-paced and Self-guided Learning

Self-directed or self-paced learning is defined as learning directed by the individual in order to meet personal learning objectives. The learner controls the pace of learning in self-paced learning. In contrast, the speed of learning may be partially controlled by the needs of curricula or the facilitator, in self-directed learning. Another type of self-learning is the guided self-study which is supported by the provision of targets and direction envisaged in study guides(7,8). The study guides are essentially

meant to expand the knowledge and understanding through active and task based learning(9). In this discussion, however, we shall employ a collective term 'self-study' to refer to all these modes of learning by oneself. In a self study program, the learner takes the initiative for diagnosing learning needs, formulating goals, identifying resources, implementing appro-priate activities and also evaluating the outcome(10).

Process

Examples of self study include (*i*) reading a book, (*ii*) watching a video or instructional manual, (*iii*) seeing a clinical case, (*iv*) seeing an object/equipment and reading the accompanying reference material, (*v*) listening to expert discussion, (*vi*) watching and performing a procedure, (*vii*) acquiring knowledge through other information sources such as internet, (*viii*) working on mannequins in a skill development center, and (*ix*) working with the facilitator on one to one basis.

Advantages

Self-study involves the learner as an active participant thus encouraging development of a deep approach to learning. This strategy is more likely to produce doctors who are prepared for lifelong learning and are able to meet the changing needs of their patients. Self-paced approach allows a more capable learner to learn at a faster pace. For a slow learner it may be highly satisfying and motivating for him to assume control the learning process. The training time and resources are better utilized. Learning activities can be sequentially organized because each component in a self-paced course has objectives that must be met before proceeding to the next component. The facilitator can concentrate and focus more on students who need assistance. Self-study promotes inculcation of a feeling of increasing self-reliance. The development of self motivated learning style should be assisted from the outset by setting the time table that encourages the students to learn on their own.

Limitations

However, initially the student may feel uncomfortable by learning on his own. Those with poor reading skill may find it difficult to comprehend the desired knowledge. A student with poor time management skill loses out to others. It may be challenging and time consuming to design and develop the appropriate study guide.

Self study is a major component of problem based or task based learning(11), the details of which are discussed below.

Problem-based Learning (PBL)

PBL is an instructional strategy in which the students identify issues raised by specific problems to help develop understanding about underlying concepts, mechanisms and principles(12). New knowledge and under-standing arise through working on the problem rather than in the traditional approach in which new knowledge is a pre-requisite for working on the problem(13). Here, the problem leads to learning. In the traditional approach, learning is followed by problem solving. Essential components of PBL include a small group of learners, a facilitator, learning resources and above all the problem itself(10). The problems are usually clinical, however they are introduced in the pre-clinical year with an aim to integrate basic science with clinical thinking.

The students may tackle patient problems, health problems, medical science or research problems. These act as stimulus for organization of learning of the basic and social sciences essential to the practice of medicine.

Step 1: Clarify and agree on working definitions and unclear terms and concepts

A classical problem based tutorial consists of 6-8 students and one facilitator who meet on a regular basis. When the tutorial group meets to consider a new problem, it receives the problem cold. This means that the group did not have an opportunity to study the problem in depth before the session. The need is therefore to identify both familiar and unclear terms and decide what information is most relevant. The advantage of this approach is that it stimulates the life long task of encountering a problem or patient, encourages to assess what is already known, and apply it to the analysis of the problem.

Step 2: Define the problems; agree which phenomena need explanation

The group defines the problem and develops explanations and hypotheses for their observations. In some cases, they may be able to describe the underlying mechanisms, which explain the observations described in the case. The tutor will assist if the group is blocked by the lack of a clear vision, but for the

most part, the group does the initial work. During the course of developing hypotheses, the group begins to encounter gaps in their understanding and identifies issues for further study. The facilitator helps the group to expand or eliminate hypotheses from its original list. The group's discussion usually focuses on questions seeking definition of problem and the most influential factors in its development.

Step 3: Analyze the problem (brainstorm), arrange possible explanations, generate and prioritize learning objectives

At the end of the first tutorial encounter with a problem, the group reviews the possible hypotheses. Which are the most likely? Why? What other data are required? What are the underlying scientific mechanisms involved? Once this priority is established, the group reviews the learning issues and generates and prioritizes the learning objectives.

Step 4: Research the learning objectives

Students work independently in pursuit of learning objectives during a period of self-study. They may go to the library, search the internet, read the books, discuss with seniors and faculty, watch the videos, *etc.* to obtain the knowledge needed to address the learning goals set by the group in Step 3.

Step 5: Report back and apply newly acquired information to the problem

The group reassembles after a period of self-study to reconsider the issues raised by the problem. During these sessions, the group begins again with the problem, critiquing initial explanations/hypotheses, elaborating on earlier discussions, and synthesizing newly acquired knowledge. The group explains what it has learnt during self-study. The facilitator now may come up with a list of learning objectives, to which the group compares its own expanded knowledge base. If there are essential objectives that the group has not considered, it should set additional learning goals and work on them afresh.

Step 6: Synthesize explanations

After the last tutorial session for a given problem, the group synthesizes what has been learned in the basic, social and clinical sciences. Making models, lists, charts etc. may help the group to summarize and organize the learning and to generalize to other situations in which such knowledge, skills, and attitudes would be applicable.

A sample problem for PBL is given in *Table II.*

Table II

A Sample Problem for Problem Based Learning

Respiratory System

Ramesh, a 3-year-old boy was brought to the pediatric outpatient department with complaints of troublesome cough and a soft but persistent wheezing sound for the last 10 days. There is no history of fever. Ramesh has no past history of chest problems. Ten days back he went to a friend's birthday party and was observed to have a choking episode while laughing. Shortly before he was seen emptying a bowl full of salted peanuts into his mouth. During the choking episode he was blue around the lips and coughed uncontrollably for 2-3 minutes, Following this episode, he appeared to be normal and continued playing at the party. However, since then his mother noted this troublesome cough. There is no family history of respiratory disease in family. The family belongs to middle socio-economic status. Ramesh has an elder sister who is 6 years old and healthy.

On physical examination, the only abnormal finding was a localized expiratory wheeze and soft inspiratory breath sounds over the right chest, both front and back. A chest *X*-ray (inspiratory) film is normal, an expiratory film showed right sided hyperinflation and mediastinal shift to the left.

The child was admitted to hospital for further investigations including a bronchoscopy and management. Two large fragments of peanuts were removed from the right main bronchus. There were no abnormal chest findings following this procedure, and at follow up 2 weeks later.

Tutor Guide

Trigger	Keywords	Learning needs
Presentation	Cough, Choking episode,	Anatomy of respiratory tract, Physiology of

	Persistent wheeze, Blue around lips Family history	cough and respiration, Obstructive sounds, Causes of sudden onset cyanosis, Importance of family history
Examination	Localized expiratory wheeze	Wheeze (Unilateral bilateral) and its causes
Investigations	Chest X-ray, Hyperinflation Mediastinal shift	Normal Chest X-ray appearance (Inspiratory vs expiratory), Relevant abnormal X-rays
Diagnosis and management	Foreign body obstruction Bronchoscopy	Foreign bodies in respiratory tract, Emergency management, Treatment and removal
Follow-up	Normal	Course of illness, Risk factors and prevention

Resource Persons required from Departments of Anatomy, Physiology, Pediatrics, Radiology, ENT

Advantages and Limitations

In the early 1990s, four systematic reviews of undergraduate medical education cautiously supported the short term and long term outcomes of PBL compared with traditional learning(14-17). Thereafter, more studies(18-20) provide empirical support for the advantages claimed for PBL. These students are better able to learn and recall information and to integrate basic science knowledge into the solutions of clinical problems. PBL has a long lasting impact on self-directed learning skills and on students' intrinsic interest in the subject matter. It has been found that students in a problem-based approach reflect more than they learn, memorize less than peers, and prefer active learning(21). Interpersonal skills, psycho-social knowledge and attitude towards patient are also found to be better. Students feel more stimulated, challenged and satisfied(22,23). In a recent study comparing PBL and conventional curriculums, it was reported that students of the PBL curriculum found learning to be "more stimulating and more humane" and "engaging, difficult, and useful", whereas students of the conventional curriculum found learning to be "non-relevant, passive, and boring"(24). Students who used the PBL method showed better interpersonal skills and psychosocial knowledge, as well as a better attitude towards patients. Students using the conventional model, however, performed better in basic science examinations. However, there was no convincing evidence of improved learning using the PBL curriculum(24). This should not be a surprise as the evaluation is based on outcomes like performance in examinations and most students will do whatever is necessary to compensate for any perceived weakness in a curriculum. However, in terms of the original goal of creating a humane learning environment, problem based learning is an unqualified success(25). It may be felt that the students may not have the opportunity to gain an understanding of the structure and framework of each discipline in a problem based approach. This problem can be obviated by following a middle path that integrates a few problem based weeks (may be at the end of one organ system) with traditional pre-clinical teaching(26). The middle path looks more feasible and attractive in a country like ours with limitations of resource availability and teacher expertise desired for problem based approach. PG was closely involved with a similar approach at B.P. Koirala Institute of Health Sciences, Dharan, Nepal.

Another real concern about PBL is that it costs more in terms of staff time; however, its effect is not to increase the teaching time but rather to change how this time is spent(22,27). Other disadvantages of PBL are the costs of starting up and maintenance, and increased stress on students and staff(28), In few studies, the problem based approach has been found to be relatively inefficient(29).

Current Status

Medical School at McMaster, Ontario Canada is the pioneer in this field and follows a total PBL based curriculum. PBL has spread to Europe, Middle & Far East, and Australia. Even the neighboring country Nepal has adopted a partial problem based approach in one of its medical schools. We, in India, have still to see merit in this approach and the latest MCI recommendations remain silent on this aspect of teaching. Though it may not be possible to adopt a total PBL curriculum in the near future, it is desirable to incorporate few elements within the traditional curriculum and within the existing resources. The motivation, again, has to come through the Medical Education Units of individual medical colleges.

Task Based Learning (TBL)

PBL is a powerful educational strategy for integrated teaching in the pre-clinical years. In later years, however, when the teaching take place in clinical attachments, the situation is different and there is little information about the use of PBL in clinical settings. Here, the learning opportunities are provided by clinical case discussions, which in the current form provide little scope for integrated teaching. TBL provides a practical approach to integration and PBL in the later years of medical course(30). Here, the focus for learning is a set of tasks addressed in clinical practice. The learning is built around the tasks and learning results as the student tries to understand not only the tasks themselves but also the

concepts and mechanisms underlying the tasks. Facilitators and study guides assist them in this process. In TBL, learning about the individual subject is not the primary aim. Instead, the clinical postings are seen as offering a rich learning opportunity. TBL recognizes the need to know not only how to do something but also the basis underlying the required action(31).

Task identification

Specific tasks are identified on the basis of their importance, which are likely to be encountered by students in more than one clinical posting during their clinical attachment. These tasks should serve as an appropriate focus for renewing the basic medical sciences as well as learning clinical medicine(30,32). Few of the tasks that fulfil these conditions are fever, chest infection, sepsis, muscle weakness, lumps, loss of weight, cough, jaundice, abdominal pain, shock, failure to thrive, dying patient, *etc.*

Integrated learning

Students take responsibility for integrating their learning as they move through different clinical postings. For example, for management of a patient with jaundice, students look in each posting at a patient of jaundice, from the perspective of that discipline. They will see medical cases of jaundice in medicine ward, surgical causes of jaundice in surgical unit, neonatal jaundice in neonatal unit/nursery or pediatric ward, jaundice during pregnancy in obstetrics posting and so on. Students therefore learn in a holistic fashion about the jaundice including anatomy and physiology of hepatobiliary tree, bilirubin metabolism and apply this basic knowledge to the task in different disciplines. In addition, he goes through the rigors of acquiring skills related to problem solving and communication. In this venture, the facilitators of different subjects help them. It is highly desirable that study guides prepared by the faculty are available for each task or each group of tasks. The guides should highlight the learning issues for each of the tasks in each of the clinical posting. The guides also provide information about the learning resources available in the form of books, scientific papers, Internet sites and specialized referral units.

Again, it may not be possible for students/faculty in a traditional curriculum to go for a complete TBL approach. However, it is definitely feasible to identify 8 or 10 tasks and have a task-week after every 3 months of clinical posting. During this task-week, the students are free to roam about in different specialties and concentrate on the given task (both clinical and pre-clinical). With TBL, the integration becomes the responsibility of the student. The integration is both vertical and horizontal. In a traditional hospital based curriculum, students can go one step ahead and try to look at the task from the perspective of both the hospital and community contexts of medical practice(30).

TBL therefore provides on the job, experimental learning. In PBL, a small group tackles a paper simulation. In TBL, the focus is on learning in context *i.e.*, in the clinical setting. The knowledge, skills, and attitudes are acquired in the same context in which they need to be applied. Therefore, it has also been described as situated learning(31).

Computer Assisted Learning (CAL)

Computer has become an integral part of our personal and professional lives and the day is not far when most of our medical colleges will be equipped with latest information technology including an access to multimedia software for learning and web- based teaching programs. It is abundantly clear that computers can be used to enhance education and training(33). CAL is defined as using the computer technology to assist with, augment or deliver part or all of the instruction or course and also to evaluate the student progress.

Two main modes of CAL are learning through multimedia and the Internet. Multi-media simply means software comprising of variety of media together. This can be text, sound, and still or videos that can be easily stored and carried in CD format. What all one needs is a computer with CD drive and the application software. For example, a student can learn about various cardiac murmurs from related software. Multimedia instructions can simulate a real life experience, such as decision-making on the job. Interactive multimedia allow the participants to interact with the computer by following instructions, completing exercises, answering questions and solving problems. The other dimension of CAL *i.e.*, learning through Internet is tricky. A load of information is available on the net that may or may not take the student to the right path. Here, the facilitators can direct the learner to the websites providing evidence-based material. Evaluation on use of interactive educational websites has revealed that it is a valuable educational tool, especially when used in conjunction with other teaching techniques(34).The stages of competence in online learning have been summarized in a recent article(35). You begin with gaining access, gradually become familiar with online environment, start seeking and giving information and ultimately take responsibility for own continuing development in online learning.

The cost of hardware, software and the telephone line charges are the major hurdles in initiating or augmenting computer-assisted learning. Students may have that initial fear or hiccup about the machine and the technology. Developing computer assisted learning application is a lengthy and skilled process; and acquiring readymade application is a very costly affair. However, innovators within the traditional courses can embrace the concept and have often produced creative and high quality material to supplement their existing courses. The focus should be to identify these resource persons and make them and their innovation visible to those who are computer savvy. Medical Education Units in individual institutions can serve to develop mechanisms to allow exchange of skills, resources and ideas between institutions and put them into practice in their respective colleges, not-withstanding the limited resources at their disposal.

Alternative Evaluation Tools

Finding appropriate evaluation tool for these alternative learning methods especially for problem based learning, task based learning and self learning ability always remains a challenge. As long as students have to go through traditional examinations, many of these methods may remain superfluous. In choosing an evaluation tool, several factors like the purpose of evaluation, the domain sought to be tested, the number of students, feasibility, resources, time available and administrative issues are to be considered besides ensuring validity and objectivity. A combination of formative and summative assessment tools, which test not only the knowledge but also the performance, is required. Assessment tools like structured oral examinations, objective structured clinical evaluation (OSCE) and objective structured long examination record (OSLER) need to be tested and incorporated in the examination system to test problem/task solving skills of the students. Objective structured evaluations with its multiple samples of performance has come to dominate performance assess-ment(36,37). Evaluating medical student searches for evidence-based information has been found to be an effective way of evaluating students' searching proficiency, and, in turn, the adequacy of the instructions they receive in computer assisted learning(38,39). Continuous efforts are needed to develop and research valid and effective tools of evaluation in current medical education(25).

Comments

To be successful, these radical changes in educational methods need to be supported by teachers and institutions in which they work. Change in learning methods will be successful only if teachers can be motivated and trained to acquire the new skills required. Another challenge would be to devise appropriate evaluation tools for these methods, specially for problem based learning and self learning ability. In this direction, various institutions in the country are managing National Teachers Training Courses (NTTC) catering to the needs of medical professionals and transforming them into good teachers. However, the focus should be on producing a good facilitator rather than a good teacher. The change can be exciting. We have to seek a balance between the use of didactic teaching and the alternative learning methods.

Another new concept in medical education is that of distance learning. Distance education uses non-conventional, learner centered system which does not rely on face to face teaching. The primary mode of instruction is through a multimedia approach, besides printed lessons. Indira Gandhi National Open University, New Delhi has already initiated few distance leaning programs in medical education including B.Sc. (Nursing) and Postgraduate Diploma in Maternal and Child Health. Distance education is a specialized field, detailed discussion of which is beyond the scope of this article.

To conclude, these valuable educational initiatives should not be allowed to stink in the cupboards of educationists, rather they need to be absorbed into the currently rigid medical school structure. For a change, Medical Council of India strongly recommended that methodology of teaching must underline active learning by the students. The didactic teaching must be reduced to less than 1/3 of total teaching time giving way to alternative learning strategies. It has also mandated establishment of Medical Education Units in each of the medical college in India(40). It is time that these units do not remain on paper and bring about concrete changes in the learning strategies in these institutions. The present review could very well serve as a background material for evoking the thought process in this regard. The overall approach is best described as one of "guided discovery"(10).

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