

Attitude of secondary class students towards biology exposed through problem based learning

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Abstract

This study compared the effect of Problem-Based Learning (PBL) and lecture method on student's attitude towards biology studying in class ninth. The study was conducted on a sample of 188 students randomly distributed into experimental (n=93, taught through (PBL) problem based learning) and control (n=95, taught through lecture method) group. Both the groups were taught the same topics of biology by the same instructor for a period of 5 weeks. The data was collected via the pre- test and post-test administration of Biology attitude test. The results were statistically analyzed using SPSS software by employing both descriptive and inferential statistics (t-test). Results indicated that There was no significant difference in attitude of students towards biology taught by Problem based learning and lecture method.

Keywords: problem-based learning, control group, experimental group, attitude towards biology

1. Introduction

Learning to know has gradually been replaced by learning to understand in the education scenario today where the role of a teacher has changed drastically. With innovation in methods of teaching-learning process learning has become a fun and enjoyable activity but still the emphasis on rote learning has not been replaced. Problem based learning is an instructional method which has been in use in the field of medical science for more than forty years and has a tremendous potential in building and developing understanding of the concepts in learners of all age groups and in varied fields due to its constructive and collaborative nature. The attitudes are important to understand in order to enhance the interest and achievement of a child towards a particular discipline and field which may in turn affect his or her motivation to excel (Osborne, Simon & Collins, 2003) [13].

1.1 Concept of Problem Based Learning

Martyn, Terwijn, Kek and Huijser (2014) [12] illustrated Problem-based learning (PBL) as a pedagogy that is authentic and reflects situations for students in real-world and practice problem-solving skills by means of peer collaboration. In view of Monrad & Molholt (2017) in problem based learning the problem act as a trigger and motivator for learning and discovery and students experience decides what they will learn rather than the tutor dispensing the syllabic content. According to Smith & Hung (2017) [18], Problem-based learning (PBL) is an instructional way by which emphasis is laid on problem-solving and active participation of the students in the pedagogical process to learn the subject. Thakur and Dutt (2017) [19] defined problem based learning as the learning that is based on the problems that are realistic, ill structured and are challenging.

1.2 Concept of Attitude

In view of Baumeister, & Finkel, (2010) [2], Attitude consists of evaluative responses that are affective, cognitive and

behavioral. Affective refers to the positive and negative feelings associated with the attitude object, cognition reflects the evaluative beliefs about the attitude object, and behavior describes the overt evaluative actions and responses to the attitude object. According to Khine & Saleh (2011) [8] "Attitude can be linked to context, environment and upbringing and plays a major role in curriculum designing and choosing powerful pedagogies for nurturing students." In the present study attitude of students towards the subject of biology is studied.

2. Objective of the study

This study compared the effect of Problem-Based Learning (PBL) and lecture method on student's attitude towards biology studying in class ninth in Chandigarh, India.

3. Literature Review

Literature review related to the effect of problem based learning on attitude:

Rajab (2007) [16] study on attitude toward biology, Mantri, *et al.* (2009) [11] study in electronics and communication engineering; Chan(2011) [3] and Kazemi & Ghoraiishi, (2012) [7] studied on attitude towards mathematics, Yurick (2011) [21] and Ferreira & Trudel (2012) [5] studied on attitude towards science; Tosun and Senocak (2013) [20] studied on attitude towards chemistry, Batdi (2014) [1] meta-analysis of 190 studies have intimated a positive and significant effect of problem based learning on attitude.

Liu, HsuanHseih, Cho and Schallert (2006) [10] in their study on students of middle school attitude towards science, Kocakoglu, Turkmen, and Solak (2010) [9] in their study on high school students' attitudes towards courses in biology, Quain (2014) [15] research on high school students' attitudes towards geography have found no significant difference in the attitude of the students taught by problem based learning and lecture method.

Demirel & Dagyar (2016) [4] in their meta-analyticr esearch of

47 studies compared students' attitudes in PBL and traditional teaching found that problem-based learning has a positive but low effect on students' attitudes. PBL has a medium effect on students' attitudes toward science classes when compared to traditional teaching.

Thus, the study on effect of problem based learning on attitude has shown a mixed result with some studies intimating a significant difference between the Problems based learning and traditional method of teaching and some indicating non-significant difference which prompted the researcher for further investigation. Attitude towards biology was studied in the present study because biology is an important subject whose basic understanding and knowledge is used by an individual in day to day life.

4. Hypothesis

The null hypothesis formulated for the study was:

There will be no significant difference in attitude scores of students taught through lecture method and problem based teaching strategy in Biology.

5. Method and Procedure

5.1 Research Design

Pre-post-test experimental research design was employed where biology attitude test was administered before and after the treatment.

5.2 Population

A group of students in the age group of 13 to 16 years studying in Class IX, of Government Schools in Chandigarh affiliated to Central Board of Secondary Education (CBSE) with English as medium of instruction constituted the population of the study.

5.3 Sample

Initially 200 students participated in the present study. The actual results were analyzed on a sample of 188 students with PBL group comprising of 93 students which were further divided into groups of four students and the control group consisting of 95 students. The researcher did not disturb the normal set up of the classroom as both the groups constituted students of high, average and low intelligence as found out by the academic records of the students of previous class. The PBL group received biology instruction in PBL format and the control group received biology instruction with traditional teaching method i.e. lecture method in selected topics of biology like: The Fundamental Unit of Life, Tissues, Why do we fall ill, Improvement in food resources and Natural resources.

5.4 Tool Used

Attitude towards biology test developed by the investigator. Many students have the perception that biology is a difficult subject and student starts losing interest as they lack the basic

understanding. The attitude towards biology test was prepared by the researcher with the sole aim for identifying the effect of problem based learning method on the attitude of the students towards biology. Few items selected for the test were taken from Biology Attitude scale by Russell & Hollander (1975) [17] and Prokop, Tuncer and Chuda (2007) [14]. The student responded by indicating the degree to which he or she agrees or disagrees with a series of statements. The statements were either positive or negative, and there were an almost equal proportion of positive and negative statements. The student's total score, or attitude index, computed by totalling the adjusted scores on the individual items helped in finding of the attitude of the students. The items having discriminating power in the range of 0.60-0.80 were retained and the final test used in the study constituted 20 items. Test retest method was applied to find out the reliability of the test. The test was administered to same group of students after 15 days. Product Moment correlation was applied for finding out the reliability. The coefficient of reliability came out to be 0.70 which is quite stable. This means that the test to measure attitude towards biology satisfies the criteria of reliability. The items selected were based on dimensions like: interest, future career, difficulty level of the subject and importance of biology. The 5-point likert scale used was: SA-Strongly agree, A-Agree, UD-Undecided, D-Disagree, SD- Strongly Disagree. The positive statements were scored as SA-4, A-3, UD-2, DA-1, SD-0 and the negative statement as SA-0, A-1, UD-2, DA-3, SD-4

The total score of the whole test to measure attitude towards biology was 80. The test was designed not only to measure the attitude of students of 9th class but also to find out the change in attitude of students towards biology after teaching 9th class biology students by problem based learning method and traditional teaching method i.e. lecture method.

6. Procedure

The study was conducted at the start of new session of 2016-17 when students after passing class 8th entered a new class 9th and had negligible knowledge about the syllabus of class 9. The duration of the study was 5 weeks from April to May. The biology topics taught to experimental group was divided into 25 worksheets and to control group was divided into 25 lectures. The study was conducted parallel in both the groups. Each group taught through PBL was given one worksheet (Name of the group Members, Group Leader, What is the problem, What do we know about the problem, What information or resources will be needed to solve the problem, what should be done to solve the problem, solution, student notes for writing extra information or query if any) for each session. Students of PBL group were allowed to use science laboratory, computer laboratory and school library to collect data to solve the problem.

The procedure of implementing problem based learning in the present study is briefly described in figure 1 below:

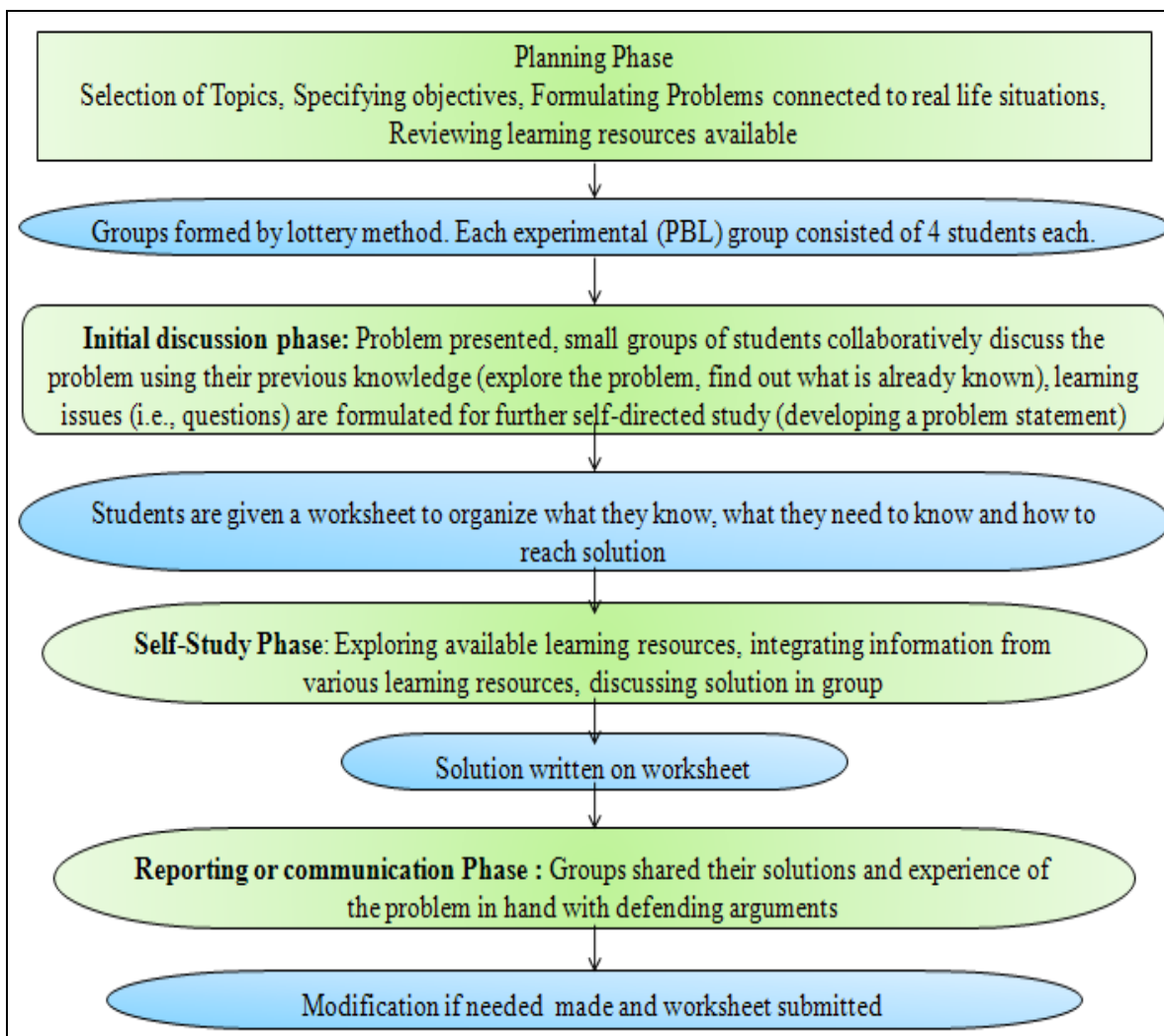


Fig 1: Procedure followed in implementing Problem Based Learning (PBL) strategy

7. Data Collection

The data was collected via the pre-test and post-test administration of attitude towards biology test. Although the study was conducted for teaching by problem based learning in group of four students but test to measure attitude towards biology was individually administered.

8. Statistical Techniques employed for Analysis of Data

Following statistical techniques were employed for analysis of the data collected by SPSS (Statistical Package for the Social Sciences):

1. Descriptive statistical techniques such as mean, median, standard deviation were computed to determine the nature of the distribution of data.
2. Differential analysis by using the t-test to analyze the effect of problem based learning.

9. Results and Discussion:

Table 1 indicates the descriptive statistics of pre-test data of experimental and control group attitude towards biology.

Table 1: Descriptive statistics of Pre Attitude towards Biology Score of Experimental and Control Group

Pre-test Score	N	Mean	Median	Standard Deviation	Skewness	Kurtosis
Experimental	93	42.82	43.0	11.240	-0.004	-0.083
Control	95	45.34	44.0	11.182	0.137	-.279

The value of standard deviation (11.240 for experimental and 11.182 for control group) of the sample represents the scattering of the scores from the mean position. The value of skewness of -.004 in experimental group and of 0.137 in control group shows that the distribution is negatively skewed in experimental group and positively skewed in control group. The negative value of kurtosis (-.083 and -.279) for experimental (PBL) and control group interprets the

distribution to be platykurtic. The mean of pretest score of experimental (PBL) group and of control group indicate that the students of both the group had an average attitude towards biology. Figure 2 represents the histogram for the scores of Pre Attitude towards Biology test of both Experimental and control group which has a bell shaped curve representing that the sample is normally distributed.

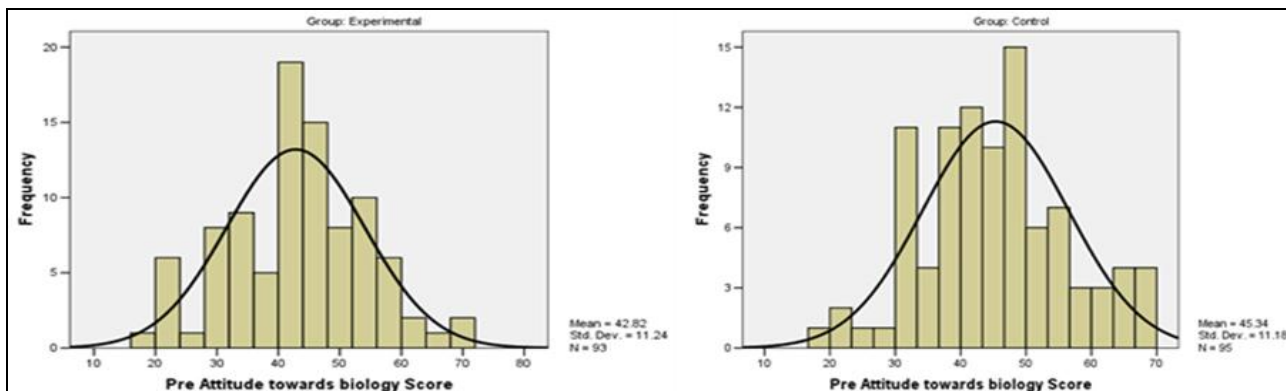


Fig 2: Histogram for scores for Pre Attitude towards Biology test for Experimental and Control Group

From Table 1, the value of median in both the groups is almost similar but there is a difference in the mean. To check whether

this difference was significant or not, t-test was applied as given in table 2.

Table 2: t-test comparing pre Attitude towards Biology test of Experimental and Control Group

Independent Samples Test							
	t-test for Equality of Means						
	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
						Lower	Upper
Pre Attitude towards biology	1.541	186	.125	2.520	1.635	-5.746	.707

Both the groups Experimental and Control group were matched for Pre Attitude towards Biology Score using t-test. The p-value of 0.125 was obtained which is more than 0.05 and hence non-significant, indicating that both the groups were equally matched on the basis of pre attitude towards biology score. Thus, before starting the actual experiment it was ensured that students in both the groups experimental and

control groups had nearly an average attitude towards biology. At the end of the experiment, attitude towards biology test was again administered to check the effect of experimental treatment. The descriptive statistics of post test data of experimental and control group attitude towards biology is given in table 3.

Table 3: Descriptive statistics of Post Attitude towards Biology Score of Experimental and Control Group

Post test Score	N	Mean	Median	Standard Deviation	Skewness	Kurtosis
Experimental	93	48.04	47.0	9.994	0.449	0.000
Control	95	46.25	46.0	7.840	0.417	-0.042

The value of skewness of 0.449 for experimental group and 0.417 of control group indicates that the distribution is positively skewed. The negative value of kurtosis -.042 for Control group interprets the distribution to be platykurtic and of 0.000 for Experimental group as leptokurtic. The mean for

post test scores of attitude towards biology of 48.04 for experimental group and 46.25 for control group indicates that there was a slight increase in the attitude of students towards biology in both the groups. But to check whether the increase was significant or not t-test was applied as given in table 4.

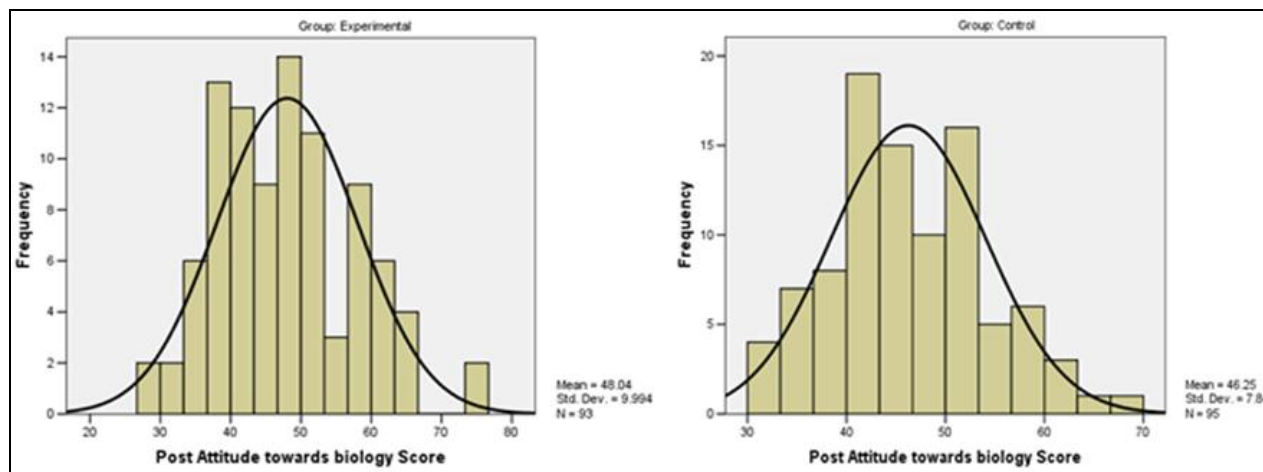


Fig 3: Histogram for scores of Post Attitude towards Biology test for Experimental and Control Group

Figure 3 represent histograms for the post test scores for attitude towards biology test for experimental and control

group which has a bell shaped curve indicating the sample to be normally distributed.

Table 4: Table representing t-test for Post Attitude towards Biology Score of Experimental and Control Group

Independent Samples Test								
	t-test for Equality of Means							
	t	DF	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference		
						Lower	Upper	
Post Attitude towards biology	1.368	186	.173	1.790	1.309	-0.791	4.372	

From Table 4, it was found that Experimental group who was taught class ninth biology by Problem Based Learning did not show any significant increase in attitude towards biology in comparison to the control group who were taught through Lecture method as the p value of 0.173 is more than 0.05. Hence, no difference in attitude towards biology was found in

experimental and control group. But to further find out whether the difference in the pre test scores and post test scores is significant, t-test was applied on the gain scores for attitude towards biology. (Difference of Post test scores and Pre test scores) given in table 6.

Table 5: Mean and Standard deviation for gain scores of Attitude towards biology

	Group	N	Mean	Std. Deviation	Std. Error Mean
Gain Attitude Towards Biology	Experimental	93	5.2258	11.70203	1.21344
	Control	95	.9158	10.05375	1.03149

Table 6: Table representing t-test for gain scores (Post-Pre) Attitude towards Biology of Experimental and Control Group

Independent Samples Test									
	Levene's Test for Equality of Variances		t-test for Equality of Means						
	F	Sig.	t	DF	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
								Lower	Upper
Gain Attitude Towards Biology	2.132	.146	2.711	186	.007	4.31002	1.59005	1.17316	7.44687

The gain score for attitude towards biology of experimental group and control group are highly significant as the p value is less than 0.05. Thus, we can say that there was a significant difference in the gain scores of experimental (PBL) group and control group. Experimental group who was taught by problem based learning depicted better gain scores than the control group who were taught class 9 biology by lecture method.

10. Conclusion

Thus, it was found that there is no significant difference in the secondary student's attitude towards biology taught through problem based learning and lecture method which is similar to the research done by Liu, HsuanHseih, Cho and Schallert (2006) [10], Kocakoglu, Turkmen, and Solak (2010) [9] and Quain (2014) [15]. The hypothesis that there will be no significant difference in attitude scores towards biology of students taught through lecture method and problem based teaching strategy in Biology is thus accepted. However, the hypothesis that there will be no significant difference in the gain attitude scores towards biology of students taught through lecture method and problem based teaching strategy in Biology is rejected as significant difference as given in table 6 was found between experimental and control group. The results support the findings of Rajab (2007) [16], Mantri, et al. (2009) [11], Chan (2011) [3], Kazemi & Ghoraiishi, (2012) [7], Yurick (2011) [21], Ferreira & Trudel (2012) [5], Tosun and Senocak (2013) [20] and Batdi (2014) [1]. Thus, we can say that there is a positive and significant change in the attitude gain of

students towards biology when taught through problem based learning.

11. References

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