

# Mathematics students' perception of Problem-based learning methodology toward proficiency

[ a case study : undergraduate mathematics students at the Islamic Azad University (Central Tehran Branch) ]

**Bahareh Nikbakhsh Tehrani**<sup>1</sup>, **Shabanali Safari Sabet**<sup>2</sup>

<sup>1</sup>Department of Mathematics, Science and Research Branch, Islamic Azad University,  
Tehran, IRAN

<sup>2</sup>Department of Mathematics, Central Tehran Branch, Islamic Azad University, Tehran,  
IRAN

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## ABSTRACT

This research is a case study of the application of the PBL method as applied to one of the undergraduate classes of Mathematics at the Islamic Azad University (Central Tehran Branch). The motivation for using this class was based on its availability. After completion of the training course using the PBL method, a questionnaire, comprised of 20 queries, was presented to the learners in order to study their perception of the problem-based learning method. The result of the students' perception of the problem-based learning method, shows that this learning methodology is effective and useful toward proficiency.

**Subject Classification:** Mathematics education

**Keywords:** Mathematics, Problem-based learning, proficiency, students' perception

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## 1. Introduction

Previous research had discovered that students are trained to develop critical thinking, are adaptable to change, able to work independently, demonstrate effective communication skills and become continual learners through problem-based learning (PBL). The PBL instructional strategy has promising implications in teaching and learning specifically in enhancing learning, thinking and communication among learners. It was popularized by Barrows and Tamblyn (1980) following their research into the reasoning abilities of medical students at McMaster Medical School in Canada. [2]

Students constantly ask why they need to study a subject or what use the information will be to them. PBL, answers these questions by placing learning in the context of real life. Students acquire new knowledge or skills to solve a problem or complete a task that is highly relevant to their lives. Problem-based learning deals with problems that are so close to real life situations as possible. [1]

Countries, developed in education, such as Canada and the United States, have considered using this approach in their educational systems. Using the PBL method, learners familiarize themselves with the practical aspects of the course content by solving problems. In this method, at the beginning of each class, practical and real life problems are presented. Interaction among learners in the class is one of the important points of this learning technique. Students are encouraged to collaborate in groups in order to be able to attain different skills. In the PBL method, the teacher's role in the management of the class time and its control is quite important.

## **2. Research Method**

In this research, the available case study was an undergraduate numerical theory class with 30 students with three orientation: educational mathematics, applied mathematics and pure mathematics in Islamic Azad University, Central Tehran Branch. During the ten session course, the researcher raised questions close to the real life related to the course issues, try to create a problem based learning environment in the classroom.

Due to the importance of learners' cooperation feature of the PBL method, while in the first session the students familiarized with the PBL method, they divided to the five person groups respectively. Since the ultimate goal of research was the investigation of the students' perception regarding to the PBL method. Therefore the questionnaire includes 20 questions was designed by the researcher and its validity and reliability were investigated. There was five options in the answer sheets : "completely agree", "agree", "no comment", "oppose" and "totally opposed" , these options has been considered in the order of grades five, four, three, two and one respectively. As an example, here is one of the questionnaire's questions:

***“Mathematic learning with the PBL method of learning math is more enjoyable than traditional method and learners feel less fatigue.”***

## **3. Lesson Plan**

To express practical issues associated with the course, in the first stage it is better to gather a collection of near real life problems related to the concept which could be interested for learners. In this way the groups act with high motivation to find solutions. As resources, you can find some typical near the real life problems in Parviz Shahriari's Book “ 99 mathematics problems” and Chystyakof's book” the historical math problems” which is translated to Farsi by Parviz Shahriari ,as well as some related sites in this regards. Puzzles and practical problems introduced in this research are related to divisibility, prime numbers and congruence concepts which are included as a main part of the number theory course.

When the lesson plan starts with definitions, formulas and complicated theorems, the learners are forced to memorize the course content instead to understand them exactly. While if the course begins with an explanation of a problem, learners will know the purpose of learning, and the learning motivation will be more.

#### **4. Analysis Method**

Content validity method was used for the questionnaire validity. Cronbach's alpha coefficient of total questions was 0.91 which represents the appropriate reliability of measurement tool used. For validity, the questionnaire was evaluated by several psychology and sociology professors specialist in evaluation and assessment, based on the results obtained from this primitive plan and consultation with supervisors and advisors, test questions were developed for research implementation.

To evaluate the research hypotheses, questions of questionnaire was divided into four parts.

#### **The research hypotheses are:**

- 1- "problem-based learning" method is effective in order to increase math skills
- 2- "problem-based learning" method is effective in order to enhance the emotional features of learners
- 3- Engage learners on their mathematics learning, has a positive effect
- 4- Increase in critical thinking has a positive impact on learning skills

For testing of four hypotheses, if normality is not rejected the test comparing the mean of a population parameter (single-sample t-student) and if normality of data is rejected non-parametric Wilcoxon single sample signed-rank test is used. In the first hypothesis, data is not normal so evaluation of this hypothesis should use the appropriate non-parametric Wilcoxon. In the second hypothesis, the data is normal so for this hypothesis the parametric test (single-sample t) could be used. Third and fourth hypothesis data are not normal so these hypotheses should evaluate by the appropriate non-parametric Wilcoxon test.

## 5.Results

### 1- “problem-based learning” method is effective in order to increase math skills

#### Wilcoxon Signed Rank Test

Test of median = 3.000 versus median > 3.000

	N for Wilcoxon	Estimated		P	Median
Hypothesis1	35	31	487	0.000	4.500

$$\begin{cases} H_0 : Median \leq 3 \\ H_1 : Median > 3 \end{cases}$$

$H_1$  : “problem-based learning” method is effective in order to increase math skills

### 2- “problem-based learning” method is effective in order to enhance the emotional features of learners

	Test Value = 3					
	t	df	Sig. (2-tailed)	Mean Difference	95% Confidence Interval of the Difference	
					Lower	Upper
hypothesis2	12.572	34	.000	1.27143	1.0659	1.4770

$$\begin{cases} H_0 : \mu \leq 3 \\ H_1 : \mu > 3 \end{cases}$$

$H_1$  : problem-based learning” method is effective in order to enhance the emotional features of learners

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**3- Engage learners on their mathematics learning, has a positive effect**

**Wilcoxon Signed Rank Test**

Test of median = 3.000 versus median > 3.000

	N for	Wilcoxon	Estimated		
	N	Test	Statistic	P	Median
Hypothesis3	35	34	595.0	0.000	4.000

$$\begin{cases} H_0 : Median \leq 3 \\ H_1 : Median > 3 \end{cases}$$

**H<sub>1</sub> : Engage learners on their mathematics learning, has a positive effect**

**4-Increase in critical thinking has a positive impact on learning skills**

**Wilcoxon Signed Rank Test**

Test of median = 3.000 versus median > 3.000

	N for	Wilcoxon	Estimated		
	N	Test	Statistic	P	Median
Hypothesis4	35	31	496.0	0.000	4.000

$$\begin{cases} H_0 : Median \leq 3 \\ H_1 : Median > 3 \end{cases}$$

**H<sub>1</sub> : Increase in critical thinking has a positive impact on learning skills**

*The result of the students' perception of the problem-based learning method, shows that this learning methodology is effective and useful toward proficiency.*

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#### References

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