

# Process Oriented Guided Inquiry Learning: An Alternate Teaching Learning Method for Pharmacology Tutorial

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## ABSTRACT

**Objectives:** To assess the effectiveness of process oriented guided inquiry learning (POGIL): an alternate teaching learning method for pharmacology tutorial. **Methods:** This cross-sectional study involved 128 students comprising of two batches namely A and B having 64 in each of them. Their tutorial classes were utilized with disturbing their routine hours and topic for POGIL was announced one week prior to both the batches. On each session one batch was taught by conventional method and another batch was asked to POGIL method under supervision. On each session the group learnt by POGIL was scored higher respectively and it was statistically significant. **Results:** Out of 128 students, 74 were girls and 54 were boys, to avoid unconscious bias their tutorial attendance and average of formative assessment was carried and found to be insignificant with  $p$  value of 0.342 and 0.246 respectively. And in tutorial session on both session students learnt themselves under guided vision was scoring higher and it was statistically significant as well ( $p < 0.00214$  and  $p < 0.0417$ ).

**Conclusion:** Process oriented guided inquiry learning was found to be effective student centric method and marks obtained by POGIL teaching were higher. It could be effectively used as effective self-directed and innovative learning.

**Key words:** Self-directed learning, POGIL, Inquiry learning, Long term memory.

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DOI: 10.5530/jyp.2021.13.9

## INTRODUCTION

Self-directed Learning (SDL) is defined as learning on one's own initiative, with the learner having primary responsibility for planning, implementing and evaluating the effort. Self-directed learning is being promoted and hours dedicated for each subject in new Graduate Medical Regulations for undergraduate medical students pursuing Bachelor of Medicine and Bachelor of Surgery (M.B.B.S). It can pose challenges from planning to implementation, mentor preparedness to self-motivation of students to learn on their own. Exploratory and reflective ways of studying is still unmet process for Indian students and cannot be blamed because of decades of didactic lecture. Instead of fully self-guided learning we adopt and suggested a method called inquiry learning or as well-known as Process Oriented Guided Inquiry Learning (POGIL). It is a kind of self-directed learning under mentor without boredom where undergraduates tend to find their time effectively in employing it.<sup>1-3</sup>

It helps every student in a tutorial or self-directing learning class to create their own way, a plan and strategy to find their own way of learning. It kindles their intrinsic inquisitiveness. In a study by Brown *et al.* an optimistic conclusion was found, as there was a post learning increase in right answer for the module given and there were specific answers. In that study they concluded, an inquiry-based peer-assisted learning module increased students' engagement, practical bioinformatics skills and process-specific knowledge. In another study by Lyros Nybo in the context of exercise physiology it has been proved that in inquiry based step by step approach students understand better exercise physiology.

Pharmacology is complex in a manner in which student need to know lot of names and uses and adverse effects drug profile are mostly similar. Mechanism of action needs better understanding, self-realization rather than being taught simply as retention time in didactic lecture is very

less unless we involve them in the process.<sup>4-6</sup> In a study by Thea Vangs *et al.* it has been proved study by inquiry learning reduced memory decay and improves memory consolidation. There is no much available objective Indian studies in the field medicine and in pharmacology per se to determine the effectiveness of POGIL method, hence this study was undertaken in our scenario.

## METHODS

This study was undertaken among II MBBS students after obtaining institutional ethics committee approval and valid consent from the students. Full autonomy was maintained and students were advised that they can leave the study at any moment and anonymity will be maintained throughout the study. This cross-sectional study involved 128 students comprising of two batches namely A and B having 64 in each of them. Their tutorial classes were utilized with disturbing their routine hours and topic for POGIL was announced one week prior to both the batches.

Two concept oriented reasoning out type framework with respect to cardiovascular system, in the first week it was put forth how even non selective beta blocker that tend to constrict vessel like propranolol reduces blood pressure and for the second session role of diuretics and prostaglandins in kidney auto regulation, urine formation and how it undergoes drug interaction by administered non-steroidal anti-inflammatory drugs were asked to reason them in step wise manner. Students were divided during study tutorial period by simply randomization method itself, 64 students belonging to group A sent for conventional tutorial classes in the first hours. Similarly students

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**Table 1: Sample step by approach questions for undergraduate.**

1. What is non-selective beta blocker?
2. What is the function beta2 receptor in blood vessel?
3. What are the actions of propranolol in cardiovascular system?
4. Does non-selective beta blocker propranolol reduce high blood pressure?
5. How propranolol does reduce blood pressure by its action?
6. Mention other contributing actions of this rug to reduce blood pressure?

**Table 2: Sample step by approach questions for undergraduate.**

1. What are loop diuretics or high ceiling diuretics?
2. How do they reduce high blood pressure?
3. What are the role prostaglandins in kidney?
4. Why aspirin co-administration abolishes function of diuretic?
5. What is diuretic resistance?

**Table 3: Analysis of Process oriented guided inquiry learning (POGIL) finding in both sessions.**

Students (n)	Average score			Students (n)	Average score		
	Group A	Group B	'p' value		Group A	Group B	'p' value
Session I (128)				Session II (128)			
Total marks (15)	9.9	13.3	0.00214		9.7	7.2	0.0417

of B batch went for POGIL method of teaching in which constructive 6 questions were given to find the answers using their book or e book with or without help of facilitator. The concept taken was how even non-selective beta blocker like propranolol reduces hypertension?. To teach by POGIL method the six step by step questions framed as given in Table 1.

This was given in self-learning module and each student should find answer using either book or e-books step by step next question and write their answers within the time allotment of 45 min under guided supervision. In the fortnight section group A and B was interchanged and yet another concept was given as given in Table 2.

In this tutorial B group underwent conventional tutorial and A group learnt themselves by step by step POGIL approach.at the end of class again assessment was taken using multiple choice questions.

## RESULTS

Out of 128 students, 74 were girls and 54 were boys, to avoid unconscious bias their tutorial attendance and average of formative assessment was carried and found to be insignificant with  $p$  value of 0.342 and 0.246 respectively. In the current study analysis showed in the first session the average B batch mark was 13.3 when compared to A batch 9.9 ( $p < 0.00214$ ) and it was reversed in second session where A batch underwent POGIL outscored B batch with 9.7 versus 7.2 ( $p < 0.0417$ ). Subset analysis showed the difference in scoring pattern was equal in memory and applied based questions as well. MCQs were selected and subset analysis was done; only those questions within same average of difficulty index was selected. Careful planning was done to avoid bizarre distractors and to avoid double negatives.

## DISCUSSION

This observational study was carried to determine the effectiveness of process oriented guided inquiry method to be considered as an alternative to conventional tutorial hours in pharmacology teaching learning methodology.

Our study results were supportive in favor of POGIL method in two subsequent session conducted with utmost precautionary methodology. In developed countries it is successful method and tested even a decade older, study conducted by Stancy *et al.* among Pharm.D students showed inclusion of POGIL method improved their grades and it was published in their American Journal of Pharmaceutical Education. In an another

study it is concluded that that this method was not only effective and also enhance students higher level of thinking and helps to improve the grading system which was published by Robert Soltis *et al.* in the same journal in the year 2017. In another study it was shown to improve their problem solving skills after introducing process oriented guided inquiry method.<sup>7-10</sup>

It is advantageous blended two types of learning methods is always helpful, in our scenario POGIL was studied less and one study results published advances in physiology education which was showing positive corroboration with our study and in our database search we could not find any specific study that was contrast either to our methodology or to study results.<sup>11-13</sup>

POGIL on biological basis improves constructivism and learning cycle in long term; to help students learn to reason through problems, instead of using conventional memory based algorithmic approaches; to build conceptual understanding through active engagement with the material; to foster growth in teamwork and collaborative problem-solving skills.<sup>14-16</sup>

Hence from our study we suggest that process oriented guided inquiry learning can be effective tutorial method along with our conventional tutorials. In POGIL method student constant involved all the tutorial time allotted and he is not being passive learner in stipulated time. As mentioned in our introduction POGIL is accountable for self-directed learning which is very much emphasized. It should be conducted at many places and many times as repeatability improves long term outcome. In our open feedback session our students expressed this method particularly helpful pharmacodynamics and reasoning out section in pharmacology.<sup>17-20</sup>

Our study is not without limitations the POGIL and conventional method handled by two staffs only and hence monotonous was a possible. Assessment was done immediately and hence long term effects on repeatability were not assessed.

## CONCLUSION

Process oriented guided inquiry learning is an effective alternative method to conduct tutorials. More studies and repeated studies are in need in our scenario to understand its efficiency in long term.

## ETHICAL COMMITTEE APPROVAL

Obtained (ECR/724/Inst/TN/2015).

## ACKNOWLEDGEMENT

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## CONFLICT OF INTEREST

The authors declare no Conflict of interest.

## ABBREVIATIONS

**POGIL:** Process Oriented Guided Inquiry Learning; **MCQ:** Multiple Choice Questions.

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**Article History:** Submission Date : 29-10-2020; Revised Date : 15-12-2020; Acceptance Date : 26-12-2020

**Cite this article:** Chary KV, Karthik VP. Process Oriented Guided Inquiry Learning: An Alternate Teaching Learning Method for Pharmacology Tutorial. *J Young Pharm.* 2021;13(1):40-2.