

# IMPACT OF PROBLEM BASED LEARNING TECHNIQUE ON STUDENTS OVERALL ACADEMIC PERFORMANCE

Dr. Karuna<sup>1</sup>, Dr Sunil Kumar<sup>2</sup>

1 School Counsellor, DAV CPS Gajeri, Theog, Shimla, Himachal Pradesh

2 Faculty, Department of Psychology, Himachal Pradesh University, Summer Hill, Shimla



[Read the Article Online](#)



## ABSTRACT

*The study was determined to see the impact of the Problem Based Learning Method on student's performance in the subject matter of English grammar and language in terms of final school exams and overall academic performance in the class. Pre-Test, Post-Test Treatment design was used on 30 students each in the experimental (Section B) and control (Section A) groups for one full academic session (a year) in the regular school setting without any changes in the regular school schedule. The participants were analysed by using analysis of covariance, and the results revealed a significant improvement in the scores of the participants of the experimental group than the control group on their post-test scores in the subject of English and as well as in their overall academic performance i.e., the participants of experimental group outperformed the participants of the control group after the intervention.*

**Key Words:** Problem based learning method, Student, Performance, English Grammar, Academic Performance

## Introduction

Education has an important role in making human resources to plan multiple challenges in the future. Multiple skills and abilities should be owned by an individual concerning the increasingly complex life demands in this 21st Century. (Douglas, 2012; King et al., 2015; Partnership for 21st Century Learning, 2015; Richland & Simms, 2015).

According to Gagne (1985), it is the primary goal of an educational system is to encourage and teach students how to solve complex problems that involves both subjects and life experiences. it is necessary as problem-solving ability helps an individual in actively adapt the environment; it is also a prerequisite for individuals to become questioning and problem-solving individuals (Marzano, 1989). As a result, individuals with these qualifications should be able to think critically. Thinking begins with a problem, and problem-solving directs an individual's thinking (Kalayc, 2001). According to Gagne (1985), problem-solving activates the most complex cognitive processes and allows the simultaneous use of several important skills such as learning by trying, establishing cause-effect relationships, and assessing the relationships between concepts and events.

These strategy selection plays an important role in creating teacher expectations, which can be met by implementing creative method, appropriate materials, and an interesting or enjoyable learning process. The researcher then attempted to solve the problem by conducting a study on improving students' speaking skills using the Problem-Based Learning (PBL) strategy. According to the researcher, this strategy will provide several opportunities for students to speak and express their ideas in an interesting and enjoyable environment. Problem-based learning is introduced and continued for a variety of reasons, according to Barrett (in Sholihah 2008:3), including (1) acquiring subject matter knowledge, (2) motivating students to learn, (3) linking theory and practise, (4) developing students' thinking skills, (5) encouraging students to integrate knowledge from various subjects, disciplines, and sources, and so on.

Academic achievement, self-efficacy, and general pleasure with the learning experience have all been demonstrated to benefit from problem-based learning. It has been identified as one of the learning methods that can assist kids in developing higher-order thinking skills. (Guedri, 2001; Arends & Kilcher, 2010). It is defined by the fact that problems serve as the beginning point for the learning process and serve as a means of honing students' problem-solving abilities (Hmelo-Silver, 2004; Sungur

**& Tekkaya, 2006).** Furthermore, PBL tasks that demand multiple knowledge can help students develop all their capacities concerning the environment in which they will be employed, as well as their problem-solving abilities (**Loyens, Magda & Rikers, 2008**). The issues that have been incorporated into the learning process are designed to assist students through a meaningful learning experience while also improving their critical thinking abilities.

Furthermore, Problem-Based Learning boosts students' willingness to learn and allows them to create a considerably more positive attitude toward learning (**Albanese and Mitchell 1993**). (**Coles, 1985; Newble and Clarke, 1986**) Problem-based learning approaches were only marginally efficient in stimulating student interest and retaining motivation (**Vernon and Blake, 1993**). **R According to Moust (2005)**, research on Problem-Based Learning has revealed that it improves both the learning process and the learning output (**Moust, 2005**).

In Germany, Sweden, and the Netherlands, **Scholkmann and Roters (2009)** evaluated the impact of Problem-Based Learning and professional development on teachers' self-assessment abilities, problem-solving skills, practical tests, and positive mood, and concluded that it has a positive effect on self-assessment abilities, problem-solving skills, in practical tests, and positive mood, in addition to problem-based testing, formative evaluation, and portfolio as keys to success.

Thus, the preceding discussion emphasizes the significance of the Problem-Based Learning method in the teaching process for the learners' learning outcomes in the wider context. As a result, the current study is designed to investigate the impact of problem-based instructional learning on students' academic performance in the subject of English with the following objectives and hypotheses:

### Objectives

- To study the difference between the experimental and control groups in the subject of English after the intervention in their class.
- To study the difference in overall academic performance between the experimental and control groups in the class's final school examination after the intervention.

### Hypotheses

- There would be a significant difference between the participants of the experimental group and control group on their post test scores in the subject English of their class after the intervention.
- There would be a significant difference between the experimental group and control group on their post-test scores in the overall performance of the participants after the intervention.

### Methodology

The present investigation was designed to study the effect of Problem-Based Learning on students' performance in a school context. The following methodology was adopted to meet the objectives of the study.

- **Design of the study:** In the present study, a Pre-Test (the term 1st school examination) and Post Test (Term 2nd school examination) treatment design were used to study the effect of Problem-based learning on students' performance in a school context, taking an Experimental group and Control group.

**Table-1: Design to study the difference between the Experimental group and control group on their Performance in the subject English of the class in the Final School examination (Post Test)**

Group	Pre-test	Post-test
Experimental Group	30	30
Control Group	30	30

**Table-2: Design to study the difference between the Experimental group and control group on their overall academic performance in the class in Final School Examination (Post Test)**

Group	Pre-test	Post-test
Experimental Group	30	30
Control Group	30	30

- **Variables:** The present study involves the following variables:
  - i) independent variable: Problem-based learning
  - ii) **Dependent variables:** ● Academic performance of 7th-grade participants in the subject English and ● Academic performance of 7th-grade participants in all the subjects (Overall)
- **Participants:** To begin, students in the seventh grade at the Government Senior Secondary School in Sanjauli who agreed to participate in the study were asked to provide parental consent. Following that, the students were into two sections, Section A and Section B. Students who had parental consent to participate in the study were placed in Section B,' which was an experimental group of 30 students, while those who did not have parental consent were placed in Section A, which was a control group of 30 students. A regular teacher attended Section 'A,' while the experimenter attended Section 'B,' to introduce Problem-Based Learning to the class for a year.
- **Procedure:** In the first phase of the study, a healthy conversation and discussion with students were held to learn about their perspectives, problems, and other factors, as English appeared to be very difficult for them, and with these factors in mind, strategies, tools, and modules were developed in the first phase of the study, followed by intervention for the experimental group. In the second phase of the study, students in the experimental group, Section B, were exposed to the Problem-Based Learning Method on their own during regular school hours by the experimenter, whereas students in the control group, Section A, continued to use the traditional classroom system for a year. The school's regular timetable was not altered.

**Tools**

Only the Problem-based learning method modules were developed for the intervention in this study; otherwise, no specific tools for the observations of the participants were administered in their pre-test and post- test to record the observations of the participants as their Academic Performance in the subject matter of English and their overall performance, however, their scores in their school's first and second term examinations in the subject of English and all of their class's subjects (Overall) were taken as the pre-test and post-test scores of the participants for the study i.e.:

- **Problem-Based Learning Method (In Brief):** Problem-Based Learning Method modules were developed for the Government's Schools' 7th Standard English Language Curriculum to be used as a teaching strategy for the study.
- b The School's First-Term Examination Schedule - The results of the participants in their first term examination of the school in the subject English, as well as their overall performance (scoring in all the subjects) in their class, were taken as the pre-test scores of the participants.

- **Post-Test:** The school's second-term examination schedule- The scores of the participants in their school's second term examination in the subject English, as well as their overall performance (scoring in all the subjects) in their class, were recorded as the post-test scores of the participants.

### Results and Discussions

After the intervention, the scores of the participants of both the experimental and control groups were subjected to analysis of covariance to analyse the effect of the intervention on the participants of the group and the result was described as:

**i) The Effect of Problem-Based Learning on the Performance of the participants of the experimental and control group in the Subject English of their class.**

To satisfy the assumption of the “control” on the independent variable i.e., pre-test score of the participants of the experimental group and control group, analysis of covariance was applied and the result showed that:

**Table-1.1: The F Value Table shows the difference between The Experimental and Control groups in their pre-test Scores in the subject of English.**

Source	Sum of squares	df	Mean square	F value
GROUPS (Pre Test scores)	633.750	1	633.75	1.273
Error	28863.900	58	497.65	
Total	154533.00	60		

Table 1.1 showed an F value of 1.273, which is not significant at a .05 level of significance indicating no significant difference between the experimental and control group on their pre-test scores i.e., there is no significant difference between the participants of the experimental group and control group in their pre-test scores. Hence qualified the assumption of control of independent variable to apply Analysis of covariance.

Further, to test the assumption of homogeneity of regression, the result in table 1.2 showed the F value of 1.470 which is also not significant at a .05 level of significance indicating no difference in the between-subjects effects on group time pre-test and thus satisfied the assumption of homogeneity of regression to qualify for analysis of covariance to test the significant difference between experimental and control group on the dependent variable i.e., the post-test score of the participants after the intervention.

**Table-1.2: The F Value Table shows the difference between the Experimental and Control groups to test the homogeneity of regression**

Source	Sum of Squares	df	Mean square	F value
GROUPS*(Pre Test scores)	84.682	1	84.682	1.470
Error	3226.396	56	57.614	
Total	185569.000	60		

Finally, an analysis of covariance was applied to see the difference between the experimental group and control group on the post-test scores of the participants in the subject of English, the F value ( $F=24.412^{**}$   $p<.01$ ) came out to be (See Table 1.3) significant at .01 level of significance indicated the significant difference between the participants of the experimental and control group on their post -test scores and further, the mean value of the experimental group (59.90) were found higher than the control group (46.06,). This revealed a significant improvement in the performance of the students of the experimental group in the subject English of their class than the performance of the students of the control group. (See Table 1.4).

**Table 1.3: The F Value Table shows the difference between the participants of the Experimental and Control groups in their post-test scores in the subject English of their class after the intervention.**

Source	Sum of Squares	df	Means square	F value
GROUPS (POST-TEST SCORES)	1418.052	1	1418.052	24.412
Error	3311.078	57	58.089	
Total	185569.000	60		

**Table 1.4: Mean value table of the participants of the Experimental and Control groups on their post-test scores in the subject English after the intervention**

Mean Values (Post Test)	
Experimental Group	Control Group
59.90	46.06

Hence Hypothesis no 1 that is, “there would be a significant difference between the participants of experimental group and control group on their post-test scores in the subject English of their class.

Problem-Based Learning enables students to improve critical thinking skills after analysing a problem to find the solution (Shepherd, 1998; Tretten & Zachariou, 1995). This is due to the positive attitudes toward learning and problem-solving abilities, to which they are exposed. **Zhou, Huang and Tian (2013)** concluded that tasked-based learning improves students' analytical skills and ability to personalize learning. Students can evaluate and infer into contents learnt while making a reasonable conclusion. With this, a habit of mind is promoted among students, which increases scientific literacy among learners. **Tamblyn (1976)** study of the added value of a six-hour Problem-Based Learning segment within a classically taught neuroscience course for second-year medical students was randomly assigned to the Problem-Based Learning and control group. Blinded ratings of the student's written problem explanation based upon viewing a demonstration of a simulated patient workup showed the Problem- Based Learning students to be better at problem formation. In a study with a heterogeneous population of sixth-grade students, **Hmelo et al. (2000)**, in collaboration with classroom teachers, developed a Problem-Based Learning unit that involved students designing artificial lungs. This design experiment demonstrated that Problem-Based Learning students showed greater gains on both short-answer tests and a drawing task than students in comparison classrooms.

**ii) The Effect of Problem-Based Learning on the overall academic performance of the participants of the experimental and control group.**

To satisfy the assumption of the "control" on the independent variable i.e., pre-test scores of the participants on their overall academic performance in experimental and control groups Analysis of covariance was applied to see the difference between pre-test scores in the experimental group and control group (See Table 2.1)

**Table 2.1: The F value Table shows the difference between the Experimental and Control Groups in the pre-test scores of the participants of the Experimental and control group.**

Source	Sum of Squares	df	Means Square	F value
GROUPS (Pre Test scores)	80373.600	1	80373.600	4.373
Error	1066120.800	58	18381.393	
Total	8733576	60		

Table 2.1 showed the F value of 4.373 which is not significant at a .05 level of significance indicating no significant difference between the participants of the experimental and control group on their pre-test

scores i.e., there is no difference across the groups in their pre-test scores and satisfied the assumption to apply analysis of covariance.

**Table 2.2: The F value table shows the difference between the participants of the Experimental and Control groups to test the homogeneity of regression**

Source	Sum of Squares	df	Means Square	F value
GROUPS (Pre Test scores)	4417.699	1	4417.699	6.400
Error	38655.130	58	690.270	
Total	11266109.00	60		

Secondly, to test the assumption of regression, the result of the analysis showed the F value of 6.400 (See Table 2.2), which is non-significant at a .05 level of significance indicating no difference in between-subject effect on group time pre-test and thus satisfied the assumption of homogeneity of regression to qualify for the analysis of covariance to test the significant difference between experimental and control group on the dependent variable i.e., the overall academic performance of the participants in Post-test scores.

**Table 2.3: The F value Table shows the difference between the participants of the Experimental and Control Group in the post-test scores of their overall academic performance**

Source	Sum of Squares	df	Means Square	F value
GROUPS (Pre Test scores)	92147.198	1	92147.198	121.942
Error	43072.830	58	755.664	
Total	11266109.00	60		

**Table 2.4: Mean value table of the participants of Experimental and Control on the pre-test scores on their overall academic performance after the intervention.**

Mean Values (Post Test)	
Experimental Group	Control Group
482.53	335.36

Finally, analysis of covariance was applied to the post-test scores of the participants of experimental and control groups in their overall academic performance and the F value ( $F=121.42^{**}$   $p<.01$ ) came out to be significant at .01 (See Table 2.3) level of significance and the mean values of the post-test scores of the participants of experimental group (482.53) and control group (335.36) revealed the significant increase in the overall academic performance of the participants of the experimental group than the control group. (See table 2.4).

Hence hypothesis no.2 that is, “there would be a significant difference between the participants of experimental group and control group on the post-test scores in terms of their overall academic performance” is stand confirmed and accepted.

The results of the present study do find support from the earlier work done in the fields. Several researchers have affirmed the successful implementation of Problem-Based learning in the classroom. **Cockrell, Caplow, and Donaldson (2000)** concluded that there was an increase in student's perception of PBL instruction since it enables them to foster transfer of knowledge. PBL is effective compared to other pedagogical approaches since it facilitates student's critical thinking and problem-solving skills since students can apply theory to practice (**Cooke & Moyle, 2002**). Problem-Based learning improves the long-term retention of knowledge compared to traditional instruction. Evidence also suggests that Problem-Based learning promotes better study habits among students (**Norman et al, 1993**) **Kayalı et**

al. (2002) showed that the active learning methods are more effective than the classic method by relying on the findings of their research conducted based on problem-based learning, brainstorming and cooperative learning. Şenocak (2005) used a problem-based learning approach in "The Gas State of Matter" unit. In the light of the findings, the researcher determined that the problem-based learning approach is more influential than the traditional teaching approach. The results of our research and these studies seem to support each other.

The results of the present study indicate that students performed better with Problem- Based Learning than with Traditional Based Learning. The pre-test post-test scores of the student outcome questionnaire show improvement in the post-test scores. With the help of Problem-based learning, there is an improvement in Final examinations of English language grammar as well as in the overall academic performance of students. Problem- Based Learning has provided a rewarding and quality learning experience for students. In terms of learning achievement, students were able to handle critical thinking, discover new strategies when interpreting, and solve interpreting problems through independent work and group work. Problem- Based Learning is confirmed as an ideal to remedy the ineffectiveness of traditional interpreting teaching that stifles students learning enthusiasm.

## References

- Açıkyıldız, M. (2004). Probleme dayalı öğrenmenin fizikokimya laboratuvarı deneylerinde etkililiğinin incelenmesi (Unpublished master thesis). Ataturk University, Graduate School of Natural and Applied Sciences, Erzurum.
- Albanese, M. A., & Mitchell, S. (1993). "Problem-based learning: A review of literature on its outcomes and implementation issues." *Academic Medicine*, 68 (1), 52-81
- Arends, R. I., & Kilcher, A. (2010). *Teaching for students learning: Becoming an accomplished teacher*. New York, NY: Taylor & Francis.
- Bidokht, M. H., & Assareh, A. (2011). Life-long learners through problem-based and self-directed learning. *Procedia Computer Science*, 3(1), 1446–1453. <https://doi.org/10.1016/j.procs.2011.01.028>
- Cockrell, K. S., Caplow, J. A. H., & Donaldson, J. F. (2000). A context for learning: Collaborative groups in the problem-based learning environment. *The Review of Higher Education*, 23(3), 347-363. [doi.org/10.1353/rhe.2000.0008](https://doi.org/10.1353/rhe.2000.0008)
- Coles, C.R. (1985). Difference between conventional and Problem-based curricula in their student's approaches to studying. *Med. Educ.*, 19(4), 308-309.
- Cooke, M., & Moyle, K. (2002). Students' evaluation of problem-based learning. *Nurse Education Today*, 22(4), 330-339. [doi.org/10.1054/nedt.2001.0713](https://doi.org/10.1054/nedt.2001.0713)
- Delisle, R. (1997). *Use problem-based learning in the classroom*. USA: ASCD.
- Dolmans, D.H.J.M., Wolhagen, I.H.A.P., and Schmidt, H.G. (1996). Effects of tutor expertise on student performance in relation to prior knowledge and level of curricular structure. *Academic Medicine*, 71(9), 1008-1011.
- Douglas, E. P. (2012). Defining and measuring critical thinking in engineering. *Procedia - Social and Behavioral Sciences*, 56 (1), 153–159. <https://doi.org/10.1016/j.sbspro.2012.09.642>
- Ertürk, S. (1979). *Eğitimde program geliştirme*. Ankara: Meteksan.
- Gagne, R. (1985). *The Conditions of Learning* (4th ed.). New York: Holt, Rinehart & Winston
- Guedri, P. Z. (2001). Problem-based learning: Bringing higher-order thinking to business schools. *Cahier de Recherche OIPG*, 1(2), 1-17.
- Guedri, P. Z. (2001). Problem-based learning: Bringing higher-order thinking to business schools. *Cahier de Recherche OIPG*, 1(2), 1-17
- Guidelines for inclusion: ensuring access to Education for All. Paris: UNESCO; 2005. (5 May 2010). <http://unesdoc.unesco.org/images/0014/001402/140224e.pdf>.
- Harland, T. (2003). Vygotsky's zone of proximal development and problem-based learning: Linking a theoretical concept with practice through action research. *Teaching in higher education*, 8(2), 263- 272
- Hmelo, C. E., Holton, D. L., & Kolodner, J. L. (2000). Designing to learn about a complex system. *Journal of the Learning Sciences*, 9, 247-298.

- Hmelo-Silver, C. E. (2004). Problem-based learning: What and how do students learn. *Educational Psychology Review*, 16(3), 235–266. <https://doi.org/10.1023/B:EDPR.0000034022.16470.f>
- Kalaycı, N. (2001). Sosyal bilgilerde problem çözme ve uygulamalar. Ankara: Gazi Guidelines for inclusion: ensuring access to Education for All. Paris: UNESCO; 2005. (5 May 2010). <http://unesdoc.unesco.org/images/0014/001402/140224e.pdf>.
- Kayalı, H., Ürek, R., Ö., A. & Tarhan, L. (2002). Kimya Ders Programı Maddenin Yapısı Ünitesindeki “Bağlar” Konusunda Aktif Öğrenme Destekli Yeni Rehber Materyal Geliştirilmesi ve Uygulanması, V. Ulusal Fen Bilimleri ve Matematik Eğitimi Kongresi Bildiri Kitabı, I, Ankara, 657-664.
- Kılınç, A. (2007). Probleme dayalı öğrenme. *Kastamonu Eğitim Dergisi*, 15(2), 561-578.
- King, F. J., Goodson, L., Rohani, F., Level, D. K., Plan, Q. E., Oliver, S., ... Order, H. (2015). Improving students' higher-order thinking competencies, including critical evaluation, creative thinking, and reflection on their own thinking. *Research in Science Education*, 3(2), 1–41. <https://doi.org/10.1007/s11165-006-9029-2>
- Loyens, S. M. M., Magda, J., & Rikers, R. M. J. P. (2008). Self-directed learning in problem-based learning and its relationships with self-regulated learning. *Educational Psychology Review*, 20(4), 411–427. <https://doi.org/10.1007/s10648-008-9082-7>
- Marzano, R. J. (1989). Dimensions of thinking. Alexandria: ASCD
- Mayer, R. E. (2002). Multimedia learning. *Psychology of Learning and Motivation*, 41, 85-139.
- Newble, D. L., Clarke, R. M. (1986). The Approaches to Learning of Students in a Traditional and in an Innovative Problem-based Medical School. *Med. Educ.* 20: 267-273.
- Peterson, R. F., & Treagust, D. F. (1998). Learning to teach primary science through problem- based learning. *Science Education*, 82(2), 215-237.
- Richland, L. E., & Simms, N. (2015). Analogy, higher order thinking, and education. *WIREs Cognitive Science* 2015, 1-16. <https://doi.org/10.1002/wcs.1336>
- Scholkmann, A., and Roters, B. (2009). Measuring the Effect of Problem-based learning-Progress in the development of a scale to rate the acquisition of professional knowledge through PBL. ECER 2009, Theory and Evidence in European Educational Research. Vienna, Austria: Technische Universität of Dortmund.
- Schon, D. A. (1983). *The Reflective Practitioner- how professionals think in action*. Basic Books. Skolverket. (2011). gY11. Stockholm: Skolverket.
- Şenocak, E. (2005). Probleme Dayalı Öğrenme Yaklaşımının Maddenin Gaz Hali Konusunun Öğretimine Etkisi Üzerine Bir Araştırma. (Unpublished Doctoral Thesis) Atatürk University Sciences Institute, Erzurum
- Shepherd, H. G. (1998). The probe method: A problem-based learning model's effect on critical thinking skills of fourth- and fifth-grade social studies students. *Dissertation Abstracts International, Section A: Humanities and Social Sciences*, September 1988,59 (3-A), p. 0779.
- Sungur, S., & Tekkaya, C. (2006). Effects of problem-based learning and traditional instruction on self-regulated learning. *The Journal of Educational Research*, 99(5), 307–320. <https://doi.org/10.3200/JOER.-99.5.307-320>
- Tatar, E., & Oktay, M. (2011). The effectiveness of problem-based learning on teaching the first law of thermodynamics. *Research in Science & Technological Education*, 29(3), 315-332
- Tretten, R. & Zachariou, P. (1995). Learning about project-based learning: Self-assessment preliminary report of results. San Rafael, CA: The Autodesk Foundation.
- Vernon DTA, Blake RL (1993). Does problem-based learning work? A meta-analysis of evaluative research. *Acad. Med.* 68: 550-513.
- Zhou, Q., Huang, Q., & Tian, H. (2013). Developing students' critical thinking skills by task-based learning in chemistry experiment teaching. *Creative Education*. 4(12), 40. retrieved from <http://www.scirp.org/journal/paperInformation.aspx?PaperID=41520>.