PROBLEM BASED LEARNING (PBL) IN MEDICAL EDUCATION: WHY, WHAT AND HOW

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Introduction

Why PBL?

Among the oldest of professions are Medicine (the art and science of healing) and Teaching, both of which, in the earliest of times, were accorded the respectability of nobility. Medicine continues to be a highly regarded profession. Many factors contribute in maintaining this notion of nobility, not the least of which is the sentiment attached to the sanctity of human life. It is largely for this reason that, Medicine, historically has remained a profession of a chosen few; from being almost a cult in Hippocratic times to being a profession almost regarded as a cult of the best of students. Two major human factors impinge on the life/professional training of those called to the medical profession. One is the sentiment which humans attach to life for which reason the societal expectations of the doctor is very high. This translates to the doctor being expected to know virtually everything about man, his structure and function, his diseases and the healing of same. A practical manifestation of this societal sentiment is that many a medical school teacher has a mind frame driven by the desire to make the students know virtually every fact that there is on any subject he lectures. This attitude tends to make the medical school curriculum so overwhelming that it creates an inclement learning environment which contributes to the drop out of otherwise brilliant students from medical school (1, 2). The second factor which is closely related to the first is that as time progresses the horizon of knowledge extends even further, thus, compounding the first factor. It is largely for these reasons that inductees to the medical profession can only be drawn from among the best of students. One of the major tasks facing anyone involved in the training of medical doctors, therefore, is working out the best approach to imparting this enormous and increasing body of knowledge to the next generation of doctors, hence the growth and development of new approaches / curricula. It has been said that with time the undergraduate medical curriculum tends to develop a chronic disorder labelled 'curriculopathy' (3). This 'syndrome' arises from the failure of the curriculum to catch up with factors that influence training, such as, increasing body of knowledge, lack of relevance, predominance of basic and biological sciences, faculty attitude to teaching, costs, and the organisation of the delivery of medical education (4). Curriculopathy, thus, hampers the efforts of the medical school at producing knowledgeable and humanistic doctors (5). It is in the search for better ways of imparting medical knowledge that the concept of problem-based learning (PBL) as a focus of training was born. Problem based learning per se is not a new learning technique. It is the adoption of its philosophical notion as the main driving force in a structured medical curriculum that represents a paradigm shift in the field of medical education. Hitherto, the philosophy of medical teaching was teacher centred. In this traditional setting, the teacher was viewed as a reservoir of knowledge from which the medical students should drink. Learning activities centred around the teacher whose main tool for dissemination of knowledge was didactic lectures. As the body of knowledge expanded, didactic lectures became more and more complex in content and required more and more lecture hours. This meant more and more pressure on the teachers and worse still on the student, thus, contributing to 'curriculopathy'. With the prevailing pressure, further aggravated by an ever-increasing public expectation, planners of medical education were left with no choice but to create ideas that can help minimise the obvious shortcomings of the traditional medical curriculum. The PBL concept is, therefore, a child of necessity. Pioneered by the McMaster University in Hamilton, Ontario, Canada as far back as the mid sixties (6), this approach which initially met with resistance (even in McMaster) is gaining popularity (7). It has been adopted by several notable medical schools such as Harvard, Southern Illinois University, University of New Mexico, all in the USA, Sherbrooke in Canada, Xinjiang in China, and Lindkoping in Sweden, etc. It is gradually becoming the standard format for medical training world wide and, therefore, represents a subject that should interest all that are involved in medical education either as teachers or administrators. One other major attribute of a PBL curriculum, is that it represents a practical application of the now established fact that knowledge is much better recalled and applied in the context it was originally learnt. Thus, the philosophy of early exposure of students of PBL curricula to clinical scenarios.

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What is PBL?

What is a PBL curriculum like? As the name indicates, PBL implies learning through facing and solving challenges. This in itself is a well known learning process which over the years has been used by teachers in all fields (including medicine), albeit, to different degrees and without it assuming a special emphasis in the curriculum. In a PBL curriculum, however, PBL assumes a higher value in terms of a well organised systematic application of its principles in medical education; the PBL becomes the driving force and centre of focus of the learning process. In the PBL curriculum, the student and not the teacher is the centre of focus. The teacher's role shifts from that of a giver of knowledge (lecturer) to that of a facilitator, a coach , a guide, a moderator. Knowledge is, therefore, acquired actively by the student who is challenged by problems requiring diverse knowledge base for solutions. In solving the problem the student naturally puts all his genius in seeking the power (knowledge) to solve the problem. Because the process is driven by the student it is a self-directed learning (SDL) process; a term which is sometimes confused with PBL. Possibly the easiest way to appreciate these terms is to understand that in a PBL curriculum the individual student drives his own learning process (SDL) through solving problems and is guided / facilitated by the tutor who ensures that the student's inquisitive mind probes into those areas of the problem that the curriculum requires of him. This active process instils into the student the confidence of being the source of the solution to the problem and many a student has expressed a psychological satisfaction with the learning experience (8,9). Further advantages of the PBL curriculum include the development of communicative skills (10) as the students do most of the talking, and the enhancement of inquisitive rather than rote learning style (11). The cultivation of a positive attitude towards problem solving tends to sustain the interest of graduates of a PBL curriculum in continuing education (12) which enriches their professional lives by, hopefully, making them life-long learners.

How is PBL adopted?

The purpose of this section is two pronged. One is to create an insight, using one or two examples, into how medical schools have transformed from the traditional lecture-based learning (LBL) curriculum (also referred to as the traditional curriculum, TC), to a PBL curriculum. The second is to attempt a brief description of the running of a PBL curriculum. Generally there exists two modes by which medical schools have transformed from the traditional to the PBL curriculum. Apart from the newer medical schools that opt for PBL right from inception, others who have adopted PBL have had to transform. The transformation process for some (e.g. the Sherbrooke School of Medicine, Quebec, Canada) was a complete change from an LBL to a PBL curriculum following years of planning (4), whereas, for others such as Harvard (13) there was an experimental transitional period during which two streams of students were running the LBL and the PBL curricula concurrently. In some cases, for example the Faculty of Medicine of the University of Hong Kong, PBL was gradually introduced, on an experimental basis, to one or two departments (7) and later adopted for the whole faculty. Irrespective of what mode of change is adopted the planning stage preparatory to the full adoption of a PBL appears to be the most crucial for the success of the programme. This is the stage that involves the mobilisation of a teaching staff that is so set in its (LBL) ways that it invariably resists the proposed change. The experience at the Sherbrooke School of Medicine (4,8) is worth a case study for any medical school transiting to a PBL curriculum and we adopt it in discussing this process. The process of transition involves four main strategic steps: 1. Identifying the need for change 2. Selecting a solution 3. Planning the implementation and 4. Adopting the solution.

1. Identification of the need for change: This derives largely from the factors contributing to curriculopathy as earlier described. Chief among these factors is the ever growing medical knowledge base with increasing fragmentation into specialities and sub-specialities and the tendency for each teacher to focus teaching on his own microscientific world, thereby, creating a distorted curriculum that lacks proper integration and, therefore, diminished in its ability to inculcate a desirable holistic attitude in its products. In the particular case of Sherbrooke, the problems included excessive course content, teaching nearly restricted to lecturing, and poor congruence between evaluation techniques and educational objectives (4). Also contributory to the acceptance of the need for a change is the fact that several other curriculum review committees had equally recommended changes because of perceived curriculopathies with similar manifestations as those identified at Sherbrooke. Notable among these committees was the Panel on the General Professional Education of the Physician and College Preparation for Medicine (the GPEP report, 1984) whose report, published by the Association of American Medical Colleges, was unequivocal in its recommendation for a change in curriculum.

2. Selecting a solution: The solution to be selected can only be based on what is known and is judged capable of solving the identified problems and, thus, achieve the set objectives of the curriculum. In Sherbrooke, the set objectives include training doctors who are adequately motivated towards self-directed learning, have a holistic perception of Medicine, are caring, and can relate adequately with the community

through a proper grasp of communicative skills and understanding of the human environment they operate in. These are laudable objectives which any modern day medical school would adopt without much argument. The rest of this paper for practical purposes shall be based on these objectives. The PBL as described above tends to be the natural choice to achieve these objectives as it possesses the ingredients for the realisation of these goals such as its student-directed learning / teaching principles which includes training in communicative skills. Having identified the PBL as the solution, the remaining task is to develop, adopt and implement this solution.

The process of developing the framework of a curriculum should involve a carefully selected committee of faculty with demonstrable interest in medical education and preferably with formal or informal training in the principles of education and pedagogy. At the head of this committee should be a faculty who possesses these qualifications or in the alternative an expert consultant hired for that purpose. Guided by the institutional philosophy and the stated goals of PBL, the committee would come up with a curriculum framework expectedly focused on patients (i.e. community-oriented and humanistic learning) and on students (i.e. a learning process favouring autonomy). An integrated organ/system-based multidisciplinary teaching approach which fits well into the practicalities of a PBL curriculum may also be recommended. The task of this committee expectedly includes looking at existing curriculum and the curricula of other innovative schools and coming up with proposals which are then reconciled and adopted by consensus.

3. Planning the implementation: Once the framework of the PBL curriculum has been identified, planning for its implementation becomes the next task. This, among others, involves:

(i) The promotion of the acceptance of the new curriculum by a large proportion of teachers. A major determinant of the success or failure of any curriculum change is the extent to which the teachers are involved in the planning and execution of the change (14, 15). At Sherbrooke, an eighty-four page planning document linking the history and the educational philosophy of the institution with the process and content of change was widely distributed in the institution. This document formed the basis for a series of departmental meetings during which the vice-Dean for education and the undergraduate program Director were involved in debates with other faculty. Such debates stimulate faculty interest and secure their co-operation once they are convinced. It is a necessary step. (ii) Defining the content of the curriculum more precisely through the establishment of multidisciplinary working groups. The Sherbrooke example is very illustrative. A working group was set up for each of the seven four-week organ/system units for the first year of the new curriculum. The group identified and defined problems of clinical relevance or problems that illustrate basic concepts and mechanisms. The same approach was used in defining the course contents of the other pre-clinical years. A different task-force planned the student learning evaluation system for the entire pre-clinical years. (iii) Educating the teachers. The success of a curriculum change depends on educated teachers. In the Sherbrooke example, several workshops and training sessions were conducted to achieve various goals aimed at improving the teachers. Among the workshops were 1. Introduction to pedagogy in medical education, 2. Basic training programme in medical pedagogy which allows participants to acquire the scientific basis of medical education, master the skills in teaching, and to develop attitudes that place the students at the centre of the educational process (4), and 3. PBL tutor training which aims at introducing participants to PBL methodology, construction of problems and the techniques for small group discussions. Some of these are conducted yearly as refresher courses.

4. Adopting the solution: Once the training of faculty has been achieved a lot of the mobilisation work would have been done through the participation of faculty in these training sessions. With a good number of faculty now willing to give the new curriculum a try, the stage for its adoption has been reached and it could then be presented to the faculty board and subsequently to the university council for adoption. This is followed by implementation which means the admission of the first cohort of students into the new training programme. As the whole process goes on, the tendency is for more and more faculty to become interested and turn into advocates of the new curriculum (8). The initial inertia of faculty to the new curriculum must be anticipated by the planners and should, thus, not constitute a demoralising influence.

The running of a PBL curriculum: The way a PBL curriculum is run is not likely to differ significantly from one medical faculty to the other for as long as the core guiding philosophy remains a student-propelled learning through problem solving. With this philosophy as a constant guide, differences in the running process shall only manifest in the timing and emphasis placed on the different subject matters to be covered within the curriculum. For example, a medical faculty that places greater emphasis on the research orientation of its products may allocate more hours to practical experimentation and tutorials on research methods while one with a greater emphasis on community orientation may expose its students to community practice right from the first pre-clinical year. In all these however, the basic learning format is PBL.

As in all educational settings, the first task in a PBL course

is to draw up the contents of the various courses. This comes after the main structure of the curriculum has been designed. The main structure of the curriculum essentially defines the integrative relationships between the various disciplines that make input to the medical school training. The structure will determine the levels at which particular courses are taught and how the lecture/tutorial hours are staggered to enable a proper integration which in the case of a PBL curriculum is an essential feature. A major determinant of the structure is the philosophy that drives the individual medical school training programme. The philosophy is also reflected in the specific contents of the curriculum and the different courses within the training programme. This principle is very crucial to the success of any training programme, because at the end of the day it determines whether or not the products of the training meet with the originally set goals defined by the programme's philosophy. It also tends to ensure consistency in the quality of the products of the training programme. In the case of a PBL curriculum, extra care must be taken to draw up the contents of the various courses with attention paid to such issues as overloading of the curriculum (1), construction of clinical problems and the proper integration of the various courses. Care must also be shown in determining which areas of the course content are best delivered by didactic lectures and which by tutorial sessions. The achievement of these principles may be a little more difficult for the pre-clinical subjects where clinically qualified expertise is a desideratum.

Teaching methodology: Fundamental to a PBL curriculum is the drastic reduction in the number of hours allocated for didactic lectures in favour of small-group (5 - 8 students) PBL tutorials which take the SDL format. For example, in the Sherbrooke programme, lecture hours were reduced to approximately 130 hours from the LBL curriculum level of 1,645 hours in two and half years while small group PBL tutorial was allocated 5,364 hours in the same period (8). PBL tutorials are basically forums for students to generate/ discuss among themselves the solutions/answers to pre-constructed problems and also problems / issues / questions emanating from the main problem. The role of the faculty is as earlier stated: a guide, tutor, facilitator or moderator. Very important to the principles of PBL is the issue of the tutor's role. It has been asserted that the tutor may in fact know very little about the topic of discussion since this will discourage active participation of the tutor; a very important goal of a PBL tutorial. A Harvard University study group on this subject concluded that ignorance on the part of the tutor about subject content is more of a benefit than a liability as content experts tend to take over the discussions to the detriment of a PBL tutorial. This finding was the basis for the use of content non-experts by Dalhousie University for their first PBL students (16). This practice was later abandoned in favour of tutors with content expertise, thus, falling in line with the respected advice of Barrows (17) that both content expertise and facilitation skills are important for the effective tutor, but forced to make a choice, one should go for the tutor with good facilitation skills. A golden rule is that tutors do not write on the board because the tendency is to fall into a lecture session (18). Problems for a tutorial session are derived from the series of problems constructed for the course curriculum by the expert working groups. As the problem is discussed it ramifies into other problems, thus, enriching the learning process in both depth and width. The problems could be theoretical, real patient case or simulated as in the Paediatric PBL at the Monash University in Australia (19).

Evaluation: Evaluation of the curriculum, including the evaluation of tutors' and students' performances, is an essential component of a well administered educational training programme. This is even more so for an innovative curriculum. Tutor evaluation can take several formats, including feedback obtained from student-targeted questionnaires and / or peer reviews. It must be stressed that such peers should be those adept in the techniques of PBL and preferably with demonstrable understanding of the principles of education and pedagogy. The staff training which the school ought to have instituted in the planning stages would provide it with an abundance of this level of manpower. Apart from these internal modalities of tutor assessment, external assessors could be invited from other institutions with similarly innovative curriculum. Approval of the curriculum by such external assessors could be a booster to the morale of tutors who are still grappling with the inertia of adopting a new curriculum (4). One of the basic contributing factors to curriculopathy is the mismatch between student evaluation processes/content and the goals of the curriculum. It has been observed that ability to match examination with the teaching format is an important factor in mobilising student interest in the PBL curriculum which is a learning approach completely different from what the students are used to (20). For example, examination questions should be problem based since the teaching style is PBL based, otherwise students who ordinarily are motivated towards passing their examinations will see no good reason for approaching learning through the PBL/SDL technique, and this can affect their enthusiasm with possible negative influences on the tutors and consequently on the new curriculum. As with the tutors, student evaluation can be both internal and external. At Sherbrooke, the internal evaluation process involves internally organised exams while the external evaluation includes internally organised exams with external examiners and also an evaluation of the students' performance in national board examinations.

Conclusion

Any medical curriculum is doomed to atrophy. This derives largely from the exponential growth in medical knowledge resulting from increasing technological capabilities which turn, overnight, the sacrosanct medical attitudes of yesterday into the taboos of today. The equally increasing public awareness of medical science fuelled by the ever-expanding influence and sophistication of information technology has created a public that is ever so demanding, inquisitive and critical of the doctor's performance. These, coupled with an equally expanding and not-so-clement legal environment has placed a burden of responsibility on medical educators to fashion out a curriculum that can start to grapple with these modern realities. Because of its inherent capabilities, particularly its capacity to promote self-directed learning and its problem-oriented and, therefore, humanistic bend, the PBL curriculum has become the favourite of innovative medical schools. One after the other, medical schools from around the globe are adopting the PBL as the way to the future. A proper transition from a TC to a PBL curriculum requires a proper administrative structure dedicated to that purpose. A crop of professional educators and /or faculty that is well informed on educational principles, pedagogy and the workings of the PBL is a sine qua non of a successful transition. A critical factor in this process is the management of the initially high anxiety levels of the faculty teaching staff. In this connection, perhaps, the Chinese proverb which says that 'when the wind of change is blowing, some people build fences while some build windmills' could be very instructive. With the realities on the ground, it is safe to say that no medical school with its eyes on the future can afford to be blind to the workings of the PBL. It is a paradigm whose time has come.

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