International Journal of Current Educational Research
Homepage: https://www.journal.iel-education.org/index.php/ijocer
Email: ijocer@iel-education.org
p-ISSN: 2961-8517; e-ISSN: 2961-8509

IJOCER, Vol. 3, No. 1, June 2024

Page 16-27

Optimizing Scientific Literacy: A Comprehensive Examination of the Effectiveness of Problem-Based Learning

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DOI : https://doi.org/10.53621/ijocer.v3i1.263

Sections Info

Article history:
Submitted: January 2, 2024
Final Revised: June 9, 2024
Accepted: June 18, 2024
Published: June 30, 2024

Keywords:
Educational Effectiveness;
Literature Review;
Problem Based Learning;
Scientific literacy;
Teaching Models.

ABSTRACT

Objective: Able to face global challenges. One approach that has garnered attention is problem-based learning, considered capable of enhancing students' scientific literacy. This article aims to design and analyze the improvement of scientific literacy through problem-based learning methods. **Method**: The method employed in this research is a literature review. **Results**: The analysis revealed that PBL significantly improves students' scientific literacy skills. N-Gain values indicated moderate to high gains, and t-test results showed significance values below 0.05, confirming a substantial increase in scientific literacy after PBL implementation. **Novelty**: This article provides a comprehensive evaluation of Problem-Based Learning (PBL) in enhancing scientific literacy. Analyzing 15 selected studies, it shows significant improvements in students' scientific literacy skills, supported by N-Gain values and t-test results. The review highlights PBL's effectiveness, including the integration of technology, and offers robust evidence of its positive impact on students' ability to understand and apply scientific information, thus enriching the literature on effective teaching strategies.

INTRODUCTION

Knowledge about the world can be obtained through science. As a process, outcome, and institution, science enables individuals to participate in the construction of new knowledge and use information to achieve desired goals (Amelia & Rahmatina, 2019). To access science, both in its use and creation, a sufficient understanding of the activities and practices of science is required, known as scientific literacy (Adiwiguna et al., 2019).

Scientific literacy skills are a manifestation of an individual's ability to investigate, comprehend, and apply scientific information carefully and critically (Putri, 2022). Scientific literacy skills have undeniable relevance in the context of the continuously evolving modern society (Nuzula, 2022). This ability serves as a crucial foundation for individuals to understand, evaluate, and effectively apply scientific information. Scientific literacy is not merely an academic skill but rather a set of skills that support active participation in the dynamics of a society increasingly influenced by scientific and technological advancements.

PISA, an International Student Assessment Program, defines scientific literacy as the mastery of scientific knowledge, the ability to use knowledge to identify new information, explain scientific phenomena, and draw conclusions related to science (Karmila et al., 2021). Currently, the mastery of scientific literacy is considered a necessity for every student in daily life. Scientific literacy plays a crucial role in shaping thinking patterns and behaviors, as well as building individual character to care for and be responsible for oneself, society, the universe, and also face the challenges encountered by a modern society highly dependent on technology. The COVID-19 pandemic has resulted in a decline in scientific literacy skills internationally by 12 points based on the PISA 2022

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