

# Project-Based Learning in Pharmacology during COVID-19 Lockdown for Second Phase Medical Undergraduates

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## ABSTRACT

**Introduction:** Project-based learning has both constructionist as well as constructivist principles that engage the students in autonomous deep learning.

**Aim:** To obtain the perceptions of participants on project-based learning in the subject of Pharmacology during COVID-19 lockdown.

**Materials and Methods:** This was an online questionnaire-based descriptive study done on the Google platform. A series of integrated lectures were conducted in the Department of Pharmacology and Internal Medicine on diabetes, lipid dysfunction and thyroid disorder for second year MBBS students. The study was conducted from August 2020 to November 2020 in a medical college in Kerala, India. Google-based project submission was done after identifying a patient at home or neighbourhood with the disease covered after each integrated lecture. A validated questionnaire was used to obtain feedback about the project-based learning on a Likert scale. Statistical analysis was done using the Statistical Package for the Social Sciences (SPSS) Version 16 software for Windows.

**Results:** The response rate was 76.9% (100 out of 130). The majority of the participants agreed/totally agreed to statements on professional attributes attained during project-based learning session like the ability to think creatively (60%), make observations (81%), compile information (80%), assess and make a decision (59%), analyse situations of professional practice (65%), develop oral communication skills (57%), develop Self-Directed Learning (SDL) (70%), develop skills needed for professional practice (54%), develop empathy towards patients with disease (79%) and develop self-confidence in learning the subject (63%) with a median score of 4. The majority of participants agreed/totally agreed to the effectiveness of the project-based learning in helping acquire various clinical and theoretical competencies during COVID-19 lockdown. The majority of the participants and the patient identified at home were happy to be part of the project-based learning.

**Conclusion:** The majority of the participants were in agreement with the questions posed to them with a median score of 4, however, a neutral opinion was obtained on the acquisition of written communication skills as well as their family members having better compliance after getting involved in project-based learning.

**Keywords:** Competence, Coronavirus-2019, Integrated lectures, Likert scale, Perceptions, Questionnaire

## INTRODUCTION

Active learning improves and enhances the outcome in medical education [1]. Pharmacology is a paraclinical subject, taught in the third, fourth, and fifth semesters (second phase) of MBBS intending to impart a strong foundation in therapeutics [2]. Application-based learning in medical education can involve clinical projects that incorporate complex tasks, based on challenging questions or problems that involve students in problem-solving, decision making, or investigative activities. Projects allow students to work relatively autonomously over extended periods which culminate in realistic products or presentations [3].

Now a days, meaningful active learning with the application of concepts is replacing rote learning [4]. Meaningful learning in pharmacology involves the acquisition of useful knowledge with horizontal and vertical integration. In medical education, problem-based learning has been widely implemented to apply the knowledge to the resolution of clinical cases [5]. However, project-based learning which is more common in other higher education degrees like engineering is not used frequently with medical students [6].

With the worldwide lockdown imposed due to the Coronavirus Disease (COVID-19) pandemic, the medical students were devoid of their usual pattern of learning which included clinical postings in rotations in various departments in the morning hours and series of lectures/practicals during the afternoon hours. This newly devised project-based learning concentrated mainly on the history-taking skills and clinical examination and management of patients with diabetes mellitus, abnormal lipid profile, and thyroid functions from among their accessible family/relatives/friend's circle [7]. During the

lockdown the second phase medical undergraduates could utilise the opportunity to learn from the available resources at home. Each session consisted of an integrated paired lecture by the investigators which helped the participants to imbibe the pharmacology of widely prescribed drugs for diabetes, lipid dysfunction, angina, and thyroid disorders as well as comprehensive approach to the clinical management of these patients [7]. This study was done to describe the perceptions of second phase medical undergraduates on project-based learning done at home during COVID-19 lockdown.

## MATERIALS AND METHODS

This was a descriptive study done for a period of four months, from August 2020 to November 2020 on online platform conducted by Department of Pharmacology, Government Medical College, Kottayam. An Institutional Review Board (IRB Clearance No: 48/2020 dated 18/08/2020) permission was obtained. The second year medical undergraduates (n=130) were taken as the sample population.

**Inclusion criteria:** All the students in the sample population who responded to the project-based learning activities and willing to participate after giving informed consent were included in the study.

**Exclusion criteria:** Incompletely filled questionnaires were excluded from the study.

## Project-Based Learning

In pharmacology, usually Adverse Drug Reactions (ADRs) are followed-up and submitted as projects by each student which add on to their internal assessment. However, from 10<sup>th</sup> March 2020, lockdown in various phases was initiated in the country which is

still continuing. So, the authors planned an integrated project-based learning which could be completed at home. This project-based learning involved integration with the Department of Medicine and was carried out by taking integrated online lectures on topics like hyperlipidaemia, diabetes mellitus, and thyroid disorders [7]. Each session lasted for two hours, one hour a day in which faculty from Pharmacology and Medicine gave a comprehensive coverage of the drugs used and practical aspects in the clinical management of hyperlipidaemia, diabetes mellitus, and thyroid disorders. Following each session, a Google fill-out form was sent which involved learning the topic by involving a patient/relative/friend of the student, suffering from the specific disease. The form contained questions regarding lifestyle changes like diet, exercise, lab investigations, other concomitant diseases, drugs used for treatment, and a case-based scenario question. This was to keep the clinical skills of the students active during the lockdown as well as to engage them in active learning.

A questionnaire was prepared based on the previous studies [1,3-5]. The construct validity was done by formal opinion on each item by the faculties in the Department of Pharmacology. The questionnaire was piloted among 10 undergraduates from the same setting. The questionnaire has 34 items pertaining to cognitive, affective, and communication domain on project-based learning. The responses were recorded on a five-point Likert scale with increasing order of agreement (1-Totally disagree to 5-Totally Agree) [8]. The response to each question was presumed to be the score of that question. The

internal consistency of the instrument was assessed for reliability using Cronbach's coefficient alpha which was 0.96.

## STATISTICAL ANALYSIS

The data were downloaded in an Excel sheet and analysed using the SPSS Version 16. The perceptions regarding project-based learning are expressed as frequencies, percentages, and median scores.

## RESULTS

Out of the 130 participants of project-based learning, 100 responded to the questionnaire (response rate-76.9%). There were 64 females and 36 males. The mean age was 21.05±1.01 years. The participants agreed/totally agreed that project-based learning sessions helped them to think creatively (60%), make observations (81%), and compile information (80%). The median score for all items except participant's opinions on the usefulness of project-based learning in making decisions around the real-life situation and the development of written communication was 4 [Table/Fig-1].

As summarised in [Table/Fig-2], the participants agreed/totally agreed that the project-based learning sessions helped them in creating interest and motivation to learn and understand pharmacology (76%), take the opportunity to learn clinically from home during lockdown (74%), orient themselves clinically during lockdown (64%), and establish connections between theory and practice (68%). The median score for all the items was 4.

The project-based learning sessions helped me to	Strongly disagree	Disagree	Neutral	Agree	Strongly agree	Median (IQ)
Think creatively	2	7	31	49	11	4 (3,4)
Make observations	3	4	12	15	66	4 (4,4)
Compile information	1	2	17	70	10	4 (4,4)
Assess a patient and make decision	1	4	36	50	9	4 (3,4)
Analyse situations of professional practice	1	3	31	53	12	4 (3,4)
Make decisions around a real situation	1	10	39	45	5	3.5 (3,4)
Develop oral communication skills	2	10	31	51	6	4 (3,4)
Develop written communication skills	3	13	42	39	3	3 (3,4)
Develop Self-Directed Learning (SDL)	1	4	25	55	15	4 (3,4)
Take a self-directed attitude to the learning process	1	5	33	47	14	4 (3,4)
Develop skills needed for my professional practice	1	12	33	47	7	4 (3,4)
Develop an empathetic feeling towards patients with the disease	0	4	17	54	25	4 (4,4,75)
Develop self-confidence in myself in learning the subject	4	9	24	51	12	4 (3,4)

[Table/Fig-1]: Professional attributes attained during project-based learning session.

The project-based learning sessions helped me to	Strongly disagree	Disagree	Neutral	Agree	Strongly agree	Median (IQ)
Increase my interest and motivation for learning pharmacology	3	5	16	52	24	4 (4,4)
Understand the theoretical contents in pharmacology	1	2	21	66	10	4 (4,4)
Help me orient clinically during lockdown	2	8	26	51	13	4 (3,4)
Take the opportunity to learn clinically from home during the lockdown	2	9	15	56	18	4 (3,4)
Establish connections between theory and practice	1	8	23	58	10	4 (3,4)
Ask questions relevant to history-taking in the disease	1	4	23	54	18	4 (3,4)
Collect data regarding a disease	1	2	11	66	20	4 (4,4)
Know about the suitable investigations	1	8	33	48	10	4 (3,4)
Analyse the clinical management of a disease	2	0	24	58	16	4 (3,4)
Think about the cost incurred to the patients	1	4	20	59	16	4 (3,25,4)
Get an idea about the cost of medicines prescribed for the disease	1	4	20	59	16	4 (3,25,4)
Investigate the need for regular follow-up of non-communicable diseases	1	5	19	66	9	4 (3,25,4)
Follow-up my relative/friend regarding the disease	3	9	23	56	9	4(3,4)
Clear doubts regarding the disease	2	6	32	50	10	4 (3,4)
Communicate about aetiopathogenesis of disease with family/friend	2	3	11	52	32	4 (4,5)
Communicate the control of disease to my family member/friend	1	5	20	52	22	4 (3,4)
Plan strategically for effective control of the disease	1	5	43	43	8	4 (3,4)

[Table/Fig-2]: Project-based learning as a method for attaining clinical competencies during the COVID-19 lockdown.

In the feedback on the project-based learning, the participants agreed that they felt happy in being a part of the project and did the project sincerely (81%), family members were cooperative (87%) and had a median score of 4. However, they were neutral (3) on the statement that family members or friends had better compliance after the project [Table/Fig-3].

Feedback on project	Strongly disagree	Disagree	Neutral	Agree	Strongly agree	Median (IQ)
Feel happy in being a part of the project	2	4	13	56	25	4 (4,4.75)
Did the project sincerely	0	2	17	54	27	4 (4,5)
My family members/ friends were cooperative for the project	0	4	9	57	30	4 (4,5)
My family members/ friends have better compliance after this project	2	4	47	39	8	3 (3,4)

[Table/Fig-3]: Feedback on the project.

## DISCUSSION

Project-based learning, though complex, is student-centred and involves the building of knowledge and skills. It gives the learner autonomy and yet has elements of competency to be attained [9]. In this study, participants identified patients with diabetes, lipid dysfunction, and thyroid dysfunction at home or neighbourhood or from the friend's circle. Eighty-one percent of the participants opined that they were happy to be a part of the project and did the project sincerely. Seventy-four percent considered it as an opportunity to learn clinically from home during the COVID-19 lockdown, and 64% agreed that they got clinically oriented to some extent during the COVID-19 pandemic while eliciting history and examining the patients at home. Ramya C et al., opined that medical educators need to innovate newer methods that keep the students interested and imbibed in learning [10]. Seventy-six percent of participants agreed that project-based learning sessions were interesting and motivated them to learn pharmacology during the lockdown.

Experiential learning helps in better retention and problem-solving capacity than rote learning. Kershaw G et al., proposed that project-based learning in the area of public health and health promotion resulted in increased interest and valuable skills among second-year medical undergraduates [11]. In this study, the majority of participants opined that the series of project-based learning helped the participants to think creatively, make observations, compile information, and indulge in self-learning. The participants agreed that acquiring skills required in professional practice such as oral communication, the ability to assess or analyse situations with competence as well as develop empathy towards patients. A study done by Tayade MC, opined that students learn better with project-based learning than the traditional form of learning [12]. In project-based learning, the process of learning is intended to be social, authentic, meaningful, and controlled, resulting in socially relevant and meaningful outcomes. It involves both constructivist as well as constructionist forms of learning [9].

In the new curriculum proposed by the Medical Council of India (MCI), we identified the competencies (a) PH1.31/IM2.18- Discuss and describe the indications, formulations, doses, side effects, and monitoring for drugs used in the management of dyslipidaemia; (b) PH1.36/IM 11.16- Discuss and describe the pharmacologic therapies for diabetes their indications, contraindications, ADRs, and interactions; (c) PH1.36/IM 11.18- Describe and discuss the pharmacology, indications, ADRs, and interactions of drugs used in the prevention and treatment of target organ damage and complications of type-2 Diabetes, including neuropathy, nephropathy, retinopathy, hypertension, dyslipidaemia, and cardiovascular disease; (d) PH1.36/IM11.19- Demonstrate and counsel

patients on the correct technique to administer insulin; (e) PH1.36/IM12.13- Describe the pharmacology, indications, ADRs, interactions of thyroxine and antithyroid drugs; (f) PH1.36/IM12.14- Write and communicate to the patient appropriately a prescription for thyroxine based on age, sex, and clinical and biochemical status for the integrated lectures and projects were based on these competencies [13]. The majority of the participants opined that they could establish connections between theory and practice, ask questions and collect data relevant to eliciting a proper history and look into the suitable investigations and analyse the clinical management of a disease. They also got an idea of the cost of medicines prescribed to their patient identified at home. They also agreed having cleared doubts about the disease and communicate about prevention and control of the disease.

Project-based learning relies on formative assessment with ongoing feedback to help learners move through the process to eventual co-construction which involves conversation and discussion which is difficult to retrieve or reflect at a later stage [9]. However, in this series of project-based learning, all the Google forms were returned with feedback which ensured storage of data and further motivation of the participants. Charmode SH et al., opined that community-based service projects should be longitudinally incorporated in the medical curriculum to enable them to interact with the public about health surveys and awareness [14]. In this project-based learning, identification of the patient at home or immediate neighbourhood is infact the first step in a community-based service project. Eighty-seven participants agreed that their patient identified at home was cooperative for the project.

Kim KJ had devised a project-based learning approach to increase medical student empathy [15]. Empathy enables the identification of ones' situation with another's situation which is required in medical education. In this project, 79% agreed on developing an empathetic feeling towards patients with the disease. Ideally in project-based learning students work autonomously to investigate and respond to a real problem or challenge which helps in the deeper acquisition of knowledge with critical evaluation, decision-making, and SDL [5]. Loyens SMM and Rikers RMJP, stated that project-based learning is inquiry-based and is built upon the learner's past experiences [16]. It helps in high-level student motivation and good relationship with real professional practice. In this study also, the majority of participants agreed having exposure in decision-making, SDL, and develop skills required for professional practice.

In the west, project-based curriculum have been implemented in the medical curriculum as it provides students with real-time experience and challenges of life-long learning [17,18]. In this study, 70% agreed that project-based learning helped in SDL. Keator S et al., stated that apart from student autonomy, consistency is required in project-based SDL and since autonomy and consistency exert opposing forces a proper balance should be there in the expectations of student and teacher [19]. In the index study, majority of the participants were consistent in submitting the projects and they agreed that they were happy for being a part of the project and it helped them understand the theoretical concepts. Project-based learning done in microbiology and pharmacology pointed out that the students enjoyed the project and it increased their understanding and interest in the subject [20-22]. Nerurkar AB and Dhanani JV, opined that student engagement in the subject can be better achieved via clinical orientation [20]. In this study, the majority of the participants agreed that this project-based learning helped them to make connections between theory and practice.

### Limitation(s)

Project-based learning was based on patients identified at home and there was no way to cross-check the authenticity of the project done. The feedback was based on a self-administered questionnaire on Google Form and it could have been biased. This was a single institution-based study done in phase 2 MBBS students who

missed the clinical postings during COVID-19 lockdown. Authors concentrated only on competencies in pharmacology and internal medicine and did not include competencies from other departments which also had clinical postings during the second year.

## CONCLUSION(S)

The overall perceptions of second phase medical undergraduates on project-based learning done at home during the COVID-19 pandemic. A median score of 3.5 was obtained for the statement that they were able to make decisions in real-life situations. The majority of participants had a neutral opinion on the item of acquisition of written communication skills as well as their family members having better compliance after getting involved in project-based learning.

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