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Effectiveness of Project Based Learning (Constructivist Learning Approach) on Students Achievement in Science at Secondary Level

Sumit Gangwar

Department of Education, School of Education, Mahatma Gandhi Antarrashtriya Hindi Vishwavidyalaya, Wardha, Maharashtra, India

Corresponding author: sumitgangwarhnbgu@gmail.com

ABSTRACT

Project Based learning (PBL) is a student centered instructional approach used to promote active learning by involving students in investigation real world issues in a collaborative environment. It gives learner's pace of learning, place and learner's control of time. PBL is a innovative teaching method and it is based on constructivist epistemology and pedagogy. In this method, children construct their own knowledge with their own experiences. The main object of the present study is to examine the efficacy of PBL on educational achievement in science at secondary level. This research is based on Pre-test Post-test Control Group Quasi Experimental Design. In this study, one secondary school was selected with the help of simple random sampling technique. All 60 students of class 9th of that school were included in research and they were divided in to two equal groups. There were 30 students in experimental group and 30 students in control group. Researcher used self-made APAT (Air Pollution Achievement Test) for data collection. The Pre-test of APAT administrated on both groups before starting the experiment. After it, the learning opportunities were given to experimental group through PBL and to control group through traditional method to learn chapter air pollution of science subject for 16 days. When treatment was over, Post-test of APAT was administrated by the researcher. An analysis of data was done using both descriptive (Mean, Median, Mode) and inferential (t-test) statistics after collecting data. Hypotheses were tested on 0.05 level of significance. After analysis of data it is found that the educational achievement level of experiment group is more than the achievement level of control group. That's by it is proved that PBL is more effective learning approach than traditional method to learn science.

Keywords: Effectiveness, project based learning (PBL), constructivist epistemology, achievement

There is a profound gap between knowledge student learn in school and the skills they need in typical 21st century communication and workplaces. To successfully face rigorous need of higher education courses, career challenges and a globally competitive workforce, school must align classroom atmosphere with real world environment by infusing 21st century skills into their teaching and learning process (Masalegoo, 2013). In the 21st century, in order to success in school, work and life, the core subjects like Science, English, Mathematics, History, Geography etc. must be expanded to include 21st century subjects such as global awareness, health and wellness, business and entrepreneurial literacy (Kilinc, 2010).

Traditional teaching is a one-way process, where teachers teach and students learn by rote, with most of the information coming from the teacher (Jha, 2009). Modern constructivist learning theories sees learning is an active process in which learners construct their own knowledge by interaction of their previous knowledge and current situations (Marsh, 2010).

Now-a-days our education system must focus on innovative teaching and learning practices such as inquiry based learning, stories telling method, problem solving method, brain storming CAI and project based learning (PBL) methods etc., so that students connect curriculum studies with real world life situation, develop high level thinking skill. Work in terms and develop a scientific temperament and attitude (Saxena, 2013). PBL can play a major role in developing such a classroom environment and bringing in a paradigm shift in education practices across the world (Jamuda, 2007). Project based learning is filled with active and engaged learning. It inspires students to obtain a deeper knowledge gained through this approach far more readily than through traditional textbook centered learning. In addition, students develop confidence and self-direction as they more through both team-based and independent work (Masalegoo, 2013).

PBL is founded upon constructivist principles (Jha, 2009). The focus of PBL is on real world problems (Saxena, 2013). The idea of PBL has roots in the progressive movement, which emphasized the importance of experiences in learning. Progressivists such as John Dewey & Killpatrick advocated the use of group work on investigate project and learning by doing instead of rote memorization (Bell, 2010).

PBL is a comprehensive, deep learning approach to classroom teaching and learning that engages students in the investigation of authentic Problems (Blumenfild *et al.,* 1991). Project Based Learning is a dynamic approach to teaching in which students explore real-world problems and challenges, simultaneously developing cross-curriculum skill while working in small collaborative group or individual (Bhatnagar & Bhatnagar, 2013). Project may focus on the development of a product or performance, and they generally call upon students to organize their activities, conduct research solve problems, and synthesize information (Al-Balushi & Al-Aamri, 2014).

Rational of the Study

Quality in science education is very much essential so that accepted objectives can be achieved. The provision of quality education is the fundamental rights of all the students in India (Nath & Srivastava, 2015). Science is the subject which deals vary day by day experiences of the human being. For the acquiring of knowledge in the field of science we need to generate a lot of trusted amongst the students. The performance of students enhanced with the help of PBL in science education. In PBL approach, learners construct their own knowledge in real life situation. Due to this importance of PBL the researcher wants to take up the study Effectiveness of Project Based Learning (Constructivist Learning Approach) on Students Achievement in Science at Secondary Level. The findings of this study may be useful for educationist, researchers, teachers and teacher educators.

Objectives of the Study

The study was conducted with the following objectives:

- To study, the effect of PBL approach on the student's educational achievement in science at secondary level.
- To study, the effect of traditional teaching on the student's educational achievement in science at secondary level.
- To study, the comparative effect of PBL approach and traditional teaching on the student's educational achievement in science at secondary level.

Hypothesis

Keeping in the mind the aim of study, need and objectives of the problem, the following main hypothesis was formulated to conduct study:

- There is no significance difference between educational achievement in science towards PBL Approach (Experimental group) and traditional teaching (Control group).

Delimitations of the Study

Due to the lack of time, resources and finance, this study is confined only to the Uttar Pradesh state board affiliated secondary school in Pilibhit district of Uttar Pradesh. The study is confined to 60 students of class 9th only.

Research Method & Research Design

According to objectives of the study, the quantitative research method was used. Experimental research design (Pre-test Post-test control group quasi experimental research design) was used as research

design. A figurative representation of the study is given in Table 1.

Table 1: Design of the study

Group	Pre-test	Independent Variable	Post-test
Experimental	X_1	PBL Approach	X_2
Control	X_1	Traditional Teaching	X_2

Population of the Study

All the students of 9th class of Pilibhit district of Uttar Pradesh are comprised the population of the study.

Sample and Sampling

In order to select the representative sample from the population, random sampling technique was used. In this study one secondary school had selected with the help of simple random sampling technique and all of 60 students of that college were include for research. The students were divide in to two groups i.e. Experimental group and Control group.

Table 2

Group	Number of Students
Experimental	30
Control	30
Total	60

Variables

- Independent variable

  PBL Approach.
- Dependent variable

  Educational achievement in science.

Tool of the Study

To obtain the data, the data generating device- APAT (Air Pollution Achievement Test) was prepared by the researcher and APAT had given to some of the experts for the establishment of content validity. The preliminary try out APAT was made on 50 students of 9th class of other school. The reliability of the tool was established by split half method and test-retest method by computing coefficient of correlation by Karl Pearson Method. The value of coefficient of correlation was found 0.79. The APAT consist of 50 multiple choice questions.

Statistical Techniques

To get the meaningful results from the present study, the researcher used mean, median, mode, correlation, standard deviation and t-test to analyze the data and verify the hypothesis.

Procedure Followed

Procedure of the experiment comprised of two main stages, that is- group formation stage and the research conducting stage.

Stage 1: Formation of groups

Two groups had formed in this study:

1. **Experimental group:** Researcher included 30 students in experimental group. Treatment had given to students of experiment group by PBL approach.
2. **Control group:** Researcher included 30 students in control group. No novel treatment had given to students of control group

Stage 2: Conducting of the experiment

The experiment had conducted in such way:

The study involved three operational stages as Pre-testing stage, Treatment stage, and Post-testing stage. A schematic view of the phases of experiment is presented in following Table 3.

Table 3

Sl. No.	Stage	Control Group	Experimental Group
1	Pre-test	Measurement of achievement in science.	Measurement of achievement in science.
2	Treatment	Teaching Science through traditional method.	Teaching Science through Project Based Learning Approach.
3	Post-test	Measurement of achievement in science.	Measurement of achievement in science.

Analysis of data and Discussion of Result

From the Table 4, it is evident that mean score of pre-test of experimental group is 30.42 and mean

score of pre-test of control group is 29.02. The S.D. of pre-test of experimental group is 6.21 and S.D. of pre-test of control group is 5.62. The t-value calculated from above two groups is 0.92 which is less than the Table value at 0.05 level, indicating no significant difference 0.05 level.

Table 4: Mean, S.D. and t-value of Pre-Test Achievement Score of Experimental and Control Group

Sl. No.	Group	N	Mean	S.D.	df	t-value	Level of Significance
1	Experimental	30	30.42	6.21	58	0.92	No Significant (NS)*
2	Control	30	29.02	5.62			

**(NS) No Significance at 0.05 level*

Therefore; two groups are similar in their pre-test performance related to their educational achievement in science before the application of the treatment. Hence, the Experimental group and Control group in the present study were matched before the Experimental treatment as shown in the table, the Experimental group had a slightly higher mean score in pre-test than the control group.

Table 5: Mean, S.D. and t-value of Pre-Test and Post-Test Achievement Score of Experimental Group

Group	Measure-ment	N	Mean	S.D.	t-value	Level of Significance
Exp. Group	Pre-test	30	30.42	6.21	8.28	Significance (S)*
	Post-test	30	43.92	6.42		

**(S) Significance at 0.05 level*

From the Table 5, it is evident that mean score of pre-test and post-test of experimental group are 30.42 and 43.92. Standard deviation (S.D.) of Pre-test and post-test of experimental group are 6.21 and 6.24. The t-value calculated from above two scores is 8.2 which is more than the Table value at 0.05 level, indicating a significant difference between the means of pre-test score and post-test score of experimental group students related to their educational achievement. So that we can say that PBL is more effective to teach science.

From the Table 6, it is evident that mean score of pre-test and post-test of control group is 29.02 and 35.94. Standard deviation (S.D.) of is pre-test and post-test of control group are 5.62 and 6.02. The t-value calculated from above two scores is 8.2 which is more than the Table value at 0.05 level., indicating a significant difference between the mean pre-test score and post-test score of control group students related to their educational achievement. If this difference and deviation in values are taken into consideration, this difference is in favour of post-test.

Table 6: Mean, S.D. and t-value of Pre-Test and Post-Test Achievement Score of Control Group

Group	Measure-ment	N	Mean	S.D.	t-value	Level of Significance
Control Group	Pre-test	30	29.02	5.62	4.37	Significant (S)*
	Post-test	30	35.94	6.02		

**(S) Significance at 0.05 level*

According to this, it is seen that there is an increase in the post-test score of students in control group who used the traditional education method. But this increase is significantly lower than the increase rate in the post-test score of the students in experimental group as shown in Table.

Table 7: Mean, S.D. and t-value of Post-Test Achievement Score of Experimental and Control Group

Sl. No.	Group	N	Mean	S.D.	df	t-value	Level of Significance
1	Experi-mental	30	43.92	6.42	58	4.98	Significant (S)*
2	Control	30	35.94	6.02			

**(S) Significance at 0.05 level*

From the Table 7, it is evident that mean score of post-test of experimental group is 43.92 and mean score of post-test of control group is 35.94. The S.D. of post-test of experimental group is 6.42 and S.D. of post-test of control group is 6.02. The t-value calculated from above two scores is 4.98, which is more than the Table value at 0.05 level, indicating a significant difference between in means of post-test score of experimental group and control group students related to their educational achievement in science. So that, the H_0 there is no significance difference between educational achievement in science towards PBL Approach (Experimental group) and traditional teaching (Control group) is rejected that's by we can say that PBL approach

is more effective to teach science in comparison to traditional teaching method.

Findings of the Study

1. The results arrived during this study show that the post-test achievement means scores of experimental group and control group's shows difference. This implies that the student who were taught using Project Based Learning (PBL) approach show significance improvement in their achievement in science than the students who have instructions through the traditional method. It suggests the PBL used teaching approach contributes toward raising the achievement of students in science.
2. A significance difference has observed between the mean achievement of pre-test score and post-test scores of experiment group related to their educational achievement.
3. A significance difference has observed between the mean achievement of pre-test score and post-test scores of control group related to their educational achievement.
4. The group of students taught through PBL approach (Experimental group) show significantly higher means gain in achievement than the group of students taught through traditional method.

CONCLUSION

Overall, the present research on PBL approach reports positive outcomes related to students learning in science. PBL has several positive effects on student's content knowledge compared to traditional teaching method. Students in PBL approach performed better on assessment of science content knowledge. Students who participated in PBL, also benefitted from improved critical thinking and Problem-solving skill. PBL has been show to benefit a variety of students in developing collaborative skill. In summary, present study indicates that PBL approach has appositive effect on student content knowledge of science and the development of skills such as collaboration, critical thinking and problem solving abilities in real life situation.

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