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Original Research Article

Using modified tutorless problem-based learning approach with 'SET triggers' to teach diabetes mellitus to undergraduate medical students

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ABSTRACT

Background: The purpose of this study was to introduce modified form of conventional problem-based learning (PBL) i.e. "Tutor less PBL" in educating medical students about type 2 diabetes mellitus (T2DM). Medical students are future physicians and can be effective healthcare professionals to screen and manage diabetes at community level. Poor levels of awareness as well as lacunae in teaching diabetes have been reported among medical students. The study aimed to assess the knowledge of undergraduate medical students about T2DM by using "Tutorless PBL" method.
Methods: Sixty-two 8th semester medical students from one of the private medical colleges in Mumbai city attained knowledge about T2DM through "Tutorless PBL" and "conventional PBL". "A structured set of engagements triggers" (SET) was used in Tutorless PBL. Students responded through pre and post-test questionnaires and 'student's unpaired t test' compared their test scores. Fourteen item questionnaires with Likert scale evaluated students' feedback about both methods.
Results: The post test scores were more for students in "Tutor less group" than in "tutored group" (15.37 vs. 14.01). The difference was statistically significant ($t=5.87$, $p<0.001$). All (100%) students appreciated both methods for enhancing their knowledge about T2DM. "Tutor less PBL" was found to be more effective than "conventional PBL" in promoting self-learning and critical thinking abilities.
Conclusions: Both methods were beneficial to students in terms of clarifying the topic, improving group interaction and yielding self-directed learning. Tutorless problem-based learning can be an effective option especially in resource (faculty) limited setting.

Keywords: Diabetes mellitus, Medical students, Problem based learning

INTRODUCTION

World health organization (WHO) has ranked India as having as one of the highest rates of diabetes mellitus (DM) at global level.[1] As per International diabetes federation, adult prevalence of diabetes in India is 7.1%.[2]

Medical students are future physicians and can be effective healthcare professionals to screen and manage diabetes at community level. It can be done only through, their adequate training in diabetes management. Poor levels of awareness as well as lacunae in teaching DM have been reported among undergraduate medical students.[3] Diabetes mellitus is also one of the vital components of medical curriculum and therefore, students are expected to learn diabetes in many aspects like its risk factors, symptomatology, diagnosis, treatment and preventive measures.

Problem based learning (PBL) is a student-centered educational strategy which encourages students to be self-directed, interdependent and independent as they

attempt to solve the set problem.[4] The role of tutor in facilitating various skills in PBL like teamwork, problem solving, critical thinking etc. is well acknowledged. In PBL, the need of tutor can be a problem mainly, if there is a faculty shortage. Implementation of tutor less PBL is useful in resource limited medical specialties like general medicine, where there is always scarcity of faculty. Few of the demerits of "tutor less PBLs" are possibility of 'misapprehensions and poor problem-solving skills, which can affect the learning process of students.[5] "Tutor less PBLs" (TPBL), have been tried in very few studies to assess the learning outcomes and process perspectives.[6,7] This may be the first study which assessed the knowledge of Indian medical students about DM type 2 by using tutor less PBL methodology supplemented with SET triggers.

METHODS

An educational interventional study was conducted at one of the private medical schools of Mumbai, city of Maharashtra state. Total 62 students of 8th semester, posted at department of general medicine, enrolled for the study. An institutional ethics committee approval was obtained, and all participants provided an informed consent for the study. The study followed research protocol as per the world medical association declaration of Helsinki. The study was conducted during July 2018 to September 2018.

Students were sensitized with basic aspects of PBL. They were randomized into two groups as 'Tutor less PBL (TPBL) group' and 'conventional PBL (CPBL) group' with 31 students in each group. To avoid inter-subject variability, both groups were matched, based on their academic performance in the preceding year. Authors subdivided both the groups into smaller groups of 15-16 students each.

Each subgroup attended two sessions of two hours duration each, on day 1 and day 4 in a week. All TPBL sessions were conducted with no active facilitation (without faculty tutor). Basic process of TPBL was similar to conventional PBL method. Students assigned the roles of 'chairman', 'secretary' and 'feedbackers' among group members. In addition to pre-listed questions on T2DM, students utilized a structured set of engagement triggers (SET) to maintain interactivity during the sessions (Table 1). Students set ground rules and were free to use mobile phones and other electronic devices to search relevant information. Throughout the session, stepwise group discussion was held, interspersed with 'question-answer session' at every step (Table 1). Students covered initial three steps in first session and accomplished remaining steps in next session (Table 1). Students used predesigned booklet containing glossary in English language with key terms in diabetes at every segment of case scenario. This enabled students to ensure deep understanding and to activate their existing knowledge to build new learning for DM.

Table 1: Structured set of engagement triggers (SET) in tutorless PBL process.

Step	SET
Step 1	Division of one paper-based problem scenario into four sections. (Each section addressed prevalence and aetiology, symptomatology, diagnosis, treatment and prevention of T2DM respectively).
Step 2	Discussion on first section of scenario (prevalence and aetiology) (Students shared their personal experiences about DM, incidence and prevalence of DM in India as well as risk factors were discussed).
Step 3	Discussion on second section of scenario (symptomatology) (Five photographs showing various clinical features and complications of T2DM were shared and discussed).
Step 4	Discussion on third section of scenario (diagnosis), (Research manuscripts from PubMed/Medline indexed journals highlighting diagnostic modalities of T2DM were used. Students specifically went through only 'diagnosis of T2DM' from the whole paper.
Step 5	Discussion on fourth section of scenario (treatment and prevention) (Students watched two edited video clips (7-10 minutes in length). The clips were related to drug therapies, screening, self-care, nutrition and other primary prevention measures of T2DM.
Step 6	Concluding session with take home messages (two strategies were used 'point of the day' (9) and 'muddiest point' (9) to ensure understanding of topic).

DM-Diabetes mellitus, T2DM-Type 2 diabetes mellitus.

The session wrapped up with two innovative techniques which made students to reflect on their learning. 'Point of the day' in which each student wrote one specific point about T2DM which he learnt and explained it to the group. 'Muddiest point' where students noted down what was the difficult to understand, on a chit of paper and chits were passed like a musical parcel 10-12 times. After stopping music, respective student read the difficult area from the chit which he had in his hand. Students asked plenty of questions, as their identities were not revealed in this method. Two faculty members supervised All TPBL sessions. Same faculty taught similar topic to CPBL group by conventional tutor facilitated PBL method but without use of SET triggers and glossary.

Statistical analysis

Internal experts validated a case scenario and all questionnaires. Authors administered 20 item questionnaires with multiple choice questions (MCQs) to assess the performance of students. All questions focused

on identified aspects of DM and were formulated according to 'blooms level of cognition'.[8] Eleven questions of knowledge, 6 of comprehension and 3 MCQs were of application and analysis. A scoring system was established, in which, one and zero score was given to correct and incorrect/unattempt answers respectively.

Statistical analysis was performed by using 'student's unpaired t test' and 'paired t test' 'student's unpaired t test' compared pre and post test scores (intergroup scores) of both the groups and within group (intragroup) scores were compared by 'paired t test'. P value less than 0.05 was considered as statistically significant. Fourteen item questionnaire survey assessed students' satisfaction about educational intervention and their opinions were recorded on a 'Likert scale' (5- strongly agree, 4-agree, 3-neutral, 2 -disagree, 1- strongly disagree). A score of 4 to 5 was considered as a satisfactory response. Cronbach's alpha was calculated to measure internal consistency and value of 0.812 was set to ensure good reliability.

RESULTS

Table 2 indicates intragroup comparison of mean pre and post test scores of conventional and tutor less PBL group.

Table 2: Intragroup comparison of mean pre and post test scores of conventional and Tutorless PBL group (n=62).

	Intragroup comparzison (onventional PBL)	Intragroup comparison (Tutorless PBL)
Pre-test mean score with SD	10.14 ±1.41	10.16±1.40
Post-test mean score with SD	14.01±1.34	15.37±1.21
P value	P<0.001	P<0.001

*Two tailed p value <0.05 was considered as statistically significant

The mean pre-test scores for TPBL and CPBL group were almost similar (10.16 vs.10.14 respectively). However, in both the groups, post test scores were statistically higher than pre-test scores (p<0.001). The post test scores were more for students in TPBL than in the CPBL group (15.37 vs. 14.01). The difference was found to be statistically significant (t=5.87, p<0.001). Two tailed p value <0.05 was considered as statistically significant.

Table 3: Students' satisfactory responses towards TPBL and CPBL method (n= 62).

Question item	No of students with response for TPBL (n=31)	No of students with response for CPBL (n=31)
Skills development		
This method stimulated my self-learning and critical thinking abilities	28 (90.32%)	24 (77.41%)
My knowledge about DM type 2 is enhanced due to this method	29 (93.54%)	31 (100%)
This method provides better learning environment than conventional methods like lectures or tutorials	24 (77.41%)	30 (96.77%)
Roles and responsibilities were uniformly distributed in this method	24 (77.41%)	31 (100%)
Attitude towards method		
It is challenging to implement this method without the help of facilitator	30 (96.77%)	31 (100%)
Method was very innovative and interactive	29 (93.54%)	24 (77.41%)
I will prefer this method of teaching	21 (67.74%)	27 (87.09%)
Students can be motivated for learning through this method	26 (83.87%)	24 (77.41%)
Method implementation		
Content and delivery of method was good	30 (96.77%)	30 (96.77%)
Few students were dominant in this method	10 (32.25%)	02 (6.45%)
The group discussion was meaningful and did not go out of track	22 (70.96%)	28 (90.32%)
Some conflict issues occurred in this method	11 (35.48%)	01 (3.22%)
I faced difficulty to find out relevant references	13 (41.93%)	04 (12.90%)
I observed negative comments from group members during the process	09 (29.03%)	02 (6.45%)

Satisfactory respondents = they are those who rated agree and strongly agree (score of 4 and 5) on the Likert scale, TPBL- Tutorless problem-based learning, CPBL- Conventional problem-based learning, DM- Diabetes mellitus.

All (100%) students appreciated both methods for enhancing their knowledge about T2DM. 'Tutorless PBL' was found to be more effective than 'conventional PBL' in promoting self-learning and critical thinking abilities (Table 3). However, students experienced some conflict issues and negative behavior more in tutorless

group than conventional group (Table 3). The supervisors (two faculty members for TPBL) and tutors (for CPBL) reported that both TPBL and CPBL methods achieved learning objectives satisfactorily. Table 3 explains that students perceived both the methods as a challenging and needed facilitator/tutor to implement it. Tutorless PBL was found to be more innovative and interactive as compared to conventional PBL method. In both TPBL and CPBL methods, content and delivery was experienced to be satisfactory. However, 13 (41.9%) students from TPBL method faced difficulty to find out relevant references against only 4 (12.90%) students from conventional PBL (Table 3). Only 24 (71.41%) students from TPBL group felt that roles and responsibilities were uniformly distributed during tutor session while all (100%) students from conventional PBL stated equal distribution of all roles and responsibilities.

DISCUSSION

In conventional PBL, faculty leads as a facilitator/tutor to make things move more easily and helps to ensure that predetermined learning objectives are covered. In addition, he plays a vital role in planning, time management, resource allocation, providing constructive feedback, stimulating analytical skills of students etc. In tutorless PBL, students perceive these as challenging tasks, as they are not trained in these processing skills.

In present study, even though, students favored TPBL, they faced conflict issues and problematic behaviors, where few group members gave negative comments throughout the session like "it is very difficult", "Authors cannot do it", "Just impossible". Woods DR et al, also identified it as one of the dominant issues for tutorless groups.[9] In current study, the percentage of conflicts and difficult behaviors was small. It might be attributed to SET triggers which engaged them into the session and motivated to learn actively. Nevertheless, these processing issues can be anticipated during initial stages of group formation, as it often needs to go through forming, storming, norming, and performing phases of group dynamics.

In this study, "Tutorless PBL" was found to be more effective than "conventional PBL" in enhancing the knowledge of students about DM type 2. Kaliyadan F et al, and Hayashi S et al, also revealed positive learning outcomes with tutorless problem-based learning. Inspite of it, comparing to conventional mode, tutorless strategy was less opted by students as 'method of teaching' (Table 3).[6,7] Poor preference of students towards TPBL can be predicted, as it is less commonly used technique than conventional PBL in educational settings; as familiarization to any new teaching methodology is necessary for its acceptance.[10,11]

Use of common words in local language in classroom provides confidence and better understanding among students if it is utilized in certain situations and for specific reasons.[12] In current study, to attain better comprehension about diabetes, TPBL group used a glossary booklet which included basic terminologies about DM in local language. They utilized it in each section of case scenario to explore the various concepts of T2DM (Table 1). It was reflected through the "Comments" section of feedback that glossary itself acted as a potential trigger to provoke the learning process of students. Improved results in TPBL group students than in CPBL group may be due to active application of glossary booklet. However, the use of glossary was made restricted to clarifying basic diabetes related terms only as excessive use of local language in educational settings may have negative impact on students' learning behavior.

One of the major challenges of this study was to empower the students to resolve any processing problems they come across during TPBL session. Making effective use of problem-based scenario and SET triggers was another daunting task in the initial phase. However, sustained self-motivation helped students to accustom the process. The study had few limitations. The sample size was small to explore the group differences and generalization of results. Due to time constraints, the study could not implement the cross over design. Authors did not measure long term performance of students as it is essential to understand their complex learning process in both the methods.

CONCLUSION

Incorporating Tutorless problem-based learning produced significant gain in the knowledge of students about type 2 diabetes mellitus. TPBL was seen to be more effective than conventional PBL technique in promoting self-learning and critical thinking abilities. Both the methods were beneficial to students in terms of clarifying the topic, improving group interaction and yielding self-directed learning. Tutorless problem-based learning can be an effective option especially in resource (faculty) limited setting.

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