

Original Article

Problem based learning: its application in Medical Education

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ABSTRACT

Malcolm Knowles introduced the term ‘Andragogy’ in adult learning, which is the science expressing principles for adult learning. The concept was first coined by Alexander Kapp in 1833. It says adults are motivated by immediate problem centred approaches in learning processes. The three learning outcomes in medical education, such as knowledge, skill and attitudes find a success if they are incorporated in the learning process of day-to-day work.

Problem based learning (PBL) is one such effort where student face a real life scenario of patients and they are expected to decipher by their own understanding and reasoning abilities. Teachers act as facilitators here and provide resources. Intense use of such resources along with group discussions, peer support and use of virtual technologies help students to self directed learning.

The uncertainty in problems given in PBL and curiosity becomes the motivation to seek, probe and study. Students gain confidence when they are allowed to solve authentic problems and knowledge gain is retained.

The effects of PBL on students learning are multiple. They gain cognitive knowledge and simultaneously improve their technical skills, developing reasoning abilities, learning group dynamics, incorporating attitudes and experiencing communication skills.

The responsibilities of the medical education unit and administration are faculty development and creating avenues for implementation of PBL applying tested strategies.

Key words: challenges, competency, learning outcomes, problem based learning, strategies of implementation.

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Introduction:

There is movement in medical education to include competencies around the globe. Countries including India have selected competencies and adopted a framework for these competencies to be gained by the Undergraduate students prior to graduating and act as physician of first contact for the society. These competencies are measurable by appropriate assessment methods at the end of the course for every student. The medical profession defines that a medical graduate is one who is not only expertise in clinical knowledge and skills but also a health manager, communicator, collaborator, scholar and health promoter. He/she should be well apprised with ethical values, and exercise with responsiveness and accountability. All the actions should follow with humanitarian principles. Hence, it is a multidimensional task and a learner should have adequate opportunities to gain these competencies during undergraduate studies, so that he can deliver in real life practice.^{1, 2}

This new educational reformed endeavour known as Competency Based Medical Education (CBME) by the Medical Council of India (MCI), have been created for the learners to gain competencies. Competency based learning in any profession signifies the implementation and designing of educational curriculum in such a way that it meets the expected standards. Competency of a medical graduate means an observable ability of the health care professional to perform the whole range of actions as desired from him/her in form of abilities to meet the standards of that country. Such actions need to be globally relevant also.³

The responsibility to train medical doctors with local and global relevance is the duty of the Government, the University and medical Institutions. With the changing demands of the society, specifically

concerning health, there is a palpable change in people's expectations. These have influenced the medical curriculum, and analysts suggested changes in medical education curriculum according to society's requirements.⁴

New learning strategies adopted in medical colleges are learner centric, multi-disciplinary, system based, integrated and problem based. This new teaching-learning SPICES (Student centred, Problem based, Integrated, Community based, Electives, Systematic) model differentiates away some aspects from the traditional method. PBL is an important aspect of this new model and a contributor in competency based learning method.⁵

PBL that commenced in 1962 from McMaster University Medical School, Hamilton Canada, incorporates basic sciences under clinical context and students utilize their knowledge and experiences in solving problems by analysis. It independently allows the development of desirable skills and reasoning process among students. PBL requires students to take the responsibility of own learning and is an important innovation of adult learning of professional courses.⁶ Thus, PBL is a student centric pedagogy, in which students learn about a subject through the experience of solving an open-ended problem found in the trigger material.⁷

History of problem based learning

Educators believe that adults develop knowledge and skills when they face a real problem and solve it by themselves. Howard Barrow, a medical educationist from Ontario, Canada tried to develop methods that enable physicians in solving health problems competently with humanitarian principles. While Medical schools across globe focused on providing knowledge, Barrow thought of ability of students in using this knowledge in evaluation of patient's health problems and

to provide appropriate care to the patients just as the way they were supposed to do in real life practice. After much pondering, Barrow developed “problem based learning” which states: “allow [medical] students to integrate, use, and reuse newly learned information in the context of patients’ problems; the symptoms, signs, laboratory data, course of illness, etc. provide cues for retrieval in the clinical context”⁸

Barrow designed a series of problems for students to solve, and, hence, to gather experience. He didn’t provide students all information, but necessitated them to search a situation, develop appropriate questions, and produce their own plan to explain the problem. This cultivated students’ “clinical reasoning process”, as well as their understanding of the tools at their disposal.⁹ When applied to teaching schedule in 1962, PBL was set on role by Barrow in McMaster University Ontario Canada. By 1970 it was adopted by Medical schools in Netherlands, Australia and Mexico.

PBL was soon adopted by other disciplines: business, dentistry, law, school education and engineering courses.^{8, 9}

Significance of problem based learning

In traditional teaching of medical science there are multiple exposures to patients of different diseases at wards and tutorial sessions. In these activities, teacher presents facts with skill demonstration and it is believed that students will build concepts and acquire skills by observation and practice. Some says that there is no real-world scenario and students are not solving actual problems^{10, 11}.

While solving PBL, students develop power of reasoning and learn concepts. Several studies showed that PBL facilitate students in gathering content and simultaneously improve thinking strategies.

The significance of PBL is the appropriate uses of learning materials by students to improve knowledge and understanding.¹²

Hence, it increases the cognition of students and influences behaviour. In analysing the Millar’s pyramid of clinical competence in context of PBL; the teaching learning method influences all levels of the pyramid from ‘knows’ to ‘does’ and helps a student to ascend from novice to expert. In addition, PBL allows participating students to get involved in group discussions, learn group dynamics and improve communication skills. In addition to the development of cognitive skills, students carry out research through enquiry, and apply their learning in solving future problems and can present their findings in a research paper. Most importantly the significance of PBL involves with intrinsic motivation and is responsible for lifelong engagement with learning.¹³

The need to implement PBL in medical education

Medical education is a learning continuum. It does not cease at the end of a postgraduate course but continues to exist throughout life and hence a professional medico needs to be a lifelong learner. Various medical bodies across the globe like MCI raised concerns about the limited uses of the present medical education. The society demands excellent communication from a medico along with actions enriched with positive attitudes and ethical values, apart from expertise in clinical field. However, there is no separate class for that. When clinical classes are introduced, there is no integration with basic science subjects. It is expected that students will build up conceptual links about human disease process by them through what has been taught. Such studies are termed as ‘surface’ learning and they do not retain in mind.^{11, 14}

Knowledge gain is just information load. It fails to encourage critical thinking process and reasoning power, both are important ingredients for a medico. Students memorize subjects to satisfy the examination driven system. Student's enthusiasm which brings them to this course is lost and information overload become intolerable burden.¹⁵

The current scenario in medical practice highlights health care system should be more patient centric. It should meet societal needs. The expectations of the society are higher. People tolerate no delay in diagnosis and treatment. All actions of the physician need to be transparent and all communications should have professionalism. Attitude development, professionalism and communication skills are some competencies which do not find any space in present medical education curriculum.¹⁶

The reasonable uses of skills by students in defining course content, use of technology, shouldering the responsibility of own learning, meaningful utilization of knowledge gain and appropriate collaboration are the need of the hour.¹⁷

Characteristics and features of PBL

The core curriculum in undergraduate medical education comprises of the basic knowledge, attitudes and skills required for a medical graduate of 21st century to become physicians of first contact for the society. This core must revolve around human and human society or public health. Among multi-dimensional approaches, clinical problem solving and developments of critical thinking abilities are primary requirement. Students from beginning should develop attitudes conducive to continuous professional evolution. Once students understand the relevance of the course learning becomes easier.¹⁸

In PBL the learners both individually and in groups assume the responsibility for generating the learning process. It induces group discussions. By both individual and peer assessments, students frame their bases and search their learning materials. It is self reflective and learners learn to monitor own learning.¹²

The activity starts with a real world problem which contains description of a set of events which needs explanation in terms of the underlying process or mechanism. The problem is presented as such it would present in reality. The task of the students is to explain the phenomenon by indulging in self study and group discussion. The most dominant factor is the quality of the problem provided. The students work with the problem; apply knowledge and experience. The student reasons with the problem and provides solution. PBL curricula allows transfer of concepts to solve problems, enhances the intrinsic interest in the subject matter, enhances self directed learning skills and this enhancement can be maintained.¹⁹

The learning that has developed with work in solving the problem is integrated into student's existing knowledge and skills. Learners are able to connect what they are learning with what is going to happen in the real world.⁸

Students have to work with the problem as far as possible and identify what they need to learn. The learners engage in self-directed study to research the information needed finding and use a variety of information resources (books, journals, reports, online information, and a variety of people with appropriate areas of expertise) for coming to an appropriate solution to the problem provided. In this way learning is personalized to the needs and learning styles of the individual. After gathering knowledge student return to the problem, apply what they have learnt and provide

reasonable solutions. After completion of the task students go for self assessment and peer assessment.²⁰

Role of teacher in PBL

Responsibility of the teacher in PBL is to provide the educational materials and guidance that facilitate learning. The principal role of the teacher as a facilitator or educational coach is to guide the learners. As learners become more proficient in the PBL learning process the teacher's role is minimised. The assessment reports provided

by student are supervised by the teacher. The teachers also appreciate the efforts of the students and supervise the problem solving activities of students. Here the teacher does not provide facts and doesn't test student's recall power via memorization of facts²¹

Steps and strategies of implementation of PBL

There are six steps in planning a PBL programme and in implementing it. The strategies are summarized as below

Steps		Strategies
1	Identify the outcome	The facilitator prepares both formative and summative assessments which will define the knowledge learnt. Identify if the project has a problem solving.
2	Design the project	Think of a real problem related to the subject courses that need to be learnt. Design the problem related to the subject that will induce brain storming to the students and simultaneously will lead students to search.
3	Introduce the PBL-Project to the students	Let the group read the scenario and allow students to attempt it in their own way giving a time limit.
4	Work by students	Activity begins with small-group brainstorming sessions where students define the problem and determine what they know about the problem (background knowledge), They need to learn more about (topics to research) and where they need to look to find data. They might need assistance from the teacher and seniors. Students develop an initial response after they have gathered necessary data.
5	Product performance	After their research and creating the hypothesis and reaching a solution to the problem provided the students now present it in front of the facilitator. Student's resources enrich the background knowledge which defines their understanding of the problem provided and then they collaboratively present their findings, including one or more viable solutions, as research posters to the class.

Steps		Strategies
6	Assessment	The teacher assesses the final product according to the summative assessment created at the beginning. All candidates need to take part in the discussion. Students should come out with feedback about the work done with appropriate reasoning so that knowledge can be utilized further and the process can be maintained

This type of process-oriented, self-directed, and collaborative pedagogical strategy can prepare students for successful futurist endeavours.²²

Challenges of PBL & solutions

Various strategies have been adopted for effective functioning and implementation of the changes which has been framed for smooth rolling down of CBME. Setting up of such environments out of the prints and to put forward in practical field are major challenge for the college Medical Education Unit (MEU) and administrative authorities. The environments are namely 1) learner centric 2) knowledge centric 3) assessment centric and 4) community centric.²³

PBL strategies need students to shoulder the onus of own learning. Problems used by the students should have strong community orientation. Educational curriculum henceforth should have modifications accordingly.²⁴

Independent study, peer group learning, small tutorial group discussions are the major teaching methods. Didactic lectures require reduction and when present needs to be interactive and focused. Hence gaining of student trust along with faculty cooperation are major roads of success for implementation of PBL. Lack of clear implementation guidelines and also not identifying learning outcomes by faculty will cause failure.

Professional ambience created by the Institute with trained faculties who can land up with appropriate learning outcomes is needed to, gain student’s trust that can guide students with group dynamics.²⁵

Examples:

With rolling down of CBME in medical education across the country Teaching-Learning methods by PBL is on force and is practised in Phase1 subjects. The clinical departments too will apply PBL in teaching methods from the year 2020-21 onwards.

For example in Medicine let us formulate one real problem scenario:

A 35 years old male had repeated admissions in hospital with history of generalised weakness and quadriparesis for last one year. On each admission he was found to be having low potassium level and his symptoms improved with potassium supplementations. Incidentally his Blood Pressure recorded was also on higher side. He was prescribed potassium supplements and calcium channel blockers for treatment. In spite of that his complaints persisted and he continued to have repeated admissions with generalised weakness and hypertension.

Now this real problem scenario will be circulated to a student group and with group discussion, self directed learning, net searching after a stipulated time say 5 days

the group will present the case in front of a facilitator coming out with what further investigations & management protocol are to be adopted to reach the diagnosis and offer treatment. Both the facilitator and students will now engage themselves in discussion so that the learning objectives are achieved.

Relevance of PBL with adult learning

Malcolm Knowles introduced the concept 'andragogy' to denote adult learning process. It is the arts and science helping adults to learn. Adults learn with motivation diagnosing their own needs and it is left to them to formulate own learning requirements and aim. Adults need support so that they can focus on learning outcomes and can execute plans. Institutes will help or teachers will support in identifying learning outcomes, identify resources and will involve in mutual planning. PBL is a method of learning in professional courses which fits into the objectives of adult learning theories and it helps in intensifying the maximum uses of resources, knowledge, group discussions and learners will have more control of their own learning. They will devise own strategies to gain their self identified learning objectives to become competent.²⁶

Conclusion

CBME needs professional assessment of competence. PBL is one such teaching learning method which allows competence to grow. It is an activity that facilitates the development of specific knowledge, requisite skills and professional attitudes by a medical graduate to become competent and also results in recognition of requisite abilities at places of professional work. In each department preparation of a log-book for the same may be created for monitoring of learning process and feedback to be

gathered from stakeholders to evaluate whether learning objectives are achieved.

PBL in teaching methods it will induce critical thinking abilities in medical undergraduates and will enhance self directed learning. Such brain storming approaches will increase understanding of concepts instead of factual recall.

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