Original Research Article

Case-based learning in pharmacy practice: Observations from an Indian pharmacy college

ABSTRACT

Today, it's getting harder to learn a career in pharmacy. In addition to self-guided individual learning, pharmaceutical educators are required to find and adopt ways that support higher-level thinking, collaborative learning, and student motivation. One strategy to achieve these aims is to develop and use case-based learning as an addition to traditional teaching techniques. They support learner-centered, small-group, interactive learning experiences as opposed to large-group, teacher-centered, didactic instruction. A cross-over study between two groups equally exposed to both didactic lectures and case-based pedagogy musculoskeletal system diseases and drug therapy; which involves assessment of perception and small group responses towards case-based learning. The outcome of which is further investigated by administering an objective structured clinical examination. The vast majority of the students reported satisfaction with case-based learning sessions and highly appreciated this method of teaching pharmacotherapy of musculoskeletal system diseases. In our study, more than 93.22% of the students opined that they enjoyed sessions and it held their interest and motivated them to learn better. The 't-test between post-test 1 and post-test 2 scores was statistically significant with a P value of 0.0001. This suggests that CBL is effective in students' learning, and reinforces important concepts, strengthening information retention and long-term memory. In conclusion, the perception of pharmacy practice students towards case-based learning is highly contented and encountered a very positive impact on understanding and retention of knowledge in musculoskeletal system diseases and drug therapies.

Keywords: Cross over, didactic lectures, perception, post-test, pharmacy practice.

1. INTRODUCTION

Clinical and technological advances are challenging the traditional paradigms of education and training for millennial graduates at a record-breaking rate, calling for a significant shift in pharmacy and pharmaceutical sciences education toward a continuum of professional growth. Students to be successful in the academic path need to acquire four core competency sets: knowledge, skills, attitude, and values; pharmaceutical educators are encouraged to find and implement ways to promote higher order thinking, and collaborative learning and to increase students' motivation. Complementing traditional instruction with case-based learning (CBL), problem-based learning (PBL), or simulation-based training (SBT), supported in authentic contexts, is one strategy for achieving these goals.

It is incumbent upon academic programs to move students from learning the material to applying that knowledge in a meaningful way [1]. Many health professions programs, including medicine, pharmacy, dentistry, and nursing, currently experimenting with variations of case-based learning to address this problem and to prepare the learner for the unexpected [2-6]. Furthermore, CBL allows the learner to go beyond knowledge acquisition in the pedagogical process and proceed to the point of knowledge application.

Case based learning allows students to develop a collaborative, team-based approach to their education [7], and promote authentic learning [8]. The implementation and assessment of CBL is well documented in various levels of biomedical sciences such as Medicine [9-11], Anatomy [12], Thyroid disease [13], glycogen metabolism and its regulation [14], Geriatrics [15], Nursing [16], Therapeutics and Medicinal Chemistry [17], Pharmaceutics [18], Obstetrics and Gynecology [19], Dental [20] and Allied Health [21]. In our observation, literature is very dwarf in the incorporation of case-based learning in pharmacy education and practice in developing and industrialized countries like India, which mandated a transformed teaching-learning process for better rational practices with expanded patient care responsibilities. It is our goal with this text to share our experience in the design and implementation of a case-based approach to pharmacotherapeutics in musculoskeletal system diseases

2. MATERIAL AND METHODS

The experimental exploratory study of six months duration (October 2021 - March 2022) approved by the institutional review board (RIPER/IRB/PP/2021/008) was performed among students pursuing pharmacy practice program, to assess: (a) the perception of students towards case-based learning, and (b) the effectiveness of case-based learning in understanding and retention of knowledge in musculoskeletal system disease of pharmacotherapeutics course (rheumatoid arthritis, osteoarthritis, and gout).

The cross-over study between two groups of students equally exposed to both didactic lectures and case-based pedagogy in musculoskeletal system diseases and drug therapy; included assessment of perception and small group responses towards case-based learning. The outcome of which is further investigated by administering an objective structured clinical examination.

Study Procedure

The study was carried out on PharmD (3^{rd} and 4^{th} Year) students, after obtaining prior permission from the Research and Development Cell and Institutional Review Board of the institute, through a structured framework involving the following steps: (i) Six clinical cases were prepared for the case-based learning sessions, in consultation with the faculty of department of pharmacy practice RIPER Autonomous. (ii) The topics covered in the clinical cases were rheumatoid arthritis (RA), osteoarthritis (OA), and gout. (iii). CBL session questions will be validated and finalized based on faculty member inputs. (iv). During the CBL session, the students will be divided into subgroups. (v). Each subgroup will be provided with handouts of the clinical case scenario a week before the session, and will be asked to study the case. (vi). Group A will have three CBL sessions (each on RA, OA, and gout) whereas Group B will have three DLs (didactic lectures) on the same topics. (vii). The students exposed to CBL will be administered with a questionnaire to assess the students perception, and the same group will be administered with another set of three cases for small group discussion and interactions and their experiences and responses will be documented. (viii). After three sessions, the cross-over of groups will be performed. (ix). Group A will have three (DLs) didactic lectures (each on RA, OA, and gout) whereas Group B will have three CBL sessions on the same topics. The students exposed to CBL will be administered with a feedback form, and the same group will be administered with another set of three cases for small group discussion and interactions and their experiences and responses will be documented. (x). CBL sessions and didactic lectures will be conducted in the lecture hall and each lasted for a minimum of 60 to 90 minutes. (xi). Feedback questionnaires for students were designed, validated, and pretested with colleagues and students from the previous batch. The students' feedback form had two parts: (a) The first

part: to assess perception towards CBL (5-point Likert Scale), and (b) The second part: to assess the small group experiences towards CBL case studies discussion (Close-ended questions). (xii). Post-test was conducted for the entire group of students immediately after the three CBL and DL sessions were completed, and then a repeat test was taken after 6 weeks duration from the first post-test. (The post-test was in an objective structured clinical examination - OSCE format).

3. RESULTS

3.1 Characteristics of study participants

In our study out of 59 student participants, 27.12% were male and 72.88% were female, in which 61.02% belonged to PharmD 3rd year and the rest 38.98% were PharmD 4th students respectively, results of which are presented in Table 1.

Table 1. Characteristics of study participants

Program and Year	Gender distribution		Total (n%)
	Male (n%)	Female (n%)	
PharmD III Year	9 (25)	27 (75)	36 (61.02)
PharmD IV Year	7 (43.75)	16 (56.25)	23 (38.98)
Total	16 (27.12)	43 (72.88)	59

3.2 Student perception towards case-based learning

The study participants experienced case-based learning in musculoskeletal system disease and pharmacotherapy, facilitated by the researcher followed by which feedback form designed with 5-point Likert scale was administered to assess the study participant's perception of sessions.

The vast majority of students expressed satisfaction with CBL sessions and great appreciation for this approach to teaching musculoskeletal system illnesses and drug therapy. CBL sessions were liked by more than 93.22% of students because it kept their attention and motivated them to learn more. Many students (52.54 %) felt that the cases taught in CBL sessions posed many challenging questions that helped them prepare for and improve clinical problem-solving. Students also opined that CBL improved their ability in terms of physical examination/drug monitoring skills/laboratory investigations interpretation. About (72.88%) of the students agreed that the case presented was relevant to the program and course curriculum. The majority of the students (93.22%) were in favor of CBL sessions in terms of benefits for knowledge retention and long-lasting memory. However, only (47.46%) stated that the cases facilitated active discussion, the responses of which are presented in Table 2.

Table 2. Student perception towards case-based learning

S. No	Inventories	5 Point Likert Scale				
		Strongly Agree	Agree	Neutral	Class Mean	SD
1	The cases were engaging and includes multiple disciplines	93.22	6.78	0	1.07	0.254
2	The case presented were pertinent to curriculum and program	72.88	27.12	0	1.27	0.448
3	The presentation/course was well-structured	76.27	22.03	1.7	1.25	0.477
4	The cases prompted lively debate	47.46	52.54	0	1.53	0.504
5	Case-based learning is beneficial to traditional teaching and learning methods	54.24	45.76	0	1.46	0.502
6	CBL enhanced laboratory investigation interpretation, drug monitoring, and physical examination skills	76.27	23.73	0	1.24	0.429
7	CBL enhanced my capacity to formulate therapeutic plans	62.71	37.29	0	1.37	0.488
8	CBL trained us for solving clinical problems	52.54	40.68	6.78	1.49	0.569
9	CBL promoted communication between the facilitator and the students	52.54	45.76	1.7	1.49	0.537
10	CBL teaching and learning process was enjoyable	71.19	27.12	1.7	1.31	0.5

3.3 Small group case-based learning response

In current study, pharmacy students of Group A and Group B after experiencing the CBL sessions were sub-divided into small sub-groups, and administered with another set of three cases. The observations of discussion, interactions, and experiences towards small group case-based learning established that female student responded more positively to tasks undertaken in the initial discussion sessions, responses of which are presented in Table 3.

Table 3. Small group case-based learning response

S. No	Inventories	Yes		No	
		Male	Female	Male	Female
1	The session had a clear goal and purpose	16	43	0	0
2	Have you engaged in the small group discussion	16	38	0	5
3	Have you become more adept at analyzing the evidence and the case's background	16	36	0	7
4	Have you developed the capacity to make predictions and suggestions	15	40	1	3
5	Have you become more competent at presenting the point clearly	16	39	0	4
6	Sessions were beneficial for learning new skills	16	35	0	8
7	The concept map for each case study was helpful	16	42	0	1
8	Small group formulated learning objectives	15	42	1	1
9	Session emphasized teamwork	16	42	0	1
10	Facilitator would have fostered the conversation better	9	40	7	3

3.4 Response towards objective structured clinical examination (OSCE) post-test 1 versus post-test 2

The outcome of case-based pedagogy towards musculoskeletal system disease and pharmacotherapy among pharmacy practice students was evaluated through objective structured clinical examinations with 20 inventories administered twice to the students, as post-test 1 (for investigating the understanding), and the post-test 2 (for investigating the retention) with a time-interval difference of 6 weeks. The completed response sheets were collected and statistically analyzed to compute the results using Microsoft Excel and SPSS version 26. Qualitative data were expressed in the form of percentages and the quantitative data were expressed in the form of mean ± standard deviation. Student's "t" test was used to compare post-test 1 and post-test 2 scores and expressed in terms of "p" value. The value of $p<0.0001$ was considered statistically significant, the results of which are presented in Table 4.

Table 4. Response towards objective structured clinical examination (OSCE) post-test 1 versus post-test 2

Inventories	Post-test 1			Post-test 2		
	Male (n = 16)	Female (n = 43)	Total (n = 59)	Male (n = 16)	Female (n = 43)	Total (n = 59)
Q 1	14	36	50	15	38	53
Q 2	8	28	36	10	33	43
Q 3	14	36	50	15	39	54
Q 4	12	29	41	13	33	46
Q 5	7	27	34	10	34	44
Q 6	14	25	39	15	32	47
Q 7	14	24	38	15	30	45
Q 8	14	28	42	15	33	48
Q 9	14	28	42	15	35	50
Q 10	14	28	42	15	34	49
Q 11	11	16	27	13	28	41
Q 12	11	37	48	13	39	52
Q 13	10	29	39	12	35	47
Q 14	12	34	46	13	38	51
Q 15	14	37	51	15	39	54
Q 16	13	32	45	14	37	51
Q 17	13	33	46	14	36	50
Q 18	14	28	42	15	32	47
Q 19	14	35	49	15	37	52
Q 20	14	23	37	15	31	46
P value		0.0001*			0.0001*	

3.5 Comparison of the students score in the post-test 1 and post-test 2

In our study, the post-test 2 scores after 6 weeks of CBL sessions were significantly better than post-test 1 scores. The 't' test between post-test 1 and post-test 2 scores was statistically significant with a P value of 0.0001, which suggests that CBL is effective in students' learning, and reinforced important concepts, and thereby strengthens information retention and long-term memory, results of which are presented in Table 5.

Table 5. Comparison of the students score in the pre-test and post-test

Post-test	Mean ± SD		P value
1	12.55 ± 2.139	13.85 ± 1.631	0.0001
2	29.65 ± 5.422	34.65±3.200	0.0001
Total	42.2±7.561	48.5±4.831	0.0001

4. DISCUSSION

Case-based learning involves guided inquiry and is grounded in constructivism whereby students form new meanings by interacting with their knowledge and the environment [22]. In Medical [23-32], dentistry [33-38], nursing [39,40], occupational and physical therapy [41] or pre-health students, case-based learning demonstrates the use of clinical reasoning, suggests pertinent testing, develops a differential diagnosis, and therapeutic plan. CBL is an effective method of teaching–learning and the prospects of incorporating the same within the curriculum to make the learning more simplified and authentic has been explored by medical colleges in India [42,43]. The worldwide literature on case-based learning in pharmacy and pharmaceutical sciences available is minuscule. To the best of our knowledge, this study is the first of its kind performed to evaluate the perception, and effectiveness of case-based learning in terms of understanding and retention of knowledge among pharmacy practice students in India.

In our study, the basic characteristics of study participants showed nearly three-fourth of female (72.88%) students in comparison to male (27.12%), similar observations have been reported by Crawford et al, 2012 [44]. The perception of pharmacy practice students of our study towards case-based learning facilitated self-directed learning and team building capacity, in addition interest and inclination for enhancement of critical analysis and decision making in musculoskeletal system disease and pharmacotherapy, observation of which were consistent with other similar studies [45,46].

Small-group case-based learning is an effective strategy for facilitating interprofessional learning, with interaction factors influencing student interest, learning, and satisfaction [47]. In our study, female student responded more positively to tasks undertaken in the initial discussion sessions, similar observation has been reported by Peplow et al, 1998 [48].

The current cross over study between two groups of pharmacy practice students equally exposed to both didactic lectures and case-based pedagogy in musculoskeletal system diseases and drug therapy revealed significantly higher learning, observations of which are similar to CBL studies performed in medical students [49-52].

In our study, the post-test 2 scores after 6 weeks of CBL sessions were significantly better than post-test 1 scores; which showcases retention of knowledge was well facilitated through case-based learning in pharmacy practice students. Ciraj et al, 2010 [53] and Bowers et al, 2022 [54] observed the same in medical microbiology course.

5. CONCLUSION

In conclusion, the perception of pharmacy practice students towards case-based learning was highly contented, which encountered a significant outcome in terms of understanding and retention of knowledge in musculo-skeletal system diseases and drug therapies. The Indian professional pharmacy curriculum should facilitate integration of case-based learning into the students' daily instruction across all facets in order to adapt to the changing demands of the profession.

CONSENT

As per international standard or university standard, Participants' written consent has been collected and preserved by the author(s).

ETHICAL APPROVAL

The institutional review board of the institute approved our study protocol with approval number (RIPER/IRB/PP/2021/008).

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ABBREVIATIONS

CBL: Case-based learning; PBL: Problem-based learning; SBT: Simulation-based training; IRB: Institutional Review Board; PP: Pharmacy Practice; PharmD: Doctor of Pharmacy; RA: Rheumatoid Arthritis; OA: Osteoarthritis; DL: Didactic Lectures; OSCE: Objective Structured Clinical Examination; SPSS: Statistical Package for Social Sciences.