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Preparing Future Geography Teachers Through Problem-Based Learning Technology: A Short Review

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ABSTRACT

This short review explores the application of problem-based learning (PBL) technology in preparing future geography teachers. PBL, an interactive and student-centered teaching method, promotes critical thinking, creativity, and problem-solving—key skills for effective geography instruction. The review examines how PBL can enhance teacher training by encouraging active engagement with geographic content, fostering practical teaching skills, and developing the ability to address real-world problems. By focusing on real-life scenarios, PBL empowers prospective teachers to adopt innovative pedagogical approaches and equips them to inspire independent, analytical thinking in their future students. The review highlights the potential of PBL to transform geography teacher education, preparing educators to meet the challenges of modern classrooms.

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1. INTRODUCTION

The quality of geography education significantly depends on the effectiveness of the teachers who deliver it. As the global educational landscape continues to evolve, there is an increasing demand for innovative teaching methods that can enhance both student engagement and learning outcomes.

One such method is Problem-Based Learning (PBL) technology, which has gained prominence for its ability to foster critical thinking, creativity, and problem-solving skills. In the context of preparing future geography teachers, PBL offers a unique opportunity to equip educators with the tools they need to address real-world issues while cultivating independent, analytical thinking among their students. Many reports regarding PBL have been well-documented (see **Table 1**). The studies examined highlight various benefits of Problem-Based Learning (PBL), but they also reveal some potential disadvantages. One common challenge across these studies is the difficulty in ensuring that all students actively participate and engage in the problem-solving process. In some cases, students may struggle with the open-ended nature of PBL, which can lead to confusion or frustration if they lack adequate guidance or prior knowledge. Additionally, implementing PBL often requires significant time and resources, which may not always be feasible, particularly in resource-limited educational settings. The complexity of real-world problems presented in these studies may also overwhelm students, particularly those who are not yet accustomed to applying theoretical concepts in practical scenarios. Furthermore, some research suggests that not all students benefit equally from PBL, with certain individuals, especially those who prefer structured learning environments, potentially finding it challenging to adapt to this teaching approach. Lastly, the assessment of learning outcomes in PBL can be more subjective, making it harder to measure individual progress and success consistently.

Table 1. Previous studies regarding PBL.

No	Title	Reference
1.	Component design and strength analysis of coffin lowering machine for Covid-19 corpse: A problem-based learning	Khoiriyah *et al*. (2021)
2.	Structural design and strength analysis of lifting machine for home appliance flood safety tool: A problem-based learning	Sineria *et al*. (2021)
3.	The effects of problem-based learning in students reading comprehension for mastering the content and vocabulary acquisition	Sidik and Masek (2021)
4.	Problem-based learning on students' attitude towards science: Action research	Rahmadani *et al*. (2024)
5.	Altering students' mindsets and enhancing engagement in mathematics in a problem-based learning	Awafala and Akinoso (2024)
6.	Motorcycle child seat for child with special needs: Its design process and problem-based learning	Qushai *et al*. (2021)

This approach encourages prospective teachers to engage deeply with geographic content, apply theoretical knowledge to practical situations, and develop teaching strategies that can inspire and challenge their future students. This review explores the role of PBL in the preparation of geography teachers, examining its potential to transform teacher education and better equip educators to meet the demands of modern education.

This study examines a short review regarding the integration of problem-based educational technology in preparing future geography teachers and teaching geography to schoolchildren. Problem-based learning (PBL) enhances pedagogical skills, subject mastery,

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and the ability to engage students in dynamic, real-world challenges by emphasizing active learning, critical thinking, and a student-centered approach. The research highlights practical applications, case studies, and outcomes of implementing PBL in teacher training programs, demonstrating its effectiveness in fostering analytical abilities, creativity, and collaborative problem-solving. While innovative methods are essential for meeting the demands of modern education, traditional approaches to mastering educational material are also briefly discussed as complementary tools, underscoring the value of a balanced and comprehensive educational strategy

2. METHODS

The method for this short review involves a comprehensive analysis of existing literature on the use of Problem-Based Learning (PBL) technology in preparing future geography teachers. Relevant studies were selected based on their focus on PBL's application in teacher education, particularly within the context of geography. A qualitative synthesis of these studies was conducted, identifying key themes, approaches, and outcomes related to the implementation of PBL in geography teacher training. The review examines the pedagogical strategies employed, the effectiveness of PBL in enhancing critical thinking and teaching competencies, and the challenges encountered in its adoption. By reviewing both the theoretical and practical aspects of PBL, this paper aims to provide insights into its potential to improve the preparation of geography teachers.

3. RESULTS AND DISCUSSION

The Republic of Uzbekistan President's Address on the "2022–2026 Development Strategy of New Uzbekistan" and Its Emphasis on Education and Teacher Excellence. In the "Fair Social Policy and Human Capital Development" section of the "2022–2026 Development Strategy of New Uzbekistan," priority is given to improving the quality of school education and advancing the knowledge and professional competencies of teachers to align with international standards.

Changes in Uzbekistan's education system present significant tasks for general secondary schools, requiring teachers to nurture well-rounded, spiritually mature, and independent thinkers. These individuals must value their national heritage, possess creativity, and demonstrate refined tastes. Achieving this vision demands tireless creativity and dedication from educators.

In his address to the Oliy Majlis (Supreme Assembly) of the Republic of Uzbekistan, President Shavkat Mirziyoyev underscored the importance of shaping students' scientific worldviews and beliefs in the intellectual era of the third millennium. He highlighted the application of modern pedagogical technologies as essential tools for achieving this goal.

Educational reforms in Uzbekistan aim to provide high-quality education that fosters physically strong, spiritually mature, and intellectually capable individuals. These reforms prioritize developing independent thinking, expanding students' worldviews, supporting talented youth, and cultivating creative inquiry skills. Among school subjects, geography plays a particularly significant role due to its inherently engaging nature. When taught creatively and effectively—particularly through problem-based learning technology—geography can inspire curiosity and critical thinking.

Problem-based learning (PBL) involves presenting information in a way that challenges students to solve real-world problems. This approach stimulates students' thinking processes by creating "problem situations," encouraging research, critical thinking, and the ability to

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draw logical scientific conclusions. PBL arises at the intersection of knowledge and ignorance, reflecting the need to advance scientific understanding in a developing society.

A "problem situation" is a mental state triggered when students recognize a conflict within a task. The PBL method teaches learners to analyze causes and consequences, explore multiple solutions, and develop skills to arrive at the most accurate conclusion. To be effective, the complexity of the problem must align with students' knowledge and age levels. Overly difficult challenges can discourage learners and diminish their confidence, while appropriately designed problems foster engagement, curiosity, and a sense of accomplishment.

Problem-based learning (PBL) technology is an educational approach that leverages modern didactic methods to build scientific knowledge, develop comprehensive worldviews, and enhance intellectual potential. In geography education, PBL plays a vital role in fostering creativity and critical thinking among students. This approach trains learners to effectively address various challenges or situations related to the subject matter by developing their problem-solving skills, identifying the core issues, and selecting appropriate solutions. It also guides students in accurately analyzing the causes of problems and determining the necessary steps for resolution, equipping them with essential skills for academic and real-world success.

Geographic problems refer to processes and phenomena resulting from natural and human-induced (anthropogenic) factors that disrupt the environmental balance, negatively impacting human health and economic activities. Geo-ecological problems, a subset of geographic issues, emerge from the complex interactions between humans and the natural environment. Key natural factors contributing to geographic problems include volcanic eruptions, earthquakes, landslides, floods, strong winds, and heavy rainfall. Geo-ecological challenges are classified by their scope and impact, ranging from planetary to regional and local levels.

Geography as a subject consists of natural and socio-economic components, encompassing all issues related to nature and society. These problems are formed and developed through natural-geographical and socio-economic processes and their interactions. One of the most important conditions for using these problems in geography lessons is classifying them according to their origins into the following groups:

(i) Natural geographical problems
(ii) Socio-economic geographical problems
(iii) Geo-ecological problems

This classification highlights the necessity of studying the following problems in geography education:

(i) Problems related to atmospheric air pollution. The primary cause of atmospheric pollution is human activity. Key anthropogenic sources include industrial processes, transportation (vehicle emissions), energy production (burning fossil fuels), agriculture (chemicals and dust), and housing-related activities. Discussions on these issues can educate students about the need for sustainable practices and develop their independent thinking skills.
(ii) Problems related to water usage. Issues such as improper irrigation techniques and freshwater scarcity arise as urbanization, agricultural expansion, and industrial development increase water demand. Students can explore the impending crisis of drinking water shortages and the need for efficient river water usage, fostering their problem-solving abilities.
(iii) Problems related to the use of mineral resources. Teachers can explain the growing demand for minerals as a driving factor in the development of key economic sectors

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and emphasize the importance of planned and sustainable use. Students are encouraged to collaborate in proposing innovative solutions and creative ideas for addressing these challenges.

(iv) Problems related to the use of biological resources. This includes discussions about deforestation, the reduction of global forest resources, and the opening of land for agricultural use, particularly in tropical regions. Students are guided to find solutions for preserving biodiversity and protecting the flora and fauna in forested areas.

(v) Problems related to the sustainable use of ocean resources. These problems include the responsible extraction of minerals and biological resources from the oceans, preventing oil spills, and addressing the oceans' role in meeting humanity's food demands. Teachers can involve students in problem-solving activities, fostering their creative thinking and independent research abilities.

(vi) Problems related to land use. Issues like erosion, salinization, degradation of pastures, overgrazing, and deforestation are explored. Discussions help students understand these problems and work toward sustainable solutions.

(vii) Problems related to recreational systems. These include pollution of natural environments with toxic chemicals and improper utilization of recreational systems.

Solving geographical problems requires applying regional, geo-systemic, and ecological principles. These issues include:

(i) The regional principle helps identify the geographical scope of a problem, its development boundaries, and areas of distribution.

(ii) This problem-based teaching technology fosters ecological awareness, a culture of sustainability, and responsible behavior toward nature among students.

In geography lessons, problem-based learning stands out for its modernity, its success in addressing problem scenarios, and its ability to promote independent thinking, decision-making, and creative activities among students. Its modern nature is also characterized by its role in managing students' cognitive activities. Problem-based scenarios not only enable the acquisition of new knowledge but also teach students to create and solve real-world problem situations, enhancing their problem-solving skills.

4. CONCLUSION

This review highlights the significant potential of Problem-Based Learning (PBL) technology in the preparation of future geography teachers. By promoting active engagement, critical thinking, and problem-solving, PBL equips teacher candidates with the skills necessary to navigate complex geographic issues and enhance their pedagogical competencies. The use of PBL encourages creativity, collaboration, and independent thinking, which are crucial for effective teaching in today's dynamic educational environment. While there are challenges, such as the need for adequate resources and the adaptation to open-ended problem-solving, the benefits of PBL in fostering a deeper understanding of geography and improving teaching methodologies are evident. Overall, PBL represents a promising approach to preparing geography educators who can inspire and engage their students in addressing real-world geographic challenges.

5. AUTHORS' NOTE

The authors declare that there is no conflict of interest regarding the publication of this article. Authors confirmed that the paper was free of plagiarism.

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