



# Perceptions of Pharmacy Students on the Application of Problem-based Learning Approach in Renal Pharmacotherapeutics

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## Authors' contributions

*This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.*

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## ABSTRACT

The millennial pharmacists are often concerned with solving problems related to a patient's health, and achievement of desired therapeutic goals that improve the patient quality of life in the practice of their profession. In Indian pharmacy education, there is very little research on problem-based learning. The current study was performed to investigate pharmacy practice student experiences

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towards problem-based learning in pharmacotherapeutics in south India. The current exploratory research aimed to assess the perception of pharmacy practice students towards pharmacotherapeutic course for renal diseases through small group problem-based pedagogy, and its end assessment of understanding through a 20 inventories objective structured clinical examination reflecting each case study. On a microscopic observation, student awareness of therapeutic courses in the renal disease has been considered more satisfied. Student reactions show that they find PBL sessions beneficial in their learning, and helping them understand basic scientific concepts. In addition, students reported that PBL session encouraged collaborative and self-directed learning, improved clinical decision-making and problem-solving skills, and helped them identify their strengths and weaknesses in the process of this program. In conclusion, the problem-based pedagogy of pharmacotherapeutic course for renal diseases gained a great momentum among pharmacy practice students and appraised objective structured clinical examination as an efficient tool for PBL assessment.

**Keywords:** *Approaches to learning; problem-based learning; pharmacotherapeutics; student experiences.*

## ABBREVIATIONS

ACCP	: American College of Clinical Pharmacy
IRB	: Institutional Review Board
OSCE	: Objective Structured Clinical Examination
PBL	: Problem-based Learning
PharmD	: Doctor of Pharmacy
PP	: Pharmacy Practice
RIPER	: Raghavendra Institute of Pharmaceutical Education and Research
WHO	: World Health Organization.

## 1. INTRODUCTION

The first problem-based learning (PBL) curriculum belongs to the Mc Master Medical School in Hamilton, Ontario, which was started in 1969 after three years of planning [1], is one of the most consolidated learning methods in the medical curriculum. It is an approach that puts a strong emphasis on student-driven learning and encourages the development of many transversal competencies. Problem-based learning pedagogy in comparison to traditional teaching strategies showcased a better academic performance among pharmacy students [2]. Through problem-based learning, pharmacy students demonstrated positive learning behavior, knowledge, skill, and attitude [3]. A pharmacist's job often involves resolving health-related issues for patients, often as part of a healthcare team. As a consequence, the contents of most curricula of pharmacy degrees should be primarily adapted to address the growing role of pharmacists as clinical or therapeutic consultants [4]. Since 2000, the use of PBL in pharmacy education has grown

dramatically. PBL is a teaching approach that prioritizes student needs and promotes the growth of problem-solving skills in real-world contexts [5]. Problem-based learning 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 have been explored in pharmaceutical education [6-8]. In Indian pharmacy education, there is very little research on problem-based learning. To the best of our knowledge, this study is the first of its kind performed to investigate pharmacy practice student experiences towards problem-based learning in pharmacotherapeutics in south India.

## 2. MATERIALS AND METHODS

### 2.1 Study Design

The current exploratory study was performed to assess the perception of pharmacy practice students towards the pharmacotherapeutic course for renal diseases through problem-based pedagogy and its outcomes by objective structured clinical examination in a south Indian pharmacy institute.

### 2.2 Study Criteria

Students enrolled in the institute's PharmD-level pharmacy practice program in their third year, whose curriculum included pharmacotherapeutics course II having renal diseases were included, but those enrolled in other years were excluded.

### 2.3 Study Duration

Six months (October 2021 - March 2022).

## 2.4 Study Procedure

### 2.4.1 Design of a pharmacotherapeutic course

PBL was functionally applied at Raghavendra Institute of Pharmaceutical Education and Research (RIPER) Autonomous in the pharmacotherapeutic course for third-year PharmD pharmacy practice students in renal system disease. Topics covered were basic pathophysiology with emphasis on diseases, choice of medication and dosing regimen, individual variability in drug response, side effects, and important drug interactions.

### 2.4.2 Course structure

The small group PBL (main teaching resource) method is used by dividing students into 5 to 10 in each group with a facilitator, working on the seven jump PBL method [9]; (1) Clarify terms and concepts not readily comprehensible, (2) Define the problem, (3) Analyze the problem (brainstorming), (4) Draw a systematic inventory of the explanations inferred from step 3, (5) Formulate learning goals, (6) Collect additional information outside the group, and (7) Synthesize and test the newly acquired information.

The group meets for about 90 minutes twice a week. They define the problems, analyze the problems, and formulate the learning objectives for a specific case during the first meeting (Steps 1 to 5). At the second meeting, they synthesize the information gathered (step 7). Students are individually responsible for their self-directed learning between group sessions (step 6).

The course employs written case studies in order to stimulate discussion. Cases describe a patient as well as his or her main problem or situation while conveying information that allows students to critically analyze the problem. This course employs a variety of case formats, but cases are typically brief stories with a single focus. Each clinical theme is followed by a classroom discussion in which the groups present their findings. These discussions also include brief student lectures of 10 minutes duration on specific topics.

### 2.4.3 Feedback from study participants

Feedback questionnaires for students were developed, validated, and pretested with colleagues and previous batch students. The

students' feedback form had two parts: (1) to assess perception towards PBL (5-point Likert Scale) - 10 inventories, and (2) to assess the small group experiences towards (open-ended feedback) the course teaching - 5 inventories.

### 2.4.4 Evaluation

Finally, an individual written examination (objective structured clinical examination - OSCE) and presentation conclude the course. Students are expected to demonstrate a critical analysis of a variety of patient cases in terms of the appropriate use of drugs in individual patients. The examination reflects the method of instruction used in this course.

## 3. RESULTS AND DISCUSSION

### 3.1 Student Perception towards Problem-based Learning

The study participants of 36 PharmD pharmacy practice students experienced pharmacotherapeutic course in thematic area of renal system disease, focusing on acute kidney injury, chronic renal failure, and drug-induced renal disease. The components of pharmacotherapeutic course were designed to incorporate cognitive and significant learning [10] related to the competencies of pharmacy practice; which involved a detailed encounter on etiopathogenesis of diseases, disease and drug monitoring, disease and drug therapy management, and drug-related problems, provided by the facilitator using problem-based pedagogy for clinical and pharmacotherapeutic decision making.

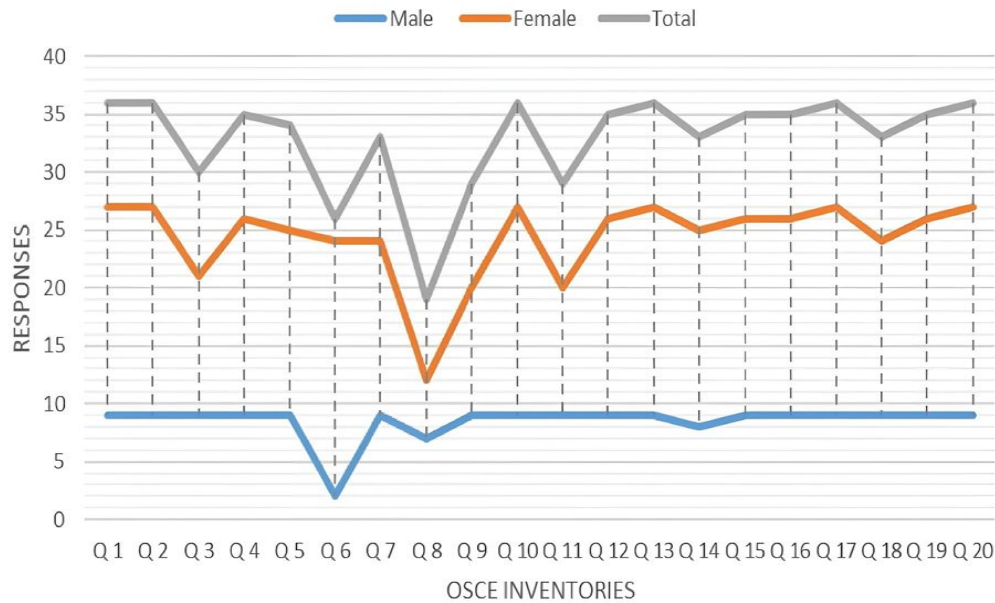
In our study, by using a validated and pretested feedback form, the perception of student participants was evaluated. The observations revealed that students' perceptions of the pharmacotherapeutic course learning in renal disorders were more positive, responses of which are presented in Table 1.

### 3.2 Student Response towards OSCE Inventories

In our study, the outcomes of the pharmacotherapeutic problem-based course in renal disease were assessed using 20 inventories of objective structured clinical examination (OSCE) questions, developed to tailor PBL cases.

**Table 1. Student perception towards problem-based learning**

S. No	Inventories	5 Point Likert Scale			Class Mean	SD
		Strongly Agree (%)	Agree (%)	Neutral (%)		
1	I was aware of the learning objectives and goals for this course	52.78	47.22	0	1.47	0.506
2	I was able to complete the learning outcomes and learning objectives, as the course was effectively designed	58.33	41.67	0	1.42	0.500
3	The course was manageable for me	33.33	66.67	0	1.67	0.478
4	I was motivated to continue learning about this topic after the training	88.89	11.11	0	1.11	0.319
5	I feel that I have achieved the course's learning goals and outcomes	44.44	55.56	0	1.56	0.504
6	The instruction medium was quite good	52.78	41.67	5.56	1.53	0.609
7	Excellent presenting techniques were used	66.67	30.56	2.78	1.36	0.543
8	I could follow the facilitator's explanations	52.78	44.44	2.78	1.50	0.561
9	The facilitator used interactive teaching techniques	33.33	63.89	2.78	1.69	0.525
10	Overall, the facilitator was successful in helping me achieve the learning objectives and outcomes	47.22	50	2.78	1.56	0.558



**Fig. 1. Students Response towards OSCE Inventories**

The current study found that students enrolled in pharmacy practice received very satisfactory learning results from a pharmacotherapeutic course on renal diseases that was taught using a problem-based pedagogy that covered a wider range of topics, including competency, interpretations, problem-solving, and decision-making, and allowed for consistent testing of students for a variety of clinical questions.

Moreover, we found that the objective structured clinical examination (OSCE) is a versatile instrument [11-13] for evaluating the problem-based teaching and learning process in pharmacy practice, responses of which are presented in Fig. 1.

### 3.3 Discussion

The current study showcased that the facilitator's integration of the pharmacotherapeutic course with stimulating case discussions in small groups made the teaching-learning process for the students more realistic [14] and effective strategy for facilitating interprofessional learning, with interaction factors influencing student interest, learning, and satisfaction [15]. Through the use of problem-based learning techniques and a 20-item OSCE, our study found that pharmacy practice students learned about renal illnesses in a way that was very satisfying. In our study, positive effects of PBL on student learning

associated with optimal learning performance were observed, in comparison to several previous studies in the areas of collaborative [16] and self-directed learning [17], decision-making, critical thinking and problem-solving [18-21] which helped them identify their strengths and weaknesses in the learning process.

Despite the fact that our observations indicated that pharmacy practice students had better perception and performance in the problem-based learning course on renal disease pharmacotherapy. The findings are based on a small number of participants that may not truly reflect the diversity of pharmaceutical education. Academicians and researchers should consider gradually introducing PBL methods into Indian pharmacy practice course curricula and perform research, doing so is likely to improve the quality of teaching and academic performance among students.

### 4. CONCLUSION

In conclusion, students greatly valued the problem-based pedagogy used in the teaching-learning process of renal pharmacotherapy course, which enabled, enhanced, and transformed deep learning in pharmacy practice. Future investigations on PBL should concentrate on experimental plans that gauge results more closely tied to educational outcomes.

## 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/2021/003).

## COMPETING INTERESTS

Authors have declared that no competing interests exist.

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