

OPTIMIZING TEACHING FOR THE MSC STUDENT IN BIOMEDICAL SCIENCES THROUGH THE USE OF PROBLEM-BASED LEARNING

Authors: Suzan Karaoglan & Stella A. Nicolaou



Outline



- Introduction
- Aims & Objectives
- Research questions
- Methods
- Results
- Conclusion
- Acknowledgement
- References



Introduction

- Most problems that confronted with biological science education are:
 - How to approach teaching
 - Effective learning for students
- Common teaching methods
 - Lecture based
 - Novel



For Example:

- Problem-based learning (PBL) method is one of the teaching strategy that supporting:
 - The development of problem-solving skills
 - Critical thinking
- 
- 



Introduction



◆ What is PBL?

- PBL is an effective learning approach and promotes academic discussion [3].
 - Highlights the importance of teamwork and communication between learners [6].
 - Small group cooperative learning [6].
 - PBL uses "real world" problems [2].
 - PBL method can create a “science” or “discovery” spirit for students [3].
 - Supporting them to behave like “researcher” [3].
 - Improve their observation skills [3].
- 
- 



Introduction

The History

- PBL is firstly implemented by Howard Barrows in 1960s to medical students and it is still useful in this field [\[6\]](#).
 - Barrows was a neurology professor and he was the first person that proposed the original fundamentals of PBL technique [\[7\]\[6\]](#).
 - PBL was first approved by McMaster University in Canada [\[6\]](#).
 - Applied and promoted in the whole United States of America and Europe in 1970s [\[6\]](#).
- 
- 



Introduction

The Theory

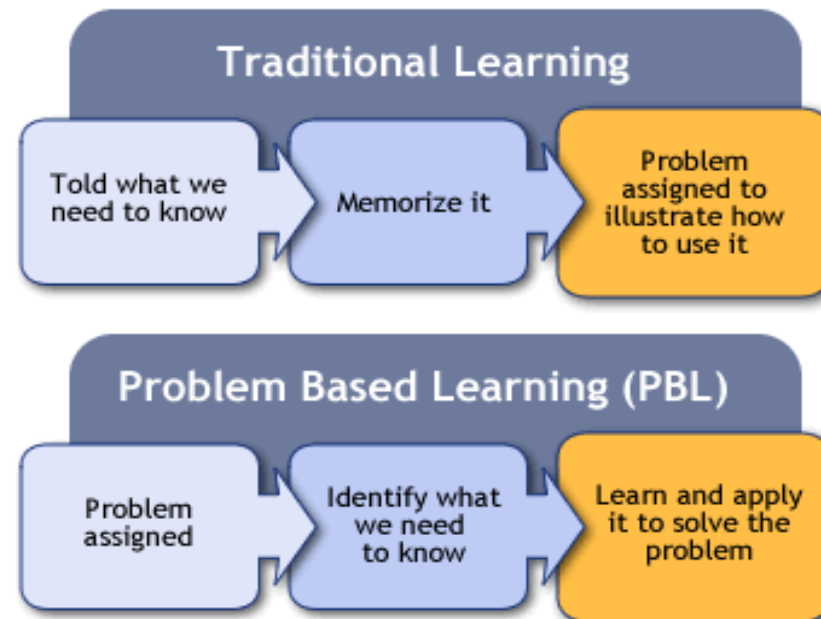
- PBL is a student centered approach, involves independent study [5]:
 - Investigations for new information and learn by themselves
 - After, transferring the new information to other students in a group-centered, hands-on setting and cooperative way [5].
- ✧ **Two** fundamental pedagogical principles underlie PBL [5]:
 - Students learn best,
 - (1) In groups [5].
 - (2) Also when they actively identify their knowledge gaps [5].
- According to Jones (2010) PBL model contain the ‘5E’ rule:
 1. Engage
 2. Explain
 3. Explore
 4. Elaborate
 5. Evaluate

Introduction

Nowadays

- PBL is expressed as a priority education strategy [3].
- Effective model that helps students to obtain essential skills [3].
- Recent studies have underlined the fact that the traditional teaching promotes passiveness among the learners [3].

Figure 1: Difference of two learning process [11]







Aims & Objectives

The aim :



- To evaluate the effectiveness of PBL in the 1st semester of Year 1 of the MSc Biomedical Science at the University of Nicosia and to optimize the learning
- Understanding how PBL might help or impede learning for different type of learners in this course.

The objectives:

- Evaluating their behavior during implementation of PBL .
 - Analyzing the student's learning preferences and their profiles.
 - Estimation of the skills that they gained at the end of the Fall 2017 period.
- 
- 



Research Questions

- 1) What are these postgraduate students' learning styles?
 - 2) What is the impact of PBL on these students' skills and class performance in their field of study?
- 
- 

Methods

Design of Research

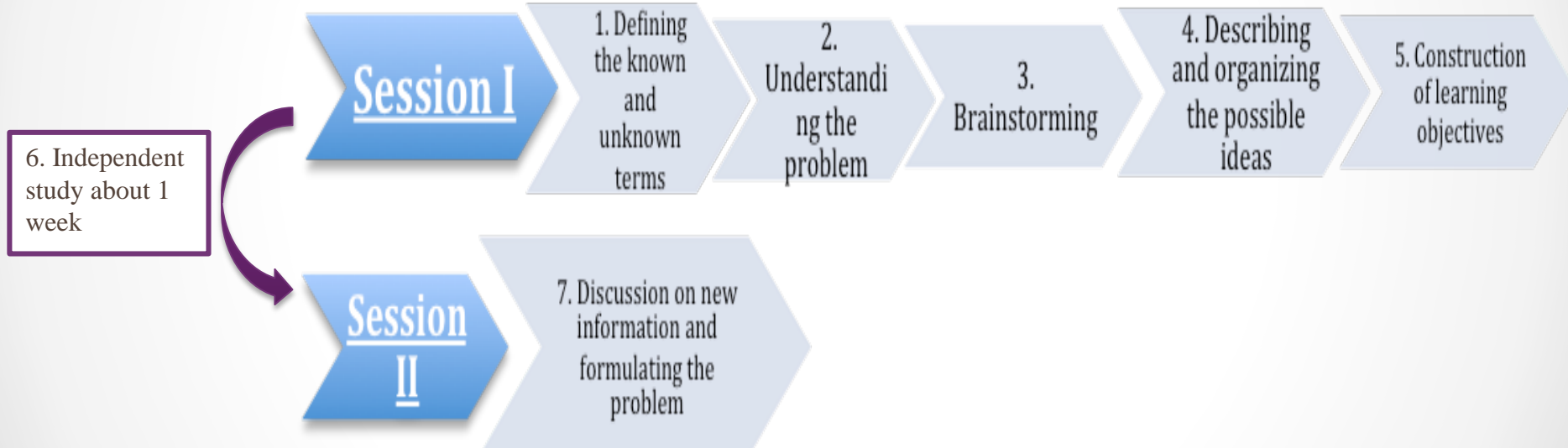
- Both qualitative and quantitative methods were used.
- Lecture based learning was used as a control
- Design of the four courses in MSc Biomedical Science program of 1st semester of 1st year shown in **table 1**.

Table 1: design of the content curriculum for four courses .

Course ID	Teaching styles
Bio-Analytical and Diagnostic Technology (BISC-512)	Full mode PBL
Cellular and Molecular Immunology (IMMU-541)	Hybrid mode PBL and lecture based learning
Molecular Genetics (BISC-532) -Control	Only lecture based learning
Pathological Basis to Disease (BISC-523) -Control	Only lecture based learning

Methods

Figure 2: Process of PBL that applied in both PBL sessions.





Methods

Participants

- MSc Biomedical Sciences students
- Total number: 17

Learning Style Questionnaires and Demographics

- The **Honey and Mumford Learning style questionnaire** was used to assess student-learning styles [4].
- This questionnaire involves **80 agree or disagree questions** in order to investigate the preferred learning styles of students.
- The four possible learning styles are: **activists, reflector, theorist and pragmatist.**
- **Demographics** were comprised mainly of yes/no questions to commit the personal profile of students.





Methods

Classroom observations

- Observations of PBL classes and non-PBL classes were conducted.
- A structured form was used
- Feedback and the views were provided from the teacher before and after the session.
- The observer included comments for students.

WHY ?

- To observe students' behaviors and class performance in PBL sessions and compare the observation data with non-PBL sessions.
 - To compare observer comments with teacher's feedback about strengths and weakness of students during each PBL and non-PBL sessions, individually.
- 
- 

Results

Honey Mumford Questionnaires

Table 2:Results of the Honey and Mumford questionnaire.

Learning styles	Number of student(s)	Percentage of Students (%)
Reflector	10	59
Activist	1	6
Theorist	3	18
Pragmatist	2	12
Reflector/Theorist/Pragmatist	1	6

- ✓ Reflectors learn best when [12]:
 - able to observe first
 - given time to think and investigate before acting
 - given an opportunity to review what has happened
 - doing tasks without tight deadlines.

Results

Demographics

Table 3: Outcomes of the demographics.

Categories	Number of student(s)	Percentage of students (%)
Gender	Female: 13 Male: 4	Female: 76 Male: 24
Age	Average: 27	Average: 27
Student status	Part time: 4 Full time: 13	Part time: 24 Full time: 76
Level of education	MSc: 14 PhD: 1 Bachelor's: 2	MSc: 82 PhD: 6 Bachelor's: 12
Employment	Yes: 7 No: 10	Yes: 41 No: 59
Last education	>1 y /a: 9 1-2 y/a : 6 >5 y/a : 1 5 y/a : 1	>1 y /a: 53 1-2 y/a : 35 >5 y/a : 6 5 y/a : 6
Learning disabilities	0	0
Local student(s)	15	88
International Student(s)	2	12



Results

1. PBL Classroom Observations (IMMU-541 & BISC-512)

- Students were engaged and enthusiastic during PBL sessions.
- They were fully engaged with this new teaching method.
- Five students' performance in PBL class observations:
 - ◆ 4 of them were extremely good in each PBL-classes even though it was their first PBL experience.
 - ◆ Applied the all characteristics of the PBL such as **communication, integration and sharing of the new information among the group members and cooperation, problem solving and well prepared during independent study.**
 - ◆ 1 of them was not fully engaged with the PBL process.





Results

2. Lecture-based learning classroom observations:

One observation was conducted.

Initial data indicated that the students:

- Not able to communicate & share & incorporate the new information with each other.
 - Could not transfer the new knowledge between themselves, instead lecturer transfer the new information to them.
 - According to this, students cannot develop essential skills during lecture based learning (when compared with PBL)
 - 2 out of 5 students were actively communicated with the lecturer such as they were asked questions and mostly they were answered the tutor's questions about the subject .
 - 5 of the students were extremely focused to the subject and tutor.
- 
- 

Conclusion

- Students seem to be **engaged with each other** and **with the subject** better during PBL sessions; they **transfer their ideas** with each other, use their **problem-solving skills** and these were **not evident** during the **non-PBL courses**.
- Preliminary data indicated that **PBL might be better suited** for postgraduate students in **some courses** and **subjects**.
- However, the lecture based teaching is necessary for **theory and background** information of the subject.
- Further study is warranted.

Acknowledgement

- I am very thankful to second author Dr. Stella A. Nicolaou, Program Coordinator of MSc in Biomedical Sciences, Department of Life Health Sciences and Dr. Maria Evagorou, Professor in Department of Education at University of Nicosia
- I am extremely thankful to the participation of students in MSc Biomedical Sciences program and University of Nicosia, Cyprus.

References

1. David, T. J., & Patel, L. (1995). Adult learning theory, problem based learning, and paediatrics. *Archives of Disease in Childhood*, 73(4), 357–363. [13 July 2017]
2. Drăghicescu, L.M., Petrescu, A., Cristea, G.C., Gorghiu, L.M. & Gorghiu, G. (2014), Application of Problem-based Learning Strategy in Science Lessons – Examples of Good Practice. *Procedia - Social and Behavioral Sciences*. 149, pp. 297-301. [online] [10/07/2017]
3. Gorghiu, G., Drăghicescu, L.M., Cristea, S., Petrescu, A. & Gorghiu, L.M. (2015), Problem-based Learning - An Efficient Learning Strategy in the Science Lessons Context. *Procedia - Social and Behavioral Sciences*, 191, pp. 1865-1870 [13 July 2017]
4. Honey, P., & Mumford, A. (1992). *The manual of learning styles*. Maidenhead: Peter Honey.
5. Jones, N.L., Peiffer, A.M., Lambros, A., Guthold, M., Johnson, A.D., Tytell, M., Ronca, A.E. & Eldridge, J.C. (2010), Developing a problem-based learning (PBL) curriculum for professionalism and scientific integrity training for biomedical graduate students, *Journal of medical ethics*, 36(10), pp. 614-619. [13 July 2017]
6. Kek, M.Y.C.A. & Huijser, H. (2017), "Towards an Ecology for Connected Learning". *Problem-based Learning into the Future*. 1st edn, Springer, Singapore, pp. 13-195. [ebook] [13 July 2017]
7. Zhang, Y., Zhou, L., Liu, X., Liu, L., Wu, Y., Zhao, Z., Yi, D. (2015). The Effectiveness of the Problem-Based Learning Teaching Model for Use in Introductory Chinese Undergraduate Medical Courses: A Systematic Review and Meta-Analysis. *PLoS ONE*, 10(3), pp. 1-24. [online] [10/07/2017]
8. Zhang, Z., Liu, W., Han, J., Guo, S., & Wu, Y. (2013). A trial of patient-oriented problem-solving system for immunology teaching in China: a comparison with dialectic lectures. *BMC Medical Education*, 13, (11), pp. 1-8. [online] [10/07/2017]
9. Ferreira, M., & Trudel, A. (2012). The Impact of Problem-Based Learning (PBL) on Student Attitudes Toward Science, Problem-Solving Skills, and Sense of Community in the Classroom. *The Journal of Classroom Interaction*, 47(1), pp. 23-30.
10. Ribeiro, L. R. C., Mizukami, M. D. G. N. (2005) Problem-based learning: a student evaluation of an implementation in postgraduate engineering education, *European Journal of Engineering Education*, 30(1), pp. 137-149.
11. Romero, A. (2015) Problem Based Learning (PBL) [Blog] *Enjoy Learning: Fun and Active Strategies for Classroom Use*. Available at: <http://ddctics.blogspot.com.cy>
12. Rosewell, J. (2005) Learning styles: Technology: Level 1 Networked living: exploring information and communication technologies. *The Open University*. Available at: http://www.open.edu/openlearn/ocw/pluginfile.php/629607/mod_resource/content/1/t175_4_3.pdf