Original Article

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Education Section

PBL Trigger Design by Medical Students: An Effective Active Learning Strategy Outside the Classroom

MAYA ROCHE[1], INDIRA KAKKUNJE ADIGA[2], AKSHATHA G. NAYAK[3]

ABSTRACT

Introduction: Problem Based Learning (PBL) is known world over as an effective, active learning strategy with many benefits for the student. Usually, in medical schools, PBL triggers are designed by a well-trained group of faculty from basic and clinical sciences. The challenge was whether this task could be given to students in the first year of their curriculum and be executed by them effectively.

Aim: To enhance active learning, comprehension and critical thinking with a view to promote horizontal and vertical integration between subjects.

Materials and Methods: Student volunteers of the first year MBBS course (n=10), who had been exposed to the curriculum for approximately 38 weeks and were familiar with the PBL process were recruited for the study. In addition to a handout on the topic 'gout', they were given the freedom to access any resource in the university library to construct the PBL triggers. The PBL triggers were vetted by two faculties. In addition to a focus group discussion with students, students' and faculty's responses were collected on a Likert scale.

Results: Students opined that the exercise helped improve their comprehension (100%), critical thinking abilities (90%) and clinical orientation to the topic (100%). They felt that designing a PBL trigger was a relevant active learning strategy (100%) and would help them answer questions on this topic better in the future (90%). The clinicians who examined the PBL triggers, felt that they were of good quality and that the process was a good tool for vertical integration between basic and clinical sciences.

Discussion: The results prove that students when given a challenge will rise to the occasion. Unfamiliarity with the nuances of a disease did not prevent them from going the extra mile to achieve their target. By taking part in this exercise, students benefitted in many ways and got a holistic understanding of the topic.

Conclusion: PBL trigger design can be introduced as an active learning strategy for students in medical schools where PBL is part of the curriculum. It promotes integration across subjects and is very effective in augmenting student motivation.

Keywords: Active learning, Critical thinking, Problem based learning, Trigger design

INTRODUCTION

Problem Based Learning (PBL) is a relatively modern pedagogical method and has become popular all over the world, being recognized as a major research area in student learning and pedagogical innovation in health sciences education [1]. For medical students in particular, every patient is a problem to be solved and in this context, PBL basically means empowerment through problem solving.

Melaka Manipal Medical College (MMMC) follows a predominantly lecture–based hybrid curriculum with components of self-directed learning, practical sessions and PBL, in the first two years of its MBBS programme. PBL was introduced into the curriculum in 2007. The curriculum in the first year is clinically oriented and divided into 4 blocks, each of 10 weeks duration. Students are oriented to the PBL process right in the beginning of the first block. From second block onwards, they are divided into groups of 10 to 14 and solve one PBL problem per block which has objectives from anatomy, physiology and biochemistry. A PBL session has 2 parts: brainstorming and presentation. The brainstorming session includes the following in sequence: listing of unfamiliar terms and issues, generation of hypothesis and learning objectives. Students are given guidance regarding the reference material, based on which the presentation session is held after a period of 2 weeks. The presentation session ends with feedback from the facilitator regarding the performance of students. PBL contributes to the summative assessment scores of the student.

MMMC is now forging ahead with ambitious plans of vertically integrating the curriculum by introducing 3 more subjects, i.e., pathology, pharmacology and microbiology from the first year itself. This means that PBL in the future will have objectives from 6 subjects from pre-clinical and paraclinical sciences.

As mentioned in literature, a good PBL trigger is one which is realistic, reflecting a true- to- life case scenario [2,3]. It should grow out of students' prior knowledge and promote integration of knowledge across disciplines. It should take students to a higher cognitive level of discussion and address pre-set learning objectives. It should be logical in flow and student-centered in design. Most importantly, the context should be relevant to their future careers [3].

It has been observed over the years, that some students in every class yearn for a deeper understanding of clinically oriented topics. This means that, a new active learning strategy be employed only for such students who want to go the extra mile to acquire deeper knowledge.

AIM

This pilot study was planned to explore the possibilities of using PBL trigger design by students as a mode of enhancing active learning along with horizontal and vertical integration.

MATERIALS AND METHODS

This prospective experimental study, from recruiting student volunteers to data analysis was carried out in a period of 3 months from June to August 2015. Since, the study was to be conducted with student volunteers and did not involve any kind of compulsions from the investigators, ethical approval was not obtained.

A batch of MBBS students of the first year, in the 2nd semester (n= 165) who were exposed to the curriculum for 38 weeks and were familiar with the PBL process, were requested to take part in the study. However, only 10 students expressed willingness and were recruited as volunteers. Their past academic performance played no role in their selection. The topic 'gout' was selected for PBL trigger

design, on the basis that it was clinically oriented and had been dealt with superficially in a lecture prior to the PBL trigger design activity. This would help them as a scaffold to draw upon prior knowledge which is one of the elements in designing a good trigger. Each one of the students was asked to design a PBL trigger independently, without consulting their peers or faculty. However, they were given reference material from a standard textbook of medicine and asked to refer to any resource available in the university library or on the internet. They were instructed to look for objectives beyond the curriculum of the first year MBBS programme. They were given 2 weeks' time to submit the PBL triggers.

A questionnaire consisting of 13 items relating to benefits derived by students' with regard to various aspects of learning from the PBL trigger design process was compiled and validated by a senior medical educationist, who is a member of the Medical Education Department of the University. Once the PBL triggers were submitted by the students, this questionnaire was e-mailed to the students and their responses were collected on a five point Likert scale. They were also asked to list any difficulties that they had faced while constructing the PBL triggers. Among the responses, the strongly agree and agree were clubbed together, since, they expressed similar sentiments and the sum was expressed as a percentage. The strongly disagree and disagree responses were also combined and the sum expressed as a percentage [Table/Fig-1]. Following this, a focus group discussion was conducted to gain insights into their experience of the whole process. During this, students' opinions on including PBL trigger design as a component of active learning in the curriculum was discussed.

Next, the PBL triggers (n=10) designed by 10 students (2 examples shown in [Table/Fig-2]) were given to 2 faculty of the study institution, with more than 20 years of teaching experience, for vetting. The faculties were asked to evaluate the correctness of the PBL triggers and point out any errors in content, following which, their opinions about the PBL triggers were collected using a questionnaire with a 5 point Likert scale with responses ranging from strongly disagree to strongly agree. The responses again were processed in the same manner as in the case of the responses from students and expressed as a percentage [Table/Fig-3].

RESULTS

As shown in [Table/Fig-1], all the students agreed that the exercise made them revise the study material (100%), improved their comprehension of the topic (100%) and gave them a deeper understanding than provided in a lecture (90%). They also opined that it improved critical thinking (90%), enhanced their clinical orientation to the topic (100%) and made them aware of the variability of the disease pattern in different individuals (80%). They felt that designing a PBL trigger was a relevant active learning strategy (100%) and students would help them answer questions on this topic better in the future (90%). All the students agreed that the exercise would help them to relate the symptoms and the co-morbidities in the clinical phase of the MBBS course (100%). Some were of the view that linking of concepts was achieved (60%) and all of them agreed that they had to refer to learning resources other than their recommended textbook (100%). None of them found the exercise strenuous. One of them mentioned that the resource material provided was rather detailed, complex and difficult to understand, though it gave them thorough knowledge of the topic.

On retrospective analysis of their performance in summative assessment exams, it was found that 70% of the participants had scored a high first class or distinction (between 70 to 85% marks) prior to their participation in the PBL trigger design exercise. The remaining students were in the pass category (between 50 to 60% marks).

During the focus group discussion, the students stated that they had not referred to any articles on PBL trigger design. They unanimously agreed that this activity had incited their curiosity to learn more about the disease and helped them to retain facts longer. They also felt that it should be a voluntary activity and not be forced upon students. They felt that, all interested students from junior batches should also take part in such exercises. They desired that the problems designed by them be deposited in the PBL trigger repository of the institution and used as triggers for subsequent batches of students.

As shown in [Table/Fig-3], the faculty who examined the PBL triggers, felt that they were of good quality and covered many of the clinical

Trigger 1
A 53-year-old man developed excruciating pain in his right foot at the metatarsophalangeal joint and was admitted to the hospital. The pain was so severe that it prevented him from walking. Physical examination showed swelling, warmth, redness and tenderness of the joint. Patient's history revealed chronic alcoholism, diabetes mellitus and hypertension. Aspirate of fluid from the inflamed joint tested positive for monosodium urate crystals.
Lab investigation results were as follows:
Random blood sugar 146 mg%
Blood uric acid 9.8mg%
Serum creatinine 1.7mg%
Total leucocyte count 2.0x107/µL
He was prescribed allopurinol by the doctor and asked to abstain from alcohol
Trigger 2
A 46-year-old metal company worker, Mr. Chia, often complained about pain in his joints, lethargy, abdominal pain and nausea. He was passing reddish urine. His condition got worse on alcohol consumption. He had a blood pressure of 140/90. Biochemical investigations on blood revealed increased lead and uric acid level.

[Table/Fig-2]: Examples of PBL triggers designed by first year MBBS students.

	Strongly Disagree	Disagree	Uncer-tain	Agree	Strongly Agree
It made us revise the study material				9	1
It made us to restructure the study material			5	3	2
It improved our comprehension about the topic				5	5
It gave us a deeper understanding of the topic than provided in a lecture			1	3	6
It improved critical thinking (ability to question and critically analyze)			1	2	7
It was a strenuous exercise		9	1		
It improved our clinical orientation to the topic				9	1
It made us aware of the variability of the disease pattern in different individuals			2	5	3
This is a relevant active learning strategy				9	1
This will help us to answer questions on the topic better			1	8	1
This will help us to relate the symptoms and co-morbidities in the clinical phase of the MBBS course				5	5
This served as a link between concepts rather than learning isolated facts			4	2	4
This made us refer to learning resources (textbooks, videos and internet) other than the recommended textbook				5	5

[Table/Fig-1]: Results of questionnaire given to students.

	Strongly Disagree	Disagree	Uncertain	Agree	Strongly Agree
Is an effective active learning strategy					100
Gives students a comprehensive understanding of the topic including different presentations and co-morbidities				50	50
Is an effective tool for vertical integration (introducing clinical subjects in the pre/para clinical years)					100
Makes students aware of challenges faced by a physician in the diagnosis and treatment of a disease			100		
Stimulates students to do extra reading					100
Brings students closer to the clinical setting					100
Promoted self-directed learning					100
Encouraged collaborative learning					100

[Table/Fig-3]: Results of questionnaire given to clinicians. Values obtained from 2 clinicians have been converted to a percentage and expressed.

scenarios and co-morbidities associated with 'gout'. They strongly agreed that this activity was an effective active learning strategy and gave the students a comprehensive understanding of the topic. They also felt that it was an effective tool for vertical integration between basic and clinical sciences and stimulated students to do extra reading. They opined that it promoted self-directed learning, collaborative learning and brought them closer to the clinical setting. However, they were unsure whether it made students aware of the challenges faced by a physician in the diagnosis and treatment of a disease.

DISCUSSION

It is well known that active learning and integration of knowledge are corner stones of knowledge retention [3]. In a pre-dominantly lecture driven curriculum, it is important to provide avenues for active learning [4]. Designing PBL triggers is an art which always involves a committee of trained experts from different disciplines from basic and clinical sciences [1]. It requires a holistic understanding of the topic under study. It is also time- consuming and labour- intensive [5]. Number of articles are available as guidelines to facilitate this process [2,6-14]. In this pilot study, this task was undertaken by relative novices, i.e., students, who had minimum knowledge of the topic and almost no knowledge of most of the clinical aspects. Delving deeper into the intricacies of the topic and coming to an understanding of the diverse possibilities in a single disease in a short span of time is a Herculean task for a novice. Since, there was no possibility of accommodating a time consuming learning activity during the working hours of the institution due to a packed schedule, it required that this activity be conducted outside the classroom and also without disturbing other students. With new developments in curriculum delivery in the offing, it was thought that this experiment would throw some light on student preparedness for such a quantum jump, i.e., would our students rise to the challenge of assimilating 6 subjects from day one of their study in the MBBS programme. We as teachers are very happy to note at this juncture that, the students' effort was commendable. They proved that they were willing to go beyond curricular demands to acquire deeper knowledge. Since, there are no studies available of students designing triggers for PBL, this study may be considered a novel experiment. Efforts are on to comply with students' requests to deposit the triggers in the PBL trigger repository of the institution.

CONCLUSION

In the words of famous American educator and author, Booker T. Washington, "Nothing ever comes to one that is worth having, except as a result of hard work". The fact that the PBL triggers designed by students were of good quality as assessed by the clinical faculty of the institution, bears testimony to the hard work put in by the students. Majority of the students who took part in this exercise were of a higher academic grade. If we were to consider the positive outcome of this PBL trigger design exercise as an indicator of academic preparedness of students for a full-fledged vertically integrated curriculum, the signs are definitely encouraging. However, it remains to be seen whether the average and the below average student is capable of coping with such a curriculum. Above all, this activity was an experiment in active learning outside the classroom. It has added a new method to the list of active learning strategies available. Active learning and motivation of students go hand-in-hand. This study has demonstrated that PBL trigger design achieves both. Most importantly, it can be easily incorporated into curricula in medical schools to augment student motivation.

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PARTICULARS OF CONTRIBUTORS:
1. Professor, Department of Biochemistry, Melaka Manipal Medical College, Manipal University, Manipal, Karnataka, India.
2. Professor, Department of Biochemistry, Melaka Manipal Medical College, Manipal University, Manipal, Karnataka, India.
3. Lecturer, Department of Biochemistry, Melaka Manipal Medical College, Manipal University, Manipal, Karnataka, India.

NAME, ADDRESS, E-MAIL ID OF THE CORRESPONDING AUTHOR:
Dr. Maya Roche,
Professor, Department of Biochemistry, Melaka Manipal Medical College, Manipal University,
Manipal-576104, Karnataka, India.
E-mail: mayaroche2011@gmail.com

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