

A Study on Efficacy of Self-Directed Based Learning (SDL) Compared to Lectures in Medical Education in Biochemistry**Nazia Anjum¹, Chinthanippula Srilatha², Gurappagari Prakash³, Sindhu P⁴, Asha Jyothi Puvvala⁵, Ganji Suresh Babu⁶**¹Tutor, Department of Biochemistry, Government medical College, Siddipet, Telangana, India²Postgraduate, Department of Biochemistry, Government Medical College, Siddipet, Telangana, India^{3,4}Tutor, Department of Biochemistry, Government Medical College, Siddipet, Telangana, India⁵Postgraduate, Department of Biochemistry, Government Medical College, Siddipet, Telangana, India⁶Professor and HOD, Department of Biochemistry, Government Medical College, Siddipet, Telangana, India**Received: 25-06-2025 / Revised: 23-07-2025 / Accepted: 26-08-2025****Corresponding Author: Nazia Anjum****Conflict of interest: Nil****Abstract:**

Traditional teacher-centered approaches to medical education are giving way to student-centered ones. By empowering students to take charge of their own education, self-directed learning (SDL) may improve long-term memory retention, critical thinking, and problem-solving skills. The purpose of this study was to assess how well undergraduate medical students learnt biochemistry through self-directed learning as opposed to traditional lecture-based instruction. The purpose of this study is to examine how well self-directed learning (SDL) and conventional lecture-based learning (LBL) enhance students' knowledge, comprehension, and involvement in biochemistry.

Methods: First-year MBBS students in the Department of Biochemistry participated in an experimental study. Batch A & Batch B were the two groups into which the participants were split. The subjects taught to both groups were the same. Validated multiple-choice and short-answer questions were used in the pre-test and post-test evaluations. A standardised feedback questionnaire was used to gather the opinions of the students.

Results: Post-test scores significantly improved for both groups ($p < 0.05$). In contrast to the lecture group, the self-directed learning group experienced a greater mean increase in knowledge. The SDL group's students reported increased motivation, stronger teamwork and communication abilities, and higher conceptual understanding.

Conclusion: self-directed learning is a useful addition to conventional lectures in the teaching of medical biochemistry. It encourages students to actively participate, develop lifetime learning habits, and gain a deeper knowledge. A more well-rounded and productive learning environment can be produced in medical education by combining SDL techniques with lectures.

Keywords: Active learning, Biochemistry, Medical Education, Self-Directed Learning, Lecture-Based Learning and Student-Centered approach.

This is an Open Access article that uses a funding model which does not charge readers or their institutions for access and distributed under the terms of the Creative Commons Attribution License (<http://creativecommons.org/licenses/by/4.0>) and the Budapest Open Access Initiative (<http://www.budapestopenaccessinitiative.org/read>), which permit unrestricted use, distribution, and reproduction in any medium, provided original work is properly credited.

Introduction

According to the recently introduced competency-based undergraduate curriculum for Indian Medical Graduates, the aim of medical education is not merely to improve knowledge and skills but to develop medical professionals who are clinicians, leaders, and lifelong learners [1]. The main idea behind the new rules is to continue and advance medical education by making it more learner-centric and outcome-based.

A person with self-directed learning (SDL) skills is a lifelong student. The rapidly growing body of medical knowledge necessitates lifelong learning, which allows health professionals to keep learning

throughout their careers [2,3]. Because it offers a current synopsis of the subject from multiple sources, it can save the student time.

Nevertheless, poor engagement among students is caused by their passive nature, limited input resources, and inadequate development of critical thinking and problem-solving skills [4]. SDL is an all-encompassing approach created to give students more power.

By involving students in SDL activities, they are forced to study, discuss, and present the material in order to participate in the learning process,

something they might not have done if they had only listened to a lecture [5].

Additionally, it is important to instill confidence in Indian medical graduates when speaking with their peers' patients, so students should be trained to speak in public without becoming nervous, especially when speaking in groups with peers and when giving stage presentations like seminars and mini lectures [6].

Aim & Objectives: Study objectives include evaluating the effectiveness of lectures and self-directed learning sessions for first-year medical students.

Objective: To ascertain whether the SDL sessions were beneficial to the pupils.

In medical education, innovative teaching strategies including self-directed learning have surfaced in recent decades, emphasising students' initiative in their education [7].

SDL is a possible approach in medical education to support lifelong learning, according to Murad et al. Medical teachers have steadily developed an interest in the SDL method as a result of the introduction of new content and competency-based medical education integrating SDL [8]. In a research conducted by Abraham et al to test the effectiveness of SDL, exam scores for the lecture method were much lower than SDL exam scores. These findings show that SDL could be a useful learning aid. Furthermore, evaluations from students indicated a more positive attitude towards SDL [9].

According to Anita et al's study, SDL promotes students to actively participate, resulting in active learning with higher memory and the development of effective communication skills; yet, 57.20% of students feel that SDL is a time-consuming technique of learning [10]. According to an interventional study conducted by Devi S. Et al. [11], comments from students suggested that SDL classes were more fascinating and helped in improved understanding of the themes; promoted thinking; and aided in the active learning process.

Another study conducted by Cheema and Arora among 150 medical students at a medical college in Jalandhar, Punjab, to assess the effectiveness of interactive lectures as a teaching method in Obstetrics and Gynaecology, found that interactive methods promote self-directed learning among students [12]. Datta et al. conducted a prospective longitudinal study in Maharashtra, finding that the pre-test scores from both groups were identical, and the post-test score of interactive lectures was better

than the conventional post-test score ($p < 0.01$) [13]. Kohli and Dhaliwal [14] found that mentorship by instructors and peers may improve students' learning environments.

Methodology

Study setting and design: This comparative study was conducted in the department of Biochemistry, using 6 lectures and SDL topics that were selected from Biochemistry syllabus from the NMC curriculum for UG students.

Study subjects: 175 undergraduate students who were enrolled in the year 2021-2022 were invited to participate in the study. Ethical committee clearance was obtained from the Ethics committee of Government Medical college, Siddipet.

Sampling: The total number of students were divided into 2 batches A and B. Batch A comprising 88 students and Batch B comprising of 87 students. A facilitator was assigned to each group to facilitate group movement and discussions.

Study duration - Total 6 Days-Table 1

- On Day 1, A selected topic, Transport across membranes was chosen for both the batches. Batch A was administered a lecture, while batch B underwent a self-directed learning session with all the study materials provided. A pre-test and post-test questionnaire was administered via google forms.
- On Day 2, the batches were reversed and another topic, Sources, RDA and deficiencies of Thiamine and riboflavin was administered as SDL to Batch A and Lecture to Batch B. A pre-test and post-test questionnaire was administered.
- On Day 3, The topic selected was Structure function relationship of Hemoglobin and Myoglobin. Batch A was given lecture and Batch B underwent SDL. A pre-test and post-test questionnaire was administered.
- On Day 4, The topic selected was Glucose homeostasis in health and disease. For Batch A, SDL was conducted and for Batch B Lecture was administered. A pre-test and post-test questionnaire was administered.
- On Day 5, The topic selected was Mucosal block theory which was delivered as lecture to Batch A and as SDL to Batch B. A pre-test and post-test questionnaire was administered.
- On Day 6, The topic selected was Classification of Porphyria, administered as SDL for Batch A and as lecture for Batch B. A pre-test and post-test questionnaire was administered.

Table 1:

S.No	TOPIC	Batch-A (88 Students)	Batch-B (87 Students)
1	Transport across membranes	Lecture	SDL
2	Sources, RDA and deficiencies of Thiamine and Riboflavin	SDL	Lecture
3	Structure- Function relationship of Hemoglobin and Myoglobin	Lecture	SDL
4	Glucose homeostasis in health and disease	SDL	Lecture
5	Mucosal Block Theory	Lecture	SDL
6	Classification of Porphyria	SDL	Lecture

Before and after each session a Google form containing 10 MCQ's from the topics was shared to the students and their scores were recorded.

Study tools: A pre-session test and a post session test was conducted for the students using google forms to assess how much knowledge the students achieved through self-centred learning and to evaluate progress.

Study methodology: Six themes were listed and chosen for the study in accordance with the NMC requirements. Every session was given a one-hour time limit. It would be required that students in batch B who are undergoing an SDL session bring their textbooks and other reference materials. The first half hour was set aside for group discussions and studies, as well as for answering any questions that might have arisen. Presentations, mini-seminars, and viva-voce took up the next half hour. The batches were switched on the second day, and the process was repeated for the remaining subjects

By comparing the pre-test and post-test results from both approaches, learning outcomes and knowledge were evaluated. MCQs were used to evaluate the topics, and vivas were clearly separated between each half topic to evaluate the distinction between lectures and SDL. A standardised, pre-validated questionnaire was used to gauge students' opinions of SDL.

Following the conclusion of all SDL sessions and lectures, the surveys were distributed. Feedback that is already structured All 175 pupils were given access to Google forms. 175 students' responses were gathered and examined to see how the students felt about SDL and lecture sessions.

Pre-Structured Questionnaire

- Question 1: which method of learning would you prefer? **SDL or Lecture**
- Question 2: what is the reason: **easy to understand the topic or better retaining**
- Question 3: for SDL sessions how many points on a scale of **1 -10** do you award?
- Question 4: For lecture sessions how many points on a scale of **1 - 10** do you award
- Question 5: which mode of learning is more active and engaging? **SDL or lecture**
- Question 6: Do you think SDL can improve your communication skills? **Yes or No**
- Question 7: Do you think SDL can help you to improving your reasoning skills? **Yes or No**
- Question 8: Do you think lectures are not as effective as the SDL? **Yes or No**
- Question 9: which mode of presentation was more effective: **Seminar, group discussion or viva voce?**
- Question 10: What is your opinion on making lectures more interactive? **Helpful/ not helpful**

Data analysis: The SPSS software trial version 20 was used to analyse the data. The standard deviation and mean were computed. The paired t-test value was used to analyse the pre-test and post-test outcomes of the SDL and traditional lecture. A P value of less than 0.05 was deemed significant.

Results and Discussions:

In the August 2021 batch, 175 students were admitted in the first year of the MBBS Program. In order to maintain 100% attendance, students were required to attend every session.

The data collected from the study is as follows

Table 2:

	Day 1	Day 2	Day 3	Day 4	Day 5	Day 6
Pretest	Lecture (Batch A)	Lecture (Batch B)	Lecture (Batch A)	Lecture (Batch B)	Lecture (Batch A)	Lecture (Batch B)
	SDL (Batch B)	SDL (Batch A)	SDL (Batch B)	SDL (Batch A)	SDL (Batch B)	SDL (Batch A)
Post Test	Lecture (Batch A)	Lecture (Batch B)	Lecture (Batch A)	Lecture (Batch B)	Lecture (Batch A)	Lecture (Batch B)
	SDL (Batch B)	SDL (Batch A)	SDL (Batch B)	SDL (Batch A)	SDL (Batch B)	SDL (Batch A)

Interpretation 1: “we observed statistically significant values between the Score of Lecture and SDL day-1 Pretest and Posttest; $t(174) = -21.969$, $p < 0.05$ ”.

Interpretation 2: “we observed statistically significant values between the Score of SDL and lecture day-2 Pretest and Posttest; $t(174) = -29.013$, $p < 0.05$ ”.

Interpretation 3: “we observed statistically significant between the Score of Lecture and SDL day-3 pretest and Posttest; $t(174) = -16.535$, $p < 0.05$ ”.

Interpretation 4: “we observed statistically significant values between the Score of SDL and

lecture day-4 Pretest Day-4 and Post-test; $t(174) = -24.270$, $p < 0.05$ ”.

Interpretation 5:

“We observed statistically significant values between the score of Lecture and SDL day-5 Pretest and Posttest; $t(174) = -18.186$, $p < 0.05$ ”.

Interpretation 6:

“we observed statistically significant values between the Score of SDL and lecture day-6 Pretest and Posttest; $t(174) = -24.270$, $p < 0.05$ ”.

There was a statistically significant value obtained in case of SDL when compared to lectures

Table 3:

Lecture– Mean Scores	Day 1 (Batch-A)	Day2 (Batch-B)	Day 3 (Batch-A)	Day 4 (Batch-B)	Day5 (Batch-A)	Day 6 (Batch-B)
Pre-Test	3.159	3.137	3.25	2.977	3.227	3.149
Post-Test	4.181	5.114	4.409	3.945	4.318	4.034

Table 4:

SDL– Mean Scores	Day 1 (Batch-B)	Day2 (Batch-A)	Day 3 (Batch-B)	Day 4 (Batch-A)	Day5 (Batch-B)	Day 6 (Batch-A)
Pre-Test	3.149	3.147	3.183	3.197	3.080	3.238
Post-Test	5.241	5.113	5.114	5.040	5.034	5.056

In contrast to the students from batch B who participated in SDL sessions, the students from batch A who received lectures on Day 1 experienced a slight improvement in their post-test scores.

The post-test results for SDL and Lecture Batch A and B on Day 2 did not differ significantly.

- When compared to the Lecture Batch, the SDL batch's post-test results on Day 3 were higher.
- When compared to the Lecture Batch, the SDL batch's post-test results on Day 4 were higher.
- When compared to the Lecture Batch, the SDL batch's post-test results on Day 5 were higher.
- When compared to the Lecture Batch, the SDL batch's post-test results on Day 6 were higher.

Individual responses to the questionnaire were gathered from 175 students, and the information gathered was interpreted as follows.

1. The answers to the first question, which asked whether you preferred lectures or SDL as a learning approach, were tallied. Of the two batches, 92 students (52.6%) selected lecture mode, whereas 83 students (47.4%) preferred SDL.

2. The answers were gathered for the second question, which asks why something is simple to comprehend or helps people remember it better. Of the pupils who answered, 99 (56.6%) said it was

easier to grasp, and 76 (43.4%) said it was better retaining.

3. In response to the third question, which asked how many points, on a scale of 1 to 10, you would assign for the SDL session, 143 students (81.7%) assigned points from 4 to 7, and 32 students (18.3.7%) assigned points from 8 to 10.

4. On a scale of 1 to 10, how many points would you assign to the fourth question, which is about the LECTURE session? Remarkably, 32 students (18.3%) provided marks in the range of 8–10, whereas 143 students (81.7%) awarded points in the range of 4–7.

5. In response to the fifth question, which asked which type of instruction is more dynamic and captivating, 103 students (58.9%) said they preferred self-directed learning (SDL), while 72 students (41.1%) said they preferred lectures.

6. The answers were either Yes or No for the sixth question, which asked if you believed SDL could help you become a better communicator. Twenty students (11.4%) opposed it, while the majority of students—155, or 88.6%—were in favor of it.

7. Of the students who answered "yes" to the seventh question, "do you think that SDL can improve your reasoning skills?" 125 (71.4%) said "yes," whereas 50 (28.6%) said "no."

8. Almost similar numbers of students responded to the eighth question, which asked if they believed lectures were less effective than SDLs: 88 (50.03%) said no, and 87 (49.7%) said yes.

9. In response to the ninth question, which asked which SDL form was more successful, 127 students

(72.6%) supported seminars, while 48 students (27.2%) supported viva voce.

10. When asked if they thought that making lectures more participatory would be beneficial, 160 students (91.4%) replied that they would, while only a small minority disagreed. This was the tenth question.

Table 5:

Question no. 1	No. Of students for SDL	Percentage	No. Of students for lecture	Percentage
	83	47.4	92	52.6
Question no. 2	No. Of students for easy to understand	Percentage	No. Of students for better retaining	Percentage
	99	56.6	76	43.4
Question no. 3	No. Of students (4-7 points)	Percentage	No. Of students (8-10 points)	Percentage
	143	81.7	32	18.3
Question no. 4	No. Of students (4-7 points)	Percentage	No. Of students (8-10 points)	Percentage
	143	81.7	32	18.3
Question no. 5	No. Of students For SDL	Percentage	No. Of students For lecture	Percentage
	103	58.9	72	41.1
Question no. 6	No. Of students For YES	Percentage	No. Of students For NO	Percentage
	155	88.6	20	11.4
Question no. 7	No. Of students For YES	Percentage	No. Of students For NO	Percentage
	125	71.4	50	28.6
Question no. 8	No. Of students For YES	Percentage	No. Of students For NO	Percentage
	87	49.7	88	49.7
Question no. 9	No. Of students For seminar	Percentage	No. Of students For viva voce	Percentage
	127	72.6	48	27.4
Question no. 10	No. Of students For seminar	Percentage	No. Of students For viva voce	Percentage
	160	91.4	15	8.6

Numerous studies have shown that SDL is beneficial for students' communication skills development, which will help them behave as respectable doctors.

SDL is preferred by students since it helps them understand the material better and allays their questions.

Additionally, SDL encourages students to actively engage, which results in lifelong learning in the medical field. However, when lectures are more participatory and interesting, students also choose to attend them.

References

1. Competency Based Undergraduate Curriculum for the Indian Medical Graduate. New Delhi: Medical Council of India; 2018. Available from: <http://www.mciindia.org/CMS/information-desk/>
2. Pai KM, Rao KR, Punja D, Kamath A. The effectiveness of self-directed learning (SDL) for teaching physiology to first year medical students. *Australas Med J* 2014; 7:448-53.
3. Candy PC. Self-Direction for Lifelong learning: A comprehensive Guide to Theory and Practice. San Francisco, CA: Jossey Bass; 1991.
4. Falkner N, Sooriamurthi R, Michalewicz Z. Puzzle based learning for engineering and computer science. *Computer*. 2010;20-28.
5. Knowels M. Self-Directed learning: A guide for Learners and Teachers. New York: Association press; 1975.
6. Gyawali S, Jauhari AC, Shankar PR, Saha A Ahmad M. Readiness for self-directed learning among first semester students of a medical school in Nepal. *J Clin Diagn Res* 2011;5: 20-3
7. Barrows, H.S. (1983). Problem-based, self-directed learning. *Jama*, 250(22), 3077-3080.
8. Murad, M.H., Coto-Yglesias, F., Varkey, P., Prokop, L.J., & Murad, A.L. (2010). The effectiveness of self-directed learning in health professional's education: A systematic review. *Medical education*, 44(11), 1057-1068.
9. Abraham, R. R., Upadhyay, S., & Ramnarayan, K. (2005). Self-directed learning. *Advances in physiology education*, 29(2), 135-136.
10. Gune, A.R., More, S.S, Satpue, S.P. Wagh, D.T., & Nikam, V.R. Perception of First Year MBBS students on self-directed learning in Anatomy: Improves Concept, Retention and Communication skills.

11. Devi S, Bhat KS, Ramya SR, et al. Self-directed learning to enhance active learning among the 2nd year undergraduate medical students in Microbiology: an experimental study. *J Curr Res Sci Med* 2016; 2(2): 80-83.
12. Cheema HK, Arora R. Effectiveness of interactive lectures as teaching methodology in OBG among final year medical students. *J Evol Med Dent Sci* 2019; 8:1563-72.
13. Datta R, Datta K, Venkatesh MD. Evaluation of interactive teaching for undergraduate medical students using a classroom interactive response system in India. *Med J Armed Forces India* 2015; 71:239-45.
14. Kohli V, Dhaliwal U. Medical student's perception of the educational environment in a medical college in India: a cross-sectional study using the Dundee ready education environment questionnaire. *J Educ Eval Health Prof.* 2013; 10.3352/jeehp.2013.10.5.