

# Study of comparative analysis Self-directed Learning and Problem Oriented Learning Sessions in Cardio- Respiratory Physiology.

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## Research article

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# Abstract

**Background:** Active learning methods like Self-directed learning and problem oriented learning are considered to be an important methods of learner centred approach of imparting knowledge in under graduate medical curriculum through integrated approach.

**Aim and objectives:** To analyse and compare the efficacy of self-directed learning and problem oriented approach for physiology subject among first year MBBS students.

## Material and methods:

The present study was conducted among 250 students of Phase I MBBS during the year 2019 for physiology course for cardiorespiratory modules. Group A (n=125) was administered with self- directed learning sessions, while group B (n=125) was administered with problem oriented learning session for the same topics. Following each session an objective assessment was conducted for all the topics covered in SDL and POL sessions and was assessed and analysed using unpaired t test.

**Results:** Group A for self-directed learning sessions (group A) of cardiovascular physiology based on the analysis of the marks of objective type assessment; Maximum marks were obtained by 25.6% (32/125); while moderate marks 21.6% (27/125) by the students of Group A. Maximum marks were obtained by 31.2% (39/125) and moderate marks were obtained 47.2% (59/125) by the students for which significant difference in the p values was noted (n=0.008). For SDL sessions of respiratory system module (group A); maximum marks were obtained by 24% (30/125) ; while moderate marks by 23.5% (29/125) of students; for problem oriented sessions maximum marks were obtained by 32.8% (41/125) and moderate marks were obtained by 48% (60/125) students; Significant variations were found in both modules test scores (n=0.008) (n=0.009).The analysis of SDL and POL against the total scores of students in their internal assessment showed considerable differences between students attaining scores 80–89% in SDL and PBL, between 70–79% for both SDL and PBL with p values of =0.0192, and 0.01184, 0.0190, and 0.01179 respectively.

**Conclusion:** Problem oriented learning sessions seems to be more effective way of delivering the concept as compared to self-directed learning sessions. There is a need of time for creating awareness and readiness of the learner for such type of learner centred active learning methods.

## Background

Current medical education in India which has adopted a new curriculum requires training in a wide spectrum of domains for medical undergraduate which mainly includes cognitive and psychomotor and affective domains according to Bloom's taxonomy. <sup>[1–5]</sup> The present medical curriculum, which was introduced in 2019, is more of learner centered than the teacher centered. The new curriculum not only demands active involvement of the learner, but also the newer modalities of teaching for increasing the active participation and engagement of a learner. <sup>[1, 2, 3]</sup> Over past few decades' medical education has

seen the dominance of lectures as commonly adopted method teaching for the medical undergraduates. Newer or recent methods of teaching and learning which focuses on active involvement of learner includes self-directed learning, problem based learning, and are considered as an effective method in delivering and explaining core and difficult concepts which leads to increased learning with an active involvement of the learner<sup>[4]</sup>. The current context of medical education in accordance with the current curriculum demand proves that traditional didactic lectures in large groups are of less significance, didactic lectures have increasingly been replaced by active learning methods. There are many studies which have reported efficiency of self-directed learning the basic medical science like anatomy, physiology and biochemistry.<sup>[10-11]</sup> various modalities are used for Self-directed learning (SDL). Multiple modalities can be used for providing self-directed learning instructions to undergraduate students, for their enthusiastic participation in the sessions.<sup>[12, 13]</sup> Various self- directed learning modalities are effective if the designed sessions are realistic within the limit of accomplishment this method help in building communication skills, helps in taking own decisions, and building team spirit and self-governance.<sup>[14-17]</sup> SDL modalities can be applicable and can be used by the learners when they are needed to learn by themselves.<sup>[1-6 18-20]</sup> One such method of self-directed learning is giving a case scenario related to the topic and asking multiple objective questions providing adequate learning resources which can be used to answer the given question.<sup>[7-9, 15, 20]</sup> Self-directed learning can work as a successful active learning method in medical education.<sup>[7 11, 12]</sup> Previous studies which compared and highlighted the beneficial effects of self-directed learning over the traditional didactic lectures.<sup>[13-15]</sup> Problem oriented learning is also considered to be the active form of learning and valuable form of group education which ensures active participation of the learner which uses different instructional methods which includes construction of problem for the given topic for small group who will discuss the problem among themselves and can derive the accurate and desired solutions. In this form of teaching and learning the facilitator is acting as a moderator and supervisor.<sup>[16-20]</sup> the approach for solving these case scenarios are theoretical and are generated by the learner. The individual groups investigate the probable and possible outcomes or solutions of the problems which will be shared in the next or other group session. This instructional active learning approach develops the communication skills, team spirit with appropriate interaction and appreciation of the views of the other group members and leadership qualities among the learners.<sup>[21, 23]</sup> The current curriculum, which expects at least one third of alignment and integration; both horizontal and vertical widely promotes use of self-directed learning which will help the learner to understand the subject or topic in intricate manner, improving knowledge retention, enhancing their critical thinking skills which is the need of current age and time.<sup>[9-25]</sup> the present research was undertaken to analyse the benefits of active learning in teaching physiology.

## Methods

The Present comparative study was conducted in department of physiology in a medical school of south India, involving 250 students. The students were divided in two groups. Group A (n = 125) was

administered with self- directed learning sessions, while group B (n = 125) was administered with problem oriented learning session for the same topics.

### **Preparation Of Learning Material**

Case based scenario sessions were prepared for various topics from both cardiovascular and respiratory system.

The topics covered in cardiovascular and respiratory system were;

1. Myocardial infarction
2. Cardiac failure
3. Shock
4. Hypertension
5. Syncope
6. Acute respiratory distress syndrome (ARDS)
7. Pulmonary tuberculosis
8. COPD( chronic obstructive pulmonary diseases)
9. Hypoxia
10. Respiratory failure

The content and objectives were same for both SDL and POL sessions. Both type of sessions were designed based on the aetiology risk factors involved, pathogenesis and one or more circumstance in association with Pathophysiology, lab investigations, differential diagnoses, and different treatment modalities and also based on the hypothesis as well as the rare chances of the discussion of the topic which cannot be addressed in other form of teaching and learning method.

### **Session planning for SDL**

Short case scenarios were prepared with desired learning outcomes. Recommended books were suggested. These sessions were planned during the afternoon hours on alternate days during the scheduled slots of SDL and POL sessions for physiology. Attendance was mandatory for all the students

As stated earlier group A was administered with SDL session. Case scenarios were sent to the students through learning management system. After reading the case scenarios; students discussed the leaning objectives with the facilitator who advised and directed them for using the required resources. These students were again divided in small ten groups each group was monitored by facilitator the students studied the case wrote their findings and discussed it with their facilitator. After this session the next day before beginning of the new session, the moderator of the module reviewed the scenarios separately and evaluation was done which was based on 10 objective type questions.

### **Example Of Learning Session:**

48 year old male was brought to the emergency unit as he fainted after dizziness. The patient had altered sensorium with blood pressure, 60/50 mmHg with heart rate of 150 beats per minute, with no pulse felt in upper as well as lower limb. Analysis of ECG showed sinus tachycardia with heart rate of 140 beats per minute, PR interval 110 milliseconds, and QRS duration of 70 milliseconds. Identify the cause and management of the given case scenario.

### **Learning objectives for sessions:**

1. Define shock?
2. Mention the types of shock?
3. Briefly explain the pathophysiology and compensatory mechanism of shocks
4. Describe briefly the methods in basic and advanced life support.

### **Example of assessment Question:**

1. Shock (mean BP less than 60 mmHg) can be caused by
  1. Low intravascular volume
  2. Low cardiac output
  3. Pleural effusion
  4. Decreased peripheral vascular resistance

### **Session Planning For Problem Oriented Learning Session**

This session was planned for B group (n = 125) students, in the beginning they were divided into 10 groups with 12 students in each group. Each group had one facilitator to guide. Unlike self-directed learning sessions case scenarios were designed. Two sessions were planned for each POL. During session I the students discussed case and learning objectives, lab investigations and differential diagnosis for the condition with the facilitator. During session II all group B students were made to sit together in a single class including the facilitators and the moderator of the session, one group representative from each was made to discuss the learning outcomes. This plenary ensured that all the desired outcomes were discussed with each student of all groups. This session was followed by an objective structured assessment consisting 10 questions. All the facilitators were from department of physiology, anatomy and biochemistry.

### **Analysis:**

As described earlier the assessment was based on ten questions followed immediately the next week for each style of learning session with no negative marking system. The comparison was based on the marks obtained by each group member and were classified as (score < 8) as high, (score 6 or 7) as

moderate, (score < 6) as low, (score < 5) as very low. *P-values* more than < 0.05 were accounted as significant. The Statistical analysis was done windows version 17.0 (SPSS)

## Results

The results analysis of the objective assessment (10 questions each for SDL and POL session) for self-directed learning session of cardiovascular system module showed that maximum marks were obtained by 25.6% (32/125) number of students ; while moderate marks by 21.6% (27/125); for problem oriented sessions the maximum marks obtained by 31.2% (39/125) number of students and moderate marks were obtained by 47.2% (59/125); For SDL sessions of respiratory system module (group A); maximum marks were obtained by 24% (30/125) number of students ; while moderate marks by 23.5% (29/125);while in problem oriented sessions the maximum marks obtained by 32.8% (41/125) and moderate marks were obtained by 48% (60/125) number of students; Significant difference was observed between marks obtained by both groups ( $n = 0.008$ ) ( $n = 0.009$ ) [Table I]. The total scores of the internal assessment examination showed significant difference among students obtaining 80–89% marks in both SDL and POL, and who scored 70–79% in both SDL and POL sessions with  $p$  values of 0.0192, and 0.01184, 0.0190, and 0.01179 respectively. [Table II]

**Table I: Number and percentage of marks of each group for SDL and PBL for both CVS and RS module.**

Module	Tool	High, n (%)	Moderate, n (%)	Low, n (%)	Very low, n (%)	t-test
Cardiovascular system	SDL	25.6% (32)	21.6% (27)	36% (45)	6.8% (21)	<b>0.00931**</b>
	POL	31.2% (39)	47.2% (59)	15.2% (19)	6.4% (08)	
Respiratory System	SDL	24% (30)	23.5% (29)	32% (40)	22.4% (28)	<b>0.00812**</b>
	POL	32.8% (41)	48% (60)	14.4% (18)	4.8% (06)	

**\*\* *P-value* using *t*-test. Abbreviations:** POL, problem-oriented learning; SDL, self-directed learning.

**Table II: Distribution of students according to their grades in SDL and POL based on their total score in cardiovascular module**

Score	Tool	High, n (%)	Moderate, n (%)	Low, n (%)	Very low, n (%)	<i>p</i> -value using independent <i>t</i> -test
≥ 90	SDL	5	3	2	2	0.4069
	POL	7	4	2	2	
80–89	SDL	6	7	9	5	0.0196
	POL	29	13	7	8	
70–79	SDL	6	10	29	17	0.01184
	POL	8	19	6	2	
60–69	SDL	2	4	9	7	0.3219
	POL	6	5	4	4	
< 60	SDL	3	1	6	2	0.4037
	POL	4	3	1	1	
*There are significant differences in the student group attaining score of 80–89% for SDL and POL, and also in-between the student group attaining 70–79% for SDL and POL.						
Abbreviations: POL, problem-oriented learning; SDL, self-directed learning.						

**Table III: Distribution of students according to their grades in SDL and POL based on their total score in Respiratory module**

Score	Tool	High	Moderate	Low	Very low	<i>p</i> -value using independent <i>t</i> -test
≥ 90	SDL	4	4	1	3	0.4073
	POL	9	3	2	2	
80–89	SDL	5	8	10	4	0.0190*
	POL	31	11	10	5	
70–79	SDL	10	12	30	13	0.01179*
	POL	10	20	4	1	
60–69	SDL	3	6	8	5	0.3213
	POL	4	7	6	2	
< 60	SDL	1	4	3	4	0.4034
	POL	5	1	2	1	

\*\*There are significant differences in the student group attaining score of 80–89% for SDL and POL, and also in-between the student group attaining 70–79% for SDL and POL.

Abbreviations: POL, problem-oriented learning; SDL, self-directed learning.

## Discussion

The Indian undergraduate medical education program is particularly designed in order to create an “Indian Medical Graduate” who is having a quest of knowledge, skills, attitudes, values and responsiveness.<sup>[1]</sup> The new Competency based undergraduate medical curriculum which was introduced in 2019 mostly focuses on the learning experience of the learner which will be helpful in facing the real life situations.<sup>[2]</sup> Based on these guidelines and amendments of the governing authority’s the weightage given for didactic lectures must not exceed beyond one third of the entire curriculum schedule for each subject; while two third of the teaching must be in the form of interactive sessions, practical’s, clinical or/and group discussions. <sup>[1, 2, 3]</sup> There is a specific mention that more focus must be on the learning process that includes clinical experiences with bedside teaching, problem oriented approach considering the burden of the health issues, case studies, or scenario based teaching, and community health care activities.<sup>[1–9]</sup> In undergraduate medical curriculum, physiology subject which is taught during the phase I curriculum deals with acquiring the facts of understanding the underlying the basic physiological mechanisms and can also form a connecting bridge between the basic science knowledge and also its application in understanding the process and progression of the disease, to correlate the underlying physiological cause for the signs and symptoms, to suggest the possible ways of treatment and also help enhancing critical thinking skills by problem solving.<sup>[3, 10]</sup>

Our study showed that POL is still the popular and effective method of delivering core concepts as compared with self-directed learning due to lack of proper planning and sensitization to the students. Self-directed learning is one of the adult instructional modalities which is widely used in health profession education, which not only helps in understanding the core concept of the subject but also enhances the learning experience. [22, 23, 25] Murphy et al in their study reported that SDL is not considered an appropriated method for understanding and learning Anatomy, as on feedback students admitted that the recall knowledge was due to the didactic lectures and not due to active learning methods. [24] Study conducted by Pai et al showed that there was no difference in the way the topic was learnt by SDL or by combining it with the didactic lectures; the assessment results were same in both the group of learners. [26] Problem oriented learning sessions are also considered to be important technique of active learning which ensures active involvement of the learner. The result of the present study based on the assessment results shows the importance of problem oriented learning sessions in integrated curriculum. These results are in accordance to the previous literature showing important role of problem solving exercises in enhancing learning experience. [9, 27-30] when compared with the high scoring groups 10 students had low to very low scores in the SDL sessions, which again raises the question on the proper planning and management of the SDL session. The student need might not have identified the instructions and learning objectives, or their might be lack of motivation which would have resulted in their low scores in SDL sessions as compared with the POL sessions. This highlights a need to reframe the SDL sessions in a proper format in accordance to the need of the students. In their study; Blumberg et al showed that PBL sessions helped the students in utilization of SDL skills. [27] Few studies have also recommended that the facilitator need to encourage and promote the students for their active participation in SDL. [28-32] these authors also concluded that such exercises help in acquiring and improving clinical skills. Researchers also found that SDL can be effectively inculcated in the current curriculum if it is properly framed with desired outcomes at each stage or phase of the curriculum. [33] the new curriculum demands implementation of SDL sessions but there has to be a clarification in framing the learning objectives, facilitator driven discussions with the learner, by dividing the students in smaller groups encouraging the group discussions by identifying the learning styles of the student. which need to be implemented in order to get the better results. [34]

## Conclusion

Active learning techniques like Self-directed learning and problem oriented learning is a need of a time and the new curriculum which mainly focuses on synchronization and integration of the subjects, such active learning techniques will enhance the learning experience helping the learner in understanding the core concepts of the subject. However, based on our finding we can suggest that with proper planning and improving the instructional methods SDL sessions will be equally beneficial to the POL sessions for subject knowledge and understanding.

## Limitation of the study

Implementation of such techniques needs lot of groundwork and proper training of the facilitators for each session. The facilitators must be trained in order utilized time given time more effectively. There should be absolute interdepartmental coordination for obtaining the desired learning outcomes. The learning material should be provided to the learner well in advance for ensuring the active involvement. Clickers and flash cards can be used for improving the responsiveness among the students.

## **Declarations**

### **Ethics approval and consent to participate**

This study was exempted for the ethical review as per the decision of the institute ethical committee of Mahatma Gandhi Medical College Pondicherry.

### **Informed consent**

Prior informed consent was taken from all the study participants.

### **Consent to publish**

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### **Availability of data and materials**

The authors declare that as and when needed the data and related materials will be uploaded as required by the competent authority.

**Competing interest:** None

**Research funding:** Nil

### **Authors contribution:**

Dr Suchitra Sachin Palve: Data collection, manuscript writing.

Dr Sachin Bhaskar Palve: Statistical analysis and manuscript editing

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