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Understanding of Electric Circuits Among Primary and Secondary School Students

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Abstract

This paper presents the results of a study on students' understanding of electric circuits in primary and secondary schools. The aim was to assess the level of knowledge acquisition and identify factors that contribute to better conceptual understanding. The research included primary school students and four high school programs: general, sports, IT and language elective area. The test consisted of 25 multiple-choice questions aligned with the learning outcomes and indicators of the physics curriculum. Primary school students completed an adapted version of the test, with tasks distributed across three cognitive levels: recall, understanding and application, while students from all high school programs answered the same test with identical questions. The results were analyzed according to task type: conceptual and computational questions – and presented graphically. As part of the study, a demonstration lesson in physics and mathematics was conducted to examine the relationship between theoretical and experimental approaches in problem solving. The sample included three cohorts of primary school students: 97 (2022/2023), 49 (2023/2024) and 94 (2024/2025), as well as 133 high school students, (78 girls and 55 boys). The findings show improvement across generations and higher achievement in tasks requiring knowledge application. The study confirms the importance of integrating theoretical and practical approaches in physics teaching and provides guidelines for improving vertical and horizontal curriculum alignment.

Keywords: Cognitive Levels; Curriculum; Electric Circuits; Experimental Teaching; Learning Outcomes