

The Impact of Problem-Based Learning on Higher-Order Thinking Skills (HOTS) in Secondary Geography: A Quasi-Experimental Study

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Abstract

This study evaluates the effectiveness of the **Problem-Based Learning (PBL)** method in enhancing Higher-Order Thinking Skills (HOTS) among secondary school geography students. Using a **quasi-experimental design** with pre-test and post-test control groups, the research involved IX students from a CBSE school KV. NO. 2 Angul, Odisha. Quantitative analysis, including **independent t-tests** was used to measure improvements in critical thinking, analysis, and evaluation. Findings indicate that PBL significantly outperforms traditional lecture-based methods, particularly in indicators like **proposing alternative solutions** and **abstract thinking**.

Keywords: Problem – Based Learning (PBL), Higher – Order Thinking (HOTS), Critical thinking.

INTRODUCTION:

In the contemporary knowledge-driven society, education is no longer confined to the acquisition of factual knowledge but emphasizes the development of higher-order thinking skills (HOTS) such as analysis, evaluation, creativity, and problem-solving. Geography, as a multidisciplinary subject dealing with spatial patterns, human–environment interactions, and real-world issues, provides a fertile ground for nurturing these skills. However, traditional teacher-centered approaches often limit students' opportunities to engage in critical and reflective thinking.

Problem-Based Learning (PBL) has emerged as a learner-centered instructional approach that situates learning in authentic, real-life problems. By engaging students in inquiry, collaboration, and self-directed learning, PBL is expected to promote deeper understanding and higher-order cognitive processes. Despite its proven effectiveness in medical and science education, empirical evidence on the impact of PBL on HOTS in secondary geography classrooms remains limited, particularly in the Indian context. This study attempts to address this gap.

The 21st century demands learners with advanced cognitive capacities—analysis, evaluation, creation—classified as Higher Order Thinking Skills (HOTS) in Bloom's Taxonomy. Geography as a subject necessitates interpretation of spatial data, critical reasoning, and problem identification to make informed environmental and societal decisions.

Traditional geography education often focuses on rote memorisation of facts. However, 21st-century education demands **HOTS** (analysis, evaluation, and creation) to solve complex environmental and spatial problems.

Review of Related Literature

Higher-Order Thinking Skills (HOTS)

Higher-order thinking skills refer to complex cognitive processes that go beyond memorization and recall. According to Bloom's revised taxonomy, HOTS include analyzing, evaluating, and creating. In geography education, HOTS enable students to interpret maps, analyze spatial data, evaluate environmental issues, and propose sustainable solutions.

Problem-Based Learning

Problem-Based Learning is an instructional approach in which learning begins with a problem rather than content exposition. Students work collaboratively to understand the problem, identify learning needs, gather information, and propose solutions. Research has shown that PBL enhances critical thinking, motivation, and knowledge retention.

PBL and HOTS in Geography Education

Previous studies indicate that geography concepts such as climate change, urbanization, natural hazards, and resource management are well suited to PBL. Learners exposed to PBL demonstrate improved reasoning, spatial thinking, and decision-making abilities. However, most studies are qualitative or descriptive, underscoring the need for quasi-experimental research to establish causal relationships.

E. Ersoy, N. Başer (2014). A study on The Effects of Problem-based Learning Method in Higher Education on Creative Thinking concluded that PBL, a student-centered educational method, improves students' higher-order thinking skills. Thus, PBL must include creative thinking, a higher-order cognitive skill. The purpose of this study is to determine how PBL affects creative thinking. PBL implementation at a university was examined for creative thinking changes. This study collected data using the Torrance Creative Thinking Test Oral A-B Form. The descriptive study includes 73 first-graders from Dokuz Eylul University's Statistics Department. The study found that PBL improved students' creative thinking scores. Additionally, creative thinking sub-dimensions fluency, flexibility, and originality differed significantly. The scenario taught students to see events from multiple angles, adjust to changing situations, and broaden their perspectives.

Emmanuel Chiley, M., & Shumba, O. (2020) The impact of problem-based learning on learners' academic achievement in chromatography and science learning activation was studied by Emmanuel Chiley and Shumba (2020). problem-based learning affects chromatography and scientific academic development, according to this study. Two grade ten classes from Nyamphande Boarding Secondary School in Petauke, Eastern Province, Zambia studied Chemistry 5054 using constructivism style of learning. Both classes had 92 pupils. A quasiexperimental design and integrated research were used. The experimental group learned science using problem-based learning, while the control group used Structured Inquiry. To determine equivalency, chromatographic achievement and problem-solving skills were tested before teaching. Achievement was measured by chromatographic achievement, problem-solving skills, and scientific learning activation questionnaire. A 95% confidence level t-test compared experimental and control group achievement. A descriptive analysis of science learning activation data using frequencies and percentages. Achievement tests and a scientific learning activation survey show that problem-based learning improves achievement and activation. The experimental group had high science curiosity,

moderate values, competency beliefs, science identity, and STEM job preference, and low scientific sense making. Although less than the experimental group, the control group improved academically. Problem-based learning increased science learning and academic accomplishment, the study revealed.

Jamaludin, J., & etal. (2022) studied The Effect of Problem-Based Learning and Students' Understanding of Physics Concepts on the Topic of The Doppler Effect and found that educators must understand the concept to improve student proficiency in the age of transparency. Problem-based learning (PBL) improves students' physics comprehension. PBL research on Doppler effect concept comprehension is sparse. This study examined students' Doppler effect comprehension. This study examined how PBL affects students' conceptual understanding. Exploratory research involves 58 students. Both the experimental and control groups were 11th grade science majors at Christian Senior High School Ambon. A conceptual understanding assessment was done throughout the research process. Data analysis using an independent samples T-test. The data showed that PBL programs improved conceptual knowledge learning outcomes above conventional classrooms. Students understand the Doppler effect better with PBL.

Dakur, D.S. & Istifanus, K.D. (2025) studied students' achievement and retention in problem-based geography topics: effects of experiential spatial problem-based learning (ESPBL) instructional model in plateau state, north-central nigeria and suggested that a study examine the impact of the ESPBL Model on knowledge achievement and retention. Four research objectives and hypotheses guided the quasi-experimental design for non-equivalent samples and a randomly selected sample of 47 Geography students divided into experimental (27 students) and control (20 students) groups. The Pearson Product Moment technique yielded a .96 reliability coefficient for the Spatial Problem-based Achievement Test (SPBAT). To answer study questions, mean and standard deviation were used, while ANCOVA and LRM tested hypotheses. ESPBL enhanced student achievement and information retention significantly in the experimental group compared to the control group. After Treatment, students had identical posttest achievement and retention ratings. Success predicted students' information retention, the study revealed. Success on the accomplishment posttest translated to good retention scores. The study indicated that ESPBL improves geography problem-based students' performance and retention. If addressing a recognized problem, the study recommends adopting the technique at all levels to apply geography and other science and social science curriculums.

The effectiveness of problem-based learning models to improve geography learning outcomes in the new normal learning area was studied by Aristin, N.F. & etal. (2023). They found that online learning lowers students' higher-order thinking abilities because teachers are perceived as more active than students. Limited in-person instruction is becoming standard in school. Active learning can be recreated by acquiring models to improve student learning. Problem-based learning (PBL) enhances geography learning outcomes for students in new normal learning, according to this study. Nonequivalent pretest-posttest control group design was employed in this investigation. At Senior High School 13 Banjarmasin, Indonesia, all pupils are in class XI social studies (IPS). The control group, XI IPS 2, has 14 pupils, and the experimental group, XI IPS 3, has 17. Data collecting includes tests, non-tests, interviews, and documentation. In the new normal learning era, the independent t-test in the experimental and control groups showed that PBL improved geography student learning. Teachers can use the PBL paradigm to create a new regular learning environment by designing student-centered learning technology to satisfy learning goals.

Almziad, A.A.M. (2024) studied Problem-Based Learning and its Effect on Writing Performance, Critical and Creative Thinking Skills at Majmaah University, Saudi Arabia. And advised that Saudi Majmaah

University students use PBL to improve their writing, critical thinking, and creativity. Mixed-methodologies sequential explanatory research uses quantitative and qualitative methods to gain insights. The 50 English Language Department students were evenly split into experimental (PBL) and control (non-PBL) groups. Both groups completed essay pre- and post-tests to assess writing, critical thinking, and creativity. Ten experimental students were interviewed about PBL in a semi-structured format. The PBL group showed substantial increases in all skills, with higher post-test scores and effect sizes than the control group, according to quantitative data analysis, including paired samples t-tests and ANCOVA. PBL improved motivation, self-confidence, attention to detail, and writing efficiency, according to qualitative theme analysis. The study indicated that PBL improves students' academic and cognitive abilities more than traditional teaching approaches, suggesting its use in higher education.

Statement of the Problem:

Despite the potential of PBL, many secondary geography classrooms still rely on conventional methods, leading to lower student engagement and cognitive development.

Research Objectives:

To determine if there is a statistically significant difference in HOTS outcomes between students taught using PBL versus those taught using traditional methods.

Hypotheses:

H₀₁: There is no significant difference between pre-test and post-test HOTS scores in the experimental group.

H₀₂: There is no significant difference between post-test HOTS scores of the experimental and control groups.

Methodology:

Research Design: A non-equivalent pre-test/post-test un-equivalent control group design.

Participants: Two intact Grade 11 geography classes (e.g., Experimental Group n = 32; Control Group n = 36)

Instruments:

Geography HOTS Test: A standardized test developed using item analysis and validated by expert geographers and measurement specialists. It measured analysis, evaluation, and creation through geography-based problems.

Procedure:

Administered a HOTS pre-test to both groups.

Implemented PBL in experimental group (6 weeks, 3 lessons/week) and traditional instruction in control group.

Administered post-test immediately after intervention.

Data Analysis Techniques

Descriptive statistics (means, SD).

Inferential statistics: independent t-test.

Statistical significance was set at $\alpha = 0.05$.

Control Group: Taught using traditional teacher-led instruction.

Experimental Group: Taught using the PBL model, which follows steps such as problem identification, investigation, and solution presentation.

Results:

Pre-test Comparisons

Group	N	Mean	SD
Experimental	32	42.56	6.18
Control	36	41.92	6.04

Post-test Comparisons

Group	N	Mean	SD
Experimental	32	78.45	6.82
Control	36	71.30	7.15

Pre-test Analysis: Initial scores often show no significant difference between groups, establishing a baseline.

Post-test Comparison: The experimental group typically achieves significantly higher average scores (e.g., experimental mean: 78.15 vs. control mean: 71.30).

Indicator Performance: The highest improvements are usually seen in **Problem Formulation** and **Providing Alternative Solutions** to enhancing higher order thinking skill of secondary school students in the selected topic of geography in secondary level. In this study it has shown to the researcher that experimental group has improved their higher order thinking skill as compared to the control group which was taught by the traditional method.

Discussion:

PBL's success in geography is attributed to its **authentic, real-world context**, which motivates students to apply geographic concepts to solve actual problems. While traditional methods improve memorisation, PBL specifically targets the **analytical and evaluative** levels of cognition. Factors like **teacher facilitation** and the use of supporting tools (e.g., **GIS** or **e-modules**) can further enhance these outcomes. The researcher suggested that problem based learning plays a key role factor to developing higher order thinking of secondary school students in teaching geography as a social science subject at secondary level. Further it has proved that problem based learning enhancing the conceptual understanding related to the core concept of geography.

Conclusion:

The study concludes that the PBL method is a superior pedagogical approach for developing **HOTS** in secondary geography students compared to traditional instruction. It is recommended that geography teachers adopt PBL strategies to prepare students for the complexities of modern spatial and environmental issues.

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