

ORIGINAL ARTICLE

Is Case Based Learning Better than Self Directed Learning? A Quantitative Analysis of Endocrine Physiology Exam Scores and Students' Feedback

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ABSTRACT

Objective: To compare the effectiveness of Case Based Learning and Self Directed Learning through end-of-module assessment scores of two groups of students studying endocrine physiology in the second year MBBS program and through student's experience about it.

Study Design: Quasi experimental study.

Place and Duration of Study: Foundation University, Islamabad, Department of Physiology, conducted in 4 months duration, starting from April till August 2020.

Materials and Methods: This study was conducted on second year MBBS students (group A) who were formally introduced to case-based learning sessions during endocrine module. The end-of-module physiology exam scores of this class were compared to endocrine module result scores of the previous class (group B), who had been taught through self-directed learning sessions during their endocrine module. Dividing same class into two groups would deprive one group from new learning strategy therefore scores of previous classes taught through SDLs were used. The number of sessions, learning objectives, facilitators, examiners, and assessment methods for both classes were ensured to be kept similar.

Results: Quantitative analysis of scores between the two groups using SPSS 23 was statistically significant (p -value = 0.001) through independent t test. Out of 143 students in group A, 96.5% passed while in group B 95% were declared pass. The above average scorers were 52% in group A and 29% in group B. Qualitative assessment of feedback questionnaire done by descriptive analysis, depicted positive impact of case-based learning sessions on students' self-perceived learning, communication skills and problem solving.

Conclusion: case-based learning sessions was found to be more effective learning strategy than self-directed-learning sessions.

Key Words: *Case-Based-Learning, Endocrine, Module, Self-Directed-Learning.*

Introduction

Teaching at Foundation University has been hybrid since 2009, employing both the conventional learning strategies as well as modern-day innovative methods like Problem-Based Learning Sessions (PBLs), tutorials and Self-Directed Learning Sessions (SDLs). Specifically, SDLs were included in the curriculum, keeping in mind the rapid advances in medical education and the importance of developing our future physicians into self-directed life-long

learners, as SDL has been widely accepted as the most appropriate learning strategy to achieve this goal.¹

In 1975, Malcolm Knowles defined SDL as “a process in which individuals take the initiative, with or without the help of others, in diagnosing their learning needs, formulating goals, identifying human and material resources for learning, choosing and implementing appropriate learning strategies, and evaluating learning outcomes.”² It is however important to note that in the systematic review conducted by Murad et al., it was found that only 8% of published studies fulfilled the precise definition of SDL as defined by Knowles.³ Likewise, the SDL time slots being offered in the curriculum of our medical students have also not been a true reflection of SDL as defined by Knowles. Students learn certain concepts on their own and any major queries would then be dealt with in classroom lectures. As such, our students often complained, about inadequate, and at times distracted learning during these SDL

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sessions, without guidance from facilitators. In the opinion of the study authors, while acknowledging the much-documented benefits of SDL learning strategy, its true effectiveness can be evaluated only when compared to other comparable methodologies, where students are guided towards focused learning while keeping the spirit of self-learning, e.g, through Case Based Learning (CBL). Case Based Learning is also an educational strategy where contextualized questions based upon real patient clinical scenarios are posed to students who are pre-informed about the content to be discussed. The case discussion is under supervision of a facilitator who is also well prepared. The implementation and assessment of CBL in various disciplines, including basic sciences, is also documented in literature.^{4,5} Though the idea and implementation of SDLs in curriculum was whole heartedly embraced by the faculty, but due to student's dissatisfaction, it was considered prudent to change the learning methodology, but before introduction of new learning method i.e., CBL, into the curriculum of basic sciences at FUIC, some tangible rationale was needed in the form of better or comparable assessment results for at least one module. Towards this end, a study was planned where assessment results of one group of students taught through SDL and lectures was compared with the results of the second group of students who were taught through CBLs and same lectures. With this rationale current study aimed to compare the end-of-endocrine module assessment scores of two groups of students studying endocrine physiology either through SDL or CBL in addition to their lectures. It was also aimed to record the perception of these methods from those students who had experienced both methods through structured questionnaire. Therefore, the objective of this study was to compare the effectiveness of CBL and SDL through end-of-module assessment scores of two groups of students studying endocrine physiology in the second year MBBS program and through student's experience about it.

Materials and Methods

This Quasi-experimental study was conducted at department of physiology of Foundation University, in the students of second year MBBS, for the duration of 4 months, starting from April till August

2020. Ethical approval for the study was obtained from ethical review committee of university. The entire 2nd year MBBS class of session 2018 comprising of 143 students was included in group A through convenience sampling. The previous modules of the same class had been taught through lectures as well as SDL sessions. Since CBL was considered new method for students therefore they were formally introduced to Case Based Learning methodology. The endocrine module runs over a duration of 8 weeks. The CBL sessions were prepared according to recommended guidelines where pre reading material and case scenario was provided to the students and subject experts, a week prior to main discussion.⁶ Physiology of pituitary, pancreas, thyroid, parathyroid, adrenal and gonadal hormones was covered, with one hormonal dysfunction scenario for one CBL session each week with a total of 8 CBLs. Students identified learning objectives, key concepts in the physiological functioning of hormones and consequences of their hypo or hyper functioning. The case summary was organized by facilitators. The end of module physiology scores of this class were compared to same exam result of class of 2017 (group B), who had been taught through lectures and one Physiology SDL per week in total 8 weeks of their endocrine module. Since the learning objectives devised for both SDLs and CBLs encompassed physiology of various hormones, therefore only physiology scores were extracted from the total module scores. Dividing same class into two groups would have deprived one group from new learning strategy therefore scores of previous classes taught through SDLs were used. However, the number of sessions, learning objectives, facilitators, examiners, and assessment methods for both classes were ensured to be kept similar, to avoid confounding factors. The subject pass percentage as per Pakistan Medical and Dental Council is 50% therefore, it was decided to compare percentage of pass and fail students, number of average scorers (50-70% scores) and number of above average scorers (above 70%) in both groups. The feedback about CBL from students was collected from group A because only they had exposure to both SDL and CBL in their academic year. It was collected through self-administered, structured questionnaires after their end of module exam. Questionnaire comprised of 8

questions with responses on Likert scale. Quantitative analysis of scores between the two groups was done using SPSS 23 where statistically significant difference with p value = < 0.05 was calculated through independent t test. Assessment of student's perceptions was done through feedback questionnaires by descriptive analysis using percentages and frequencies.

Results

There were 143 students who attended CBLs along with lectures (group A, n=143) and same number of students attended SDL sessions along with lectures (group B, n=143). Out of 143 students (group A) the pass percentage was 96.5% (138) while 3.4 % (5) failed to clear the modular exam. In group B, 95% (136) were declared pass while 4.8% (7) students couldn't score the pass percentage (50%).

The mean score in percentage of CBL+ Lecture group and SDL+ Lecture group along with standard deviation is shown in table I. The difference of scores between the two groups was significant at p -value of 0.003 applying t-test.

Table I: Comparison of Mean Score in Percentage of CBL (Group A) and SDL (Group B) (N= 143)

Group	Mean±SD	p-value
Group A	68.35±8.15	0.003*
Group B	65.55±8.83	

*p-value significant (less than and equal to 0.05%)

The number of students scoring above average scores (71-85 %) was 75 (52%) in group A while 42 (29%) students scored above average marks in group B. The number of students scoring average percentage (51-70%) was 67 (45%) in group A while 94 (65%) in group B.

Table II. Students' Feedback Questionnaire Scores Analysis (Figure in Parenthesis Indicates Score for That Choice) (N = 143)

Sr No.	Question	Strongly Agreed (5)	Agreed (4)	Not sure (Neither agree, nor disagree) (3)	Disagree (2)	Strongly Disagree (1)
1.	Case Based Learning (CBL) is a worthwhile progression from Self-Directed Learning	41 (27.5%)	43 (28.9%)	34 (22.8%)	14 (9.4%)	11 (7.4%)
2.	CBL improved my communication skills	34 (22.8%)	38 (25.5%)	29 (19.5%)	25 (16.8%)	17 (11.4%)

3.	CBL improved my ability to retain information	34 (22.8%)	50 (33.6%)	33 (22.1%)	14 (9.4%)	12 (8.1%)
4.	CBL helped me prepare for exams	30 (20.1%)	49 (32.9%)	40 (26.8%)	14 (9.4%)	10 (6.7%)
5.	This teaching method is a useful preparation in clinical problem solving	50 (33.6%)	51 (34.2%)	23 (15.4%)	8 (5.4%)	11 (7.4%)
6.	The discussion sessions facilitated interaction between staff and students	41 (27.5%)	37 (24.8%)	29 (19.5%)	21 (14.1%)	15 (10.1%)
7.	Time allowed for case discussion was sufficient	32 (21.5%)	32 (21.5%)	35 (23.5%)	20 (13.4%)	24 (16.1%)
8.	I enjoyed case-based learning	34 (22.8%)	40 (26.8%)	32 (21.5%)	20 (13.4%)	17 (11.4%)

Discussion

The current study was planned to evaluate the outcome of incorporation of CBL sessions, instead of SDL time slots, in the endocrine module timetable of second year MBBS class of 2018. There are multiple ways to evaluate a learning intervention in literature including knowledge assessment and surveys, therefore, both have been employed in the current study.⁷ The module exam physiology results of group A, who were taught through CBL sessions in addition to lectures showed better overall scores compared to group B, who were taught through same lectures and dedicated 08 SDL time slots in timetable of endocrine module. Mean percentage score obtained by group A students was significantly higher 68.35±8.15 compared to 65.55±8.83 of group B with a p value of 0.003. Similar results were derived by Datta A et al., who found that post-test mean scores of CBL groups were significantly higher than that of didactic lecture groups when both were compared after teaching two clinical pathology topics.⁸ The strength of our study is that a series of CBLs was conducted throughout the endocrine module, to evaluate their outcome in formal exam results. Another strong point of our study is that basic physiological aspects of each hormone were taught in lecture before the CBL session, as literature search suggests that true effectiveness of CBL can be achieved when students have already acquired

foundation knowledge of the topic.⁷

In our study, although the pass percentage of group A was higher than group B, their difference did not reach statistical significance. Although the number of 'average scorers (50-70%)' was more in group B i.e 95 (65%) compared to 67(45%) in group A, yet it was interesting to find that this difference was compensated by considerably more 'above average scorers (above 70%)' in group A, 75(52%) compared to group B, 42(29%). This suggests that students of group A had better in-depth understanding of the subject compared to group B. These findings are comparable to the results of Sahiba K et al., where authors found that incorporation of CBL method in biochemistry was superior in imparting knowledge to students. Their claim was supported by significant difference between pre and post CBL mcq test scores of students.⁹ Questionnaire based inclination of students towards CBL sessions compared to SDLs also suggests its effectiveness as a student-preferred learning tool. Students considered it effective for knowledge retention and exam preparation which was reflected in their exam scores too. The clinical correlation with the acquired physiological concepts could be the reason of better perceived knowledge retention. As Bunmi S et al., concluded in their cohort study that perceived clinical relevance was a contributing factor to the retention of basic science knowledge in their students and they suggested that curriculum planners should make clinical relevance a more explicit component of medical teaching.¹⁰

The impact of CBL has been evaluated in various studies which concluded that students not only enjoyed the sessions but felt that CBL enhanced their understanding.¹¹⁻¹⁸ These conclusions are similar to the results of our study. Our students considered CBLs enjoyable, the reason could be the interactive and focused discussion with facilitators and the clinical application of their already acquired basic science theoretical knowledge.

An interesting finding in our study was the low number of students who were in favor of SDLs. This clearly shows the lack of readiness of our students towards self-directed learning, even at university level. Current study does not indicate why students were not in favor of SDL, however cultural factors have been shown to impede SDL assimilation in medical students across different cultural groups.

For Asian students, the pressure of high achievement and traditional reliance on teachers has been documented as the main restraining factor in failure to adapt SDL strategies.¹⁴

Current study results motivate us to plan more CBLs for other modules that are being run during basic sciences years of medical students. However, the importance of making our future physicians' lifelong learners through self-directed learning cannot be overlooked. Therefore, it is recommended and planned, not to totally replace SDLs with CBLs, but to incorporate a few dedicated SDL time slots in every module in addition to CBLs.

True comparison of CBL and SDL by dividing the same class into two groups would have been gold standard but this was limitation of our study as authors did not want to deprive half of the class from new learning strategy.

Conclusion

CBL was found to be more effective learning strategy than SDL, as reflected in student's physiology scores of endocrine module exam. Student's perception about CBL was concluded as it being a helpful and enjoyable tool for learning.

REFERENCES

1. Pai KM, Rao KR, Punja D, Kamath AJTAmj. The effectiveness of self-directed learning (SDL) for teaching physiology to first-year medical students. *Australas Med J*. 2014;7(11):448.
2. Knowles MS. *Self-directed learning: A guide for learners and teachers*. ERIC. 1975.
3. Murad MH, Coto-Yglesias F, Varkey P, Prokop LJ, Murad ALJMe. The effectiveness of self-directed learning in health professions education: a systematic review. *Med Educ*. 2010;44(11):1057-68.
4. Srinivasan M, Wilkes M, Stevenson F, Nguyen T, Slavin SJAM. Comparing problem-based learning with case-based learning: effects of a major curricular shift at two institutions. *Acad Med*. 2007;82(1):74-82.
5. Ricchi A, Martelli E, Molinazzi MT, Vaccari S, Messina MP, Banchelli F, Neri I. Survey of students of the degree course in obstetrics, on learning using case-based learning (cbl) method in the area of professional teachings. *Clin Ter*. 2018 Sep-Oct;169(5): e213-e216. doi: 10.7417/CT.2018.2081. PMID: 30393807.
6. Jamkar A, Burdick W, Morahan P, Yemul V, Singh GJJJoS. Proposed model of case based learning for training undergraduate medical student in surgery. *INDIAN J SURG*. 2007;69(5):176-83.
7. McLean SFJJJoME, Development C. Case-based learning and its application in medical and health-care fields: a review of worldwide literature. *J Med Educ Curric Dev*.

- 2016;3:JMECD.S20377.
8. Datta A, Ray JJIAoIM. Case based learning in undergraduate pathology—A study to assess its efficacy and acceptability as teaching-learning tool. *Int Arch Med.* 2016;3(6):93-100.
 9. Chhabra N KA, Kukreja S, Gill M. Introduction of Case-based Learning as a Teaching/Learning Tool to enhance Students' Knowledge in Biochemistry. *Curr Trends Diagn Treat.* 2017;1:96-9.
 10. Malau-Aduli BS, Lee AY, Cooling N, Catchpole M, Jose M, Turner RJBme. Retention of knowledge and perceived relevance of basic sciences in an integrated case-based learning (CBL) curriculum. *BMC Med Educ.* 2013;13(1):139.
 11. Kamat SK, Marathe PA, Patel TC, Shetty YC, Rege NNJlJop. Introduction of case based teaching to impart rational pharmacotherapy skills in undergraduate medical students. *Indian J Pharmacol.* 2012;44(5):634.
 12. Hansen WF, Ferguson KJ, Sipe CS, Sorosky JJAjoo, gynecology. Attitudes of faculty and students toward case-based learning in the third-year obstetrics and gynecology clerkship. *Am J Obstet Gynecol* 2005;192(2):644-7.
 13. Massonetto JC, Marcellini C, Assis PSR, de Toledo SFJBME. Student responses to the introduction of case-based learning and practical activities into a theoretical obstetrics and gynaecology teaching programme. *BMC Med Educ.* 2004;4(1):26.
 14. Bowsher G, Parry-Billings L, Georgeson A, Baraitser P. Ethical learning on international medical electives: a case-based analysis of medical student learning experiences. *BMC Med Educ.* 2018 Apr 11;18(1):78. doi: 10.1186/s12909-018-1181-7. PMID: 29642906; PMCID: PMC5896122.
 15. Frambach JM, Driessen EW, Chan LC, van der Vleuten CPJMe. Rethinking the globalisation of problem-based learning: how culture challenges self-directed learning. *Med Educ.* 2012;46(8):738-47.
 16. Chandrasekar H, Gesundheit N, Nevins AB, Pompei P, Bruce J, Merrell SB. Promoting student case creation to enhance instruction of clinical reasoning skills: a pilot feasibility study. *Advances in medical education and practice.* 2018;9:249.
 17. Jauregui J, Bright S, Strote J, Shandro J. A novel approach to medical student peer-assisted learning through case-based simulations. *Western Journal of Emergency Medicine.* 2018;19(1):193.
 18. Thistlethwaite JE, Davies D, Ekeocha S, Kidd JM, MacDougall C, Matthews P, et al. The effectiveness of case-based learning in health professional education. A BEME systematic review: BEME Guide No. 23. *Medical teacher.* 2012;34(6):e421-e44.
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