
ORIGINAL ARTICLE**Transition from traditional to problem-based and self-directed learning:
A retrospective analysis of student performance**

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Abstract

Background: The expeditious changes of the world today present massive challenges and demand rapid modifications in our education system. Focusing on concept-based learning and core understanding of topics for practical application is the cornerstone for a better outcome. Didactic Lectures (DL) are the most widely used method; however, in the current changing face of our education system, newer techniques like Self-directed Learning (SDL), SDL with Focussed Discussion (SDL-FD) and Problem-based Learning (PBL), which encourage active participation by the learner are being increasingly employed for better understanding of the subject. *Aim and Objectives:* To examine the effect of transition from traditional to newer methods on student performance. *Material and Methods:* We conducted a retrospective study involving 409 students, over two years, to evaluate the scores attained in examinations among topics delivered by different modalities namely DL, SDL, PBL and SDL-FD. *Results:* The scores achieved were higher among topics delivered by DL when compared with SDL and PBL approach which were statistically significant. The score of DL when compared with SDL-FD was higher, however did not have statistical significance. *Conclusion:* DL may help the learner immensely in a scenario of an examination-oriented evaluation. However, it may limit the learners' ability to question and ponder over the subject matter, mindlessly clinging to facts dissipated in class room. We recommend that a unified approach along with activities of self-learning and discussions, may tremendously improve the outcome.

Keywords: Didactic, Problem-based, Self-directed, Focussed discussion

Introduction:

The traditional approach to learning is teacher-centered and teacher-guided involving delivery of lectures to learners who are mostly passive and requiring rote memorization instead of grasping concepts. Such learners are ill-equipped to deal with new situations and new challenges [1-2]. Effective learning strategies, activities and learning environment intend to encourage high-quality learning [3]. Cognitive processing

strategies aim to inculcate proper thinking needed to process the material learned, to relate the different study concepts to the learning objectives and real-life situations. This in turn leads to deep processing and understanding of the study content. Regulatory strategies like self-learning help students to take control of their learning process, set goals, monitor and motivate themselves to achieve the same [3-4].

Didactic Lecture (DL) is a traditional, effective and probably one of the earliest methods of learning. It is a medium of direct instruction in which the lecture is delivered verbally in combination with visual aids such as projector and a writing surface. There has been a pragmatic shift towards student centred approaches like Problem-based Learning (PBL) and Self-directed Learning (SDL) [1-2].

SDL is a form of active learning in which the students can plan, monitor and evaluate their learning process. Several innovative pedagogic methods can be explored to make the learning impactful and interesting. Focused discussions can be utilized as a reinforcement technique to help the students in assigning importance to the learning objectives in the SDL and facilitate understanding of concepts [2, 5, 6].

PBL is a pedagogical approach which uses clinical vignettes as the starting point for generating the desired learning objectives. The objectives are to facilitate the acquisition of generic skills and attitudes such as team work, presentation skills, respect for colleagues' views, critical evaluation of literature, and co-operative learning. The students try to solve the given clinical problem based on their prior knowledge; and in course they gather new knowledge about the topic. When they try to connect the existing and newly gained knowledge and apply it to the realistic situation such as the given problem, it stimulates deep and concrete processing. The teacher only acts as a facilitator and asks in-depth questions, to probe and reinforce their understanding [1, 6].

Education has seen a revolution in the teaching-learning process and the literature is replete with various instructional strategies. Studies have shown that the performance of students who underwent these newer approaches was equivalent

to those who were exposed to the traditional format in the cognitive domain but had more benefits in the conative and affective domains like motivation, student satisfaction and self-directed learning [1, 5, 7].

The present study aims to compare the impact of the instructional approaches involving lectures, PBL and SDL on student performance.

Material and Methods

A two-year retrospective study (June 2017-September 2019) was conducted in the Department of Pathology of a Medical College with bi-annual student intake. The course curriculum is outcome based with learning objectives classified based on revised Bloom's taxonomy into levels pertaining to remembering, understanding, application and analysis. The delivery modes of curriculum included DL, SDL and PBL exercises.

DL involved lectures with PowerPoint presentations, white board/chalk, and board instructions. In SDL, students were instructed to read the topic beforehand and then undergo an activity in the form of fill-in-the-blanks/ concept maps/ crossword puzzles, following which feedback was given. A variant was SDL with Focused Discussion (SDL-FD) where an SDL activity was followed by a focused question and answer session pertaining to the learning objectives by the facilitator.

In PBL, students were divided into small groups (10-12 learners) and each group was presented with a problem dealing with different aspects of the topic. It involved pre-discussion phase, self-study and reporting/discussion phase. The pre-discussion phase and the discussion were done under the observation of a subject expert facilitator.

The teaching schedules of the three batches namely Batch 1 (n=148), Batch 2 (n=167) and Batch 3 (n=94) were reviewed and the common

topics delivered through different modalities were identified.

Topics identified:

- Parkinson's disease: Delivered to Batch 1 as SDL and to Batch 2 as DL
- Peptic ulcer disease: Delivered to Batch 1 as DL and to Batch 2 as PBL
- Shock: Delivered to Batch 1 as DL and to Batch 3 as SDL-FD

The restricted response essay questions administered in different sessional examinations were reviewed and the ones pertaining to Parkinson's disease (for Batch 1 and 2), peptic ulcer disease (for Batch 1 and 2) and shock (for Batch 1 and 3) were selected. All these questions were made according to the learning objectives and evaluated in accordance, the maximum score for each of the questions was 5. The performance (marks scored) by the students in the aforesaid questions was retrieved from the archived examination data, and the mean scores were compared between the groups by unpaired 't' test. Value of $p < 0.05$ was considered significant.

The study was performed in accordance with the ethical standards as laid down in the 1964 Declaration of Helsinki and its later amendments or comparable ethical standards. It is a retrospective study based on the archived data and does not use any personal identifiers or biological samples.

Results

The mean scores obtained when the mode of delivery was DL were 4.03, 3.78 and 3.5 for Parkinson's disease, peptic ulcer disease and shock respectively. The mean scores for other modalities were 2.62 for SDL (Parkinson disease), 2.91 for PBL (peptic ulcer disease) and 3.36 for SDL-FD (shock).

When compared within the same topic, the mean scores in DL were higher than those of SDL, PBL and SDL-FD. A statistically significant difference was seen between DL and SDL in Parkinson's disease ($p=0.0001$) and between DL and PBL in peptic ulcer disease ($p=0.001$). Although marginally higher, the mean scores were not statistically significant amongst DL and SDL-FD in shock

Table 1: Academic performance of students amongst topics with different modalities

Topic	Parkinson's disease		Peptic ulcer disease		Shock	
	DL	SDL	DL	PBL	DL	SDL-FD
Mode of delivery	DL	SDL	DL	PBL	DL	SDL-FD
Number of students	167	148	148	167	148	94
Scores (Mean \pm SD)	4.03 \pm 0.91	2.62 \pm 0.88	3.78 \pm 0.87	2.91 \pm 1.28	3.5 \pm 1.28	3.36 \pm 1.61
	t = 13.9389 df = 313 SED = 0.101 p = 0.0001*		t = 6.9645 df = 313 SED = 0.125 p = 0.0001**		t = 0.7491 df = 240 SED = 0.187 p = 0.4545	

SED-standard error of difference, * mean scores between DL and SDL for Parkinson's disease, **mean scores between DL and PBL for peptic ulcer disease, DL: Didactic Lectures, SDL: Self-directed Learning, SDL-FD: SDL with Focussed Discussion, PBL: Problem- based Learning (PBL)

($p=0.4545$). The mean scores and standard deviation of the topic and modality wise academic performance are summarized in Table 1.

Although mean scores of SDL-FD were higher than SDL and PBL, a statistical comparison was not done owing to the inherent difference in the difficulty levels and learning objectives of the topics. Two of the topics (Parkinson's disease and shock) had objectives under recall level while the other topic (peptic ulcer) involved comprehension and analysis.

Discussion

In higher education, self-study is a principal component of the study program. This depends on how the students learn and invest their time. In DL, the teaching is defined by learning outcomes and the concepts are explained to the students. Important and difficult topics can be reinforced via pre-prepared reading material. DL emphasizes on memorization of key concepts, helps in recall and reproduction in examinations, and is an example of less effective, superficial learning strategy [7-8].

In SDL, activities like case-based scenarios, crosswords, quizzes, identifying true and false statements, and making concept maps can be employed. The utilization of these novel unconventional methods enables students to learn at their own pace, to search information from other resources, to learn concepts and find out answers for themselves thereby stimulating active learning and inculcating the habit of referring to multiple resources [5-6].

PBL helps the students to identify appropriate learning issues; do independent, out-of-class study; contribute to group discussions, communicate, and

work effectively. It fosters the effective usage of deep processing and self-regulation [6, 9]. It also enhances their intrinsic motivation and knowledge construction. Some of the disadvantages of PBL include uncertainty due to information overload among the students and the inability to decide the relevance of the information. Providing reliable course material and guidance for an effective literature search pertaining to the objectives can help the student to retain focus. The need for more staff to actively contribute to facilitation and group led discussion, and better infrastructure like physical space are some of the other limitations [1, 3, 10].

The present study results highlight a statistically significant higher mean score for the students with topics covered by DL in comparison to SDL and PBL, while the scores obtained in SDL and PBL were comparable to each other. This is in concordance with study done by Smits *et al.* [11] where performance in lecture topics was better than PBL topics. Atta *et al.* [12] found the performance in SDL topics to be lesser than in PBL topics. The results in the present study, although similar with a slightly better performance in PBL than SDL, were not statistically significant. Imran *et al.* [8] however, in their study have found a contradictory result with better academic performance in PBL topics than in the DL topics.

Better examination scores in topics delivered as DL can be attributed to structured delivery of information supported by lecture notes making their reproducibility in examinations better. Students do not perform well in PBL and SDL topics primarily due to inability to discern the salient points in the topic due to lack of guidance in association with multiple other drawbacks [12].

Though PBL and SDL are designed for extensive active learning, the lack of organized lecture notes and inability of the learners to identify the important concepts, contributes to somewhat deficient understanding.

These pedagogic learning methods require a lot of motivation from the students to read the topics and answer the SDL questions prior to class [11-12]. Supplementing these exercises with a brief outline and focused discussion can make the learning more impactful. The present study elicits an improved academic performance in SDL-FD when compared to only SDL or PBL concordant with studies done by Srivastava *et al.* [13] and Kartikeyan *et al.* [7]. Most of the examination patterns largely assess the cognitive domain, thereby explaining the better student outcome in DL topics. PBL and SDL are believed to promote the conative and affective domains better; needless to say, these domains are more essential in preparing to face challenges in real life scenarios [8, 11].

A limitation of the study is the methodology, using a retrospective analysis of student scores does not allow the control of confounding factors. A more valid result could be drawn from a prospective experimental study design. A class is usually comprised of all strata of learners, this study only compares the average scores and no insight is provided on the scores of good and poor performers.

Conclusion

The ideal approach to deliver the curriculum should include an optimum blend of active learning methods like PBL, SDL and passive learning method like lectures. PBL and SDL promote higher order thinking and analytical skills. However, it is not possible to replace the DL completely. In DL, learners benefit most from organized presentation of information. Examination patterns should be mapped with the learning outcomes for effective assessment. Student-centered learning methodologies will pave the way for nurturing critical thinking in learners.

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