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Comparative study of Problem Based Learning and Traditional Lecture Delivery- A case study

Prof. R. T. Patil

Associate Professor ETC Department, RIT Sakharale (MS), India
ramesh.patil@ritindia.edu

Abstract: In order to contrast the pedagogies and results, the class of final year, divided into two strings—The PBL string and the Traditional string. PBL class could not support a large size; the number was limited to 25. Traditional String was quite traditional with the students sitting in the classroom in rows, facing the teacher. The demarcation of Lecture, Tutorial and Practical classes was quite clear. The teacher gave lecture in lecture classes, made the students practice closed ended problems in tutorial classes and made the students do experiments in the practical classes, in a typical laboratory set up. For the PBL string, there was no structured plan in terms of delivery of content. However the teacher termed Facilitator - prepared a complete set of Technical Nodes and Learning Objectives. The role of the teacher was changed from the "content-delivery-man" to a facilitator

Keywords: PBL- Problem based learning, Traditional String, Knowledge and Skill Scores, Table Descriptive, ANOVA (Analysis of variance), Standard deviation

I. Introduction: Problem-based learning (**PBL**) is a student-centered pedagogy in which students learn about a subject through the experience of solving an open-ended problem. It is a learning method based on the principle of using problems as a starting point for the acquisition and integration of new knowledge. Students learn both thinking strategies and domain knowledge. PBL is characterized by a student-centered approach, teachers as "facilitators rather than disseminators," and open-ended problems (in PBL, these are called "ill-structured") serve as the initial stimulus and framework for learning. While working in groups, students identify what they already know, what they need to know, and how and where to access new information that may lead to the resolution of the problem. The role of the instructor (known as the tutor in PBL) is to facilitate learning by supporting, guiding, and monitoring the learning process. PBL represents a paradigm shift from traditional teaching and learning philosophy, which is more often lecture-based.

Steps involved in a PBL process:

1. Clarify terms and concepts not readily comprehensible.
2. Define the problem.
3. Analyze the problem (brainstorming).
4. Resolve issues based on prior knowledge.
5. Formulate learning objectives
6. Information gathering, (self-study)
7. Synthesize and test the newly acquired information

The methodology adopted for implementing PBL technique will be as given below

1. The course coordinator (tutor) will have to give an open ended (ill-structured) problem to students and not the lectures or assignments or exercises.
2. The role of course coordinator will be only to facilitate learning by supporting, guiding and monitoring the learning process.
3. Small groups of 2-4 students will be working on the problem given or presented by course coordinator.
4. These groups will usually meet twice a week for around 1-2 hours.
5. At the first meeting, the groups of students will be given a new situation or problem (trigger).
6. The students will have to identify the main issues and raise questions in order to find out the solution to the problem.
7. Period of 2-3 days is given for individual study. The group reconvenes again.
8. A group discussion and sharing of knowledge will be done.
9. At the end of the course, assessment of individual student will be carried out jointly by course coordinator based on the work done by students.

Illustrative Example

PBL is implemented at RIT for the course Embedded System Design Using MSP430 (PE-II) (EC408) with its evaluation scheme. The methodology adopted for implementing PBL technique & Evaluation Scheme adopted is as given below:

ISE: Evaluated for 20 marks based on different evaluation parameters.

MSE: Written exam is conducted and evaluated for 30 marks

ESE: Regular written exam. is conducted. After completing the module, the students are expected to meet the following learning outcomes:

1. Understand the design methodologies, techniques and test strategies used in the embedded system design.
2. Develop transferable skills in the use of computer tools to capture, simulate, verify and implement (on MSP430 launch pad) digital circuits/systems of different levels of complexity.
3. Demonstrate skills in teamwork, time management, collection and presentation of information, decision

making, report writing and oral presentation.

Assessment Method Used:

The assessment method of this module, laying the emphasis on PBL and split as 20% **ISE ,** 30% MSE and 50% ESE course work, was considered to stimulate Problem-Based Learning (PBL) in Embedded System Design Using MSP430 (PE-II) (EC408) learning and to be matching well the expected learning outcomes of the module.

Knowledge Scores Traditional & PBL String

MSE: Written exam is conducted and evaluated for 30 marks and **ESE:** Regular written exam of **100 marks** is considered to evaluate Knowledge scores in Traditional & PBL string. The Descriptive and the ANOVA tables are shown. From these descriptive tables it is found that the higher values of Mean in PBL groups and smaller values of Standard deviations, Results also compared with scilab tool.

ANOVA gives the idea about the scatter of the values of items of a variable in the series around the true value of average. In order to measure this scatters, in statistical called measures of dispersion. Important measures of dispersion are (a) range, (b) mean, and (c) standard deviation.

Table No.1 ANOVA in Excel

Summary Sheet

Groups	*Count*	*Sum*	*Average*	*Variance*
MSE 2016	22	434	19.72727	15.35065
MSE 2015	23	463	20.13043	18.84585

ANOVA

Source of Variation	*SS*	*df*	*MS*	*F*	*P-value*	*F crit*
Between Groups	1.8276	1	1.8276	0.1066	0.7455	4.0670
Within Groups	736.97	43	17.138			
Total	738.8	44				

Table No.2 PBL and Traditional scores using Scilab Tool

	N	Mean	SD	Mini	Max	Variance
MSE May 2016	24	19.875	4.426329	12	30	19.59239

	N	Mean	SD	Mini	Max	Variance
MSE May 2015	23	58.913	11.437	43	84	13.8102

Table No.3 ANOVA in Excel

Summary Sheet

Groups	*Count*	*Sum*	*Average*	*Variance*
ESE 2016	23	1502	65.30435	84.58498
ESE 2015	22	1289	58.59091	124.0628

ANOVA

Source of Variation	*SS*	*df*	*MS*	*F*	*P-value*	*F crit*
Between Groups	506.79	1	506.79	4.8793	0.0325585	4.0670
Within Groups	4466.188	43	103.8648			
Total	4972.978	44				

Table No.4 PBL and Traditional scores using Scilab Tool

ESE	**N**	**Mean**	**SD**	**Mini**	**Max**	**Variance**
May 2016	24	64.333	10.1752	42	86	103.5362
May 2015	23	58.913	11.4372	43	84	130.8102

Table No.5 PBL and Traditional scores

Exam	**N**	**Mean**	**SD**	**Min**	**Max**	**Variance**
MSE May 2015	23	19.652	3.84481	9	26	14.782609
MSE May 2016	24	19.875	4.42632	12	30	19.592391
ESE May 2015	23	58.913	11.4372	43	84	130.81028
ESE May 2016	24	64.333	10.1752	42	86	103.53623

Table No.6 PBL and Traditional scores

?	PBL string 2016, ESE		Traditional string 2015 ESE	
	Mean	SD	Mean	SD
Q1		2.1923		2.027
Q2	7.9726	1.247925	4.906467	1.1616
Q3	4.310133	1.2093	3.524633	1.1431
Q4	3.584533	1.3722	3.684967	1.213867
Q5	4.387667	1.195567	4.2	1.306867

Fig.1 shows the distribution of PBL String & Traditional string ESE scores. It also showed that while the PBL students scored much better in the internal component of the knowledge test.

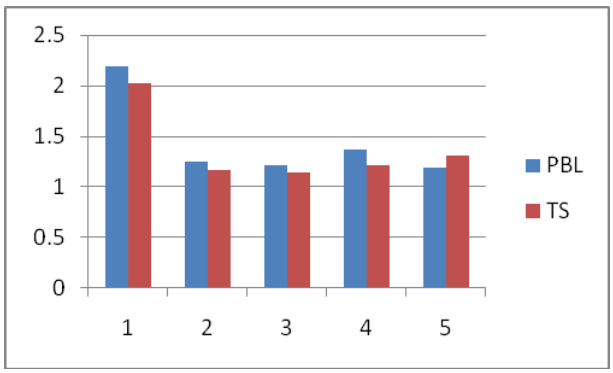

Fig. 1 Distribution of PBL & TS scores

Skill Scores Traditional & PBL String:

ISE: Evaluated for 20 marks based on different evaluation parameters & it is considered to evaluate Skill scores in Traditional & PBL string. The students are evaluated based on regularity in attending classes, participation in class room activities, discipline and behaviour in assigned work. The Descriptive and the ANOVA tables are shown. A remarkable difference was noticed in the skill test

Table No.7 PBL and Traditional scores

ANOVA in **Excel**

Summary Sheet

Groups	*Count*	*Sum*	*Average*	*Variance*
ISE 2016	24	426	17.75	1.3260869
ISE 2015	23	354	15.3913	7.1581027

Table No.8 PBL and Traditional scores

Two-Sample Assuming Unequal Variances

	Variable 1	*Variable 2*
Mean	17.75	15.3913
Variance	1.326086957	7.158103
Observations	24	23
Hypothesized Mean Difference	0	
df	30	
t Stat	3.896273582	
P(T<=t) one-tail	0.000253695	
t Critical one-tail	1.697260851	
P(T<=t) two-tail	0.000507391	
t Critical two-tail	2.042272449	

Conclusions

It is found that mean total evaluation score in the PBL group is higher than in the traditional group in our study. The higher values of Mean in PBL groups and smaller values of standard deviations. Standard deviation is a measure of the dispersion of a set of data from its mean. The deviation is higher if data spread apart is high. Mean deviation is the average of difference of the values of items from some average of the series. Such a difference is technically described as deviation.

References

[1] A. Mantri, S. Dutt, J.P. Gupta, and M. Chitkara, "Design and Evaluation of a PBL based Course in Analog Electronics," IEEE Transactions on Education, vol. 51, no. 4, pp. 432–438, Nov 2008.

[2] Nooshabadi, S., Garside, J, "Modernization of Teaching in Embedded Systems Design—An International Collaborative Project", IEEE Transactions on Education, Vol 49, Issue 2, May 2006 pp. 254 - 262.

[3] A. Mantri, S. Dutt, J.P. Gupta, and M. Chitkara, "Designing problems for problem-based learning course in Analog Electronics: Cognitive and pedagogical issues," Australasian Journal of Engineering Education, vol. 14, no. 2, pp. 33–42, 2008.

[4] Davcev, Danco, "Project based learning of embedded systems." *Proc. 2nd WSEAS Int. Conf. Circuits, Syst., Signal Telecommun*. 2008.

[5] Gann, David M., and Ammon J. Salter. "Innovation in project-based, service-enhanced firms: the construction of complex products and systems." *Research policy* 29.7(2000): 955-972.