



Process Oriented Guided Inquiry Learning as an Innovative Teaching Method in Clinical Biochemistry: Piloting of the Process

Gayathri Balasubramaniam

Department of Biochemistry, PSG Institute of Medical Sciences and Research, India

ARTICLE INFO

Received : 15/12/2014
Accepted : 13/03/2015
Published : 10/06/2015

ABSTRACT

Current teaching practices in clinical Biochemistry are focused on didactic lectures. It minimizes the understanding, retention of the subject and hence disengages the students from the learning process. Due to this the application of knowledge and problem solving skills among students are greatly reduced. Introduction of Process Oriented Guided Inquiry Approach (POGIL) an Innovative method in clinical Biochemistry teaching enhances the basic learning and problem solving skills in students. Introduced to teach diabetes mellitus in two sessions among students, POGIL was found successful. After the POGIL sessions, the student's performance improved markedly and they felt confident in their knowledge in diabetes mellitus. It also improved the communication skills, critical thinking and problem solving skills in students. This method if employed in successful years among larger volume of students shall be a very effective innovative teaching-learning method in clinical biochemistry.

KEYWORD

Guided Inquiry
Self-directed learning
Critical thinking
POGIL

©Medical Education Department, School of Medical Sciences, Universiti Sains Malaysia. All rights reserved.

CORRESPONDING AUTHOR: Gayathri Balasubramaniam, Associate Professor, Department of Biochemistry, PSG Institute of Medical Sciences and Research, India.
Email: drgayathrikeerthivasan@gmail.com

Introduction

Current teaching strategies in first year MBBS clinical biochemistry class rooms are more focused on didactic lectures. This minimizes the level of student understanding, comprehension and disengages students from the learning process causing information to be quickly forgotten. Process oriented Guided Inquiry Learning (POGIL) - a self-managed, student centred learning cycle format as an innovative strategy focuses on core concepts, encourages deep understanding of the subject and develop higher order thinking skills among students. POGIL in clinical biochemistry encourages full participation and accountability by each student. This transforms students into self-directed

learners and promotes them to be better physicians (1). With the effectiveness of POGIL in chemistry previously proved (2), here we introduce an application of guided inquiry approach in teaching diabetes mellitus through POGIL sessions to enhance the basic learning and problem solving skills in clinical biochemistry among first year MBBS students.

Method

Two POGIL modules on diabetes mellitus consisting of clinical problems, student's and facilitator's guide and a list of learning objectives were developed and administered to a small batch of six first year MBBS students after

they had undergone a routine lecture teaching session on diabetes mellitus.

4. Integrate the understanding of DM with the development of complications of DM.

The learning outcomes of the modules were,

1. Apply your understanding on the metabolic changes in DM.
2. Explain the metabolic basis for the complications of DM.
3. Interpretation of the clinical data with clinical features and diagnosis of DM.

The plan of a POGIL teaching session with specific roles of the students is given in table 1.

After routine lecture class, a questionnaire was administered to evaluate the performance of students. After the conduct of two POGIL sessions, a post test questionnaire was administered.

Table 1: Outline of a POGIL teaching session

Steps in POGIL learning process	Teacher's role	Component of the activity	Class Schedule
Identify a need to learn	Engage	An issue of Interest is given. Learning objectives are defined.	10 minutes
Connect to prior understandings	Elicit	A question or issue is raised, student's explanations are sought	10 minutes
Explore	Explore	A task is provided. Resource material is identified. Students explore the model in response to critical thinking questions.	25 minutes
Concept invention, introduction and formation	Explain	Critical thinking questions which lead to identification of concepts and understanding is developed.	20 minutes
Practice applying knowledge		Skill exercises involve the application of the knowledge.	20 minutes
Apply knowledge in new contexts	Elaborate and Extend	Extended problems require transfer of concepts	15 minutes
Reflect on the process	Evaluate	Problem solutions and answers to questions are validated and integrated with concepts. Learning and performance assessed.	20 minutes

The team roles included manager, recorder, spokesperson, reflector, skeptic and optimist.

Table 2: Student's perceptions on learning gains in POGIL sessions

To what degree do you agree with the following statements?	Levels, %					
	5	4	3	2	1	NA
1. The course materials helped me to prepare for the activity	67	33	0	0	0	0
2. The activities in POGIL helped me better understand the subject	84	0	16	0	0	0
3. Working with peers improved the skill of problem solving	100	0	0	0	0	0
5. Working with peers helped to solve complicated problems	67	33	0	0	0	0
6. Feedback on activities helped to understand the concepts	100	0	0	0	0	0
7. Working in groups made me less likely to give up on difficult problems	84	16	0	0	0	0
8. Working with peers outside of class helped me understand concepts	67	33	0	0	0	0
9. POGIL sessions made me more responsible for my own learning	100	0	0	0	0	0
10. The textbook helped me understand the concepts after POGIL sessions	67	0	33	0	0	0
11. Learning is better in lecture classes	16	0	0	84	0	0
To what extent did you make gains in the following as a result of POGIL sessions?						
1. Confidence in analyzing and interpreting data from the text	84	16	0	0	0	0
2. Confidence in my ability to solve new problems	84	16	0	0	0	0
3. Ability to think through a problem	100	0	0	0	0	0
4. Confidence in my ability to learn complex material	67	33	0	0	0	0
6. Ability to communicate through the sessions	84	16	0	0	0	0
8. Becoming a self-directed and self-reflective learner	100	0	0	0	0	0
10. Belief that I can learn and apply what I have learned in biochemistry	100	0	0	0	0	0
11. Tolerance of others/respect the opinion of others	100	0	0	0	0	0
12. Taking responsibility for my own learning	100	0	0	0	0	0

Levels: 5 – A great deal; 4 – A lot; 3 – Somewhat; 2 – A little; 1 – Not at all; NA – not applicable.

Results

Direct comparison on the student's performance before and after POGIL sessions showed that there was a considerable improvement in both the scores and skills on problem solving that require complex cognitive skills after the POGIL sessions. The mean score of the students after the regular lecture session was 18 ± 2.5 and after POGIL session was 27 ± 1.7 . Student's perceptions on learning gains in POGIL sessions based on Student Assessment of Learning Gains (3) are tabulated (Table-2)

Discussion

We have found that POGIL is ideally suited for teaching clinical Biochemistry among I MBBS

students. The results and performance of the students after POGIL sessions in post-test questionnaire were significantly better when compared with traditional classes. The magnitude of knowledge, the development of problem solving skills and to address new critical problems in clinical Biochemistry poses a difficult task for the students. Course goal of POGIL (table-3) is set by incorporating Blooms levels (4) in exploration, concept invention and applications into the sessions. It created positive interdependence, individual accountability, mutual support of learning, collaborate skills and self-assessment, which was explained as five elements of cooperative learning in groups as outlined by Johnson and coworkers(2) and described by Hanson.(5)

Table 3: Course Goals in POGIL.

Cognitive	Affective	Social	Lifelong learning
1. Acquire and master vocabulary of biochemistry	1. Obtain a belief in one's ability to learn and apply the material	1. Work cooperatively and demonstrate commitment to a group	1. Become self-directed: Initiate the learning process
2. Organize information Understand complex relationships in biochemistry	2. Advance intellectual, tolerance and integrity	2. Listen to and learn from peers	2. Become self-reflective: Review goals, purposes, outcomes, and new learning
3. Improve visualization and modeling skills	3. Set personal goals for improvement and ask for help	3. Value others	3. Become a self-assessor: Assess one's own progress for strengths, areas for improvement and insights into the learning process to continuously improve
4. Improve problem solving skills by asking questions and examining assumptions			
5. Analyze and interpret data Apply knowledge to new situations			
6. Develop the ability to select appropriate actions and/or tools			

Adopted from Lecture Free Biochemistry. A Process oriented guided Inquiry approach. Biochemistry and Molecular Biology Education. Minderhoutt et al (2007).

Almost all the students felt confident in understanding of biochemical concepts and applying it in clinical context, after POGIL sessions.

Students felt that they learn better when they are actively engaged in the structured learning format during the sessions, which improved their concept construction and understanding. About 84% of students reported that they developed greater confidence in analysis and interpretation of clinical biochemistry data. Students also felt that feedback given to during the sessions helped

them to acquire complete knowledge about the subject and made them to connect to prior understandings. This made them to extend their knowledge base with new concepts and it also created a rich learning environment among them.

Although the small number of student respondents limits the statistical analysis of data, we believe the findings are relevant because the results reflect the student's responses in various aspects of POGIL. Most students find the POGIL sessions transform them into self-directed

learners. With these observations and also with reports on previous studies (6), taking POGIL sessions for more number of clinical biochemistry teachings shall benefit the student community a lot.

Conclusion

Our implementation of POGIL in teaching diabetes mellitus in clinical biochemistry classes has been highly successful as evidenced by student's performance and their perception in acquiring higher order cognitive, social and affective skills. These skills would benefit the students greatly in their future professional lives.

Reference

1. D. Hanson, T. Wolfskill (2000) Process workshops—A new model for instruction, *J. Chem. Educ.* 77, 120–130.
2. D. W. Johnson, R. T. Johnson, K. A. Smith (1991) *Cooperative Learning: Increasing College Faculty Instructional Productivity*, The George Washington University, Graduate School of Education and Human Development, Washington, DC.
3. Student Assessment of Learning Gains. www.wcer.wisc.edu/salgains/instructor/ (copyright 1997).
4. B. S. Bloom, M. D. Englehart, E. J. Furst, W. H. Hill, D. R. Krathwohl (1956) *Taxonomy of Educational Objectives: The Classification of Educational Goals. Handbook 1: Cognitive Domain*, David McKay, New York.
5. D. Hanson (2006) *Instructor's Guide to Process-Oriented Guided-Inquiry Learning*, Pacific Crest, Lisle, IL.
6. Vicky Minderhout, Jennifer Loertscher.(2007) Lecture Free Biochemistry. A process oriented Guided Inquiry Approach.35,3,172-180.