ABSTRAK

PENINGKATAN PEMAHAMAN KONSEP HUBUNGAN KUAT ARUS, TEGANGAN, DAN HAMBATAN LISTRIK BERBANTUAN *VIRTUAL LAB*

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Penelitian ini bertujuan untuk mengetahui peningkatan pemahaman konsep hubungan kuat arus, tegangan, dan hambatan listrik berbantuan *virtual lab* PhET. penelitian ini menggunakan metode kuantitatif dengan desain *pre-experimental* berupa *one group pretest-posttest design.* Subjek penelitian adalah mahasiswa Program Studi Pendidikan fisika Universitas Sanata Dharma angkatan 2024 dan 2025. Instrumen penelitian berupa tes diagnostik pilihan ganda (*one-tier diagnostic test)* yang diberikan sebelum dan sesudah pembelajaran menggunakan *virtual lab* PhET, serta LKPD sebagai instrumen pendukung praktikum.

Tahapan penelitian diawali dengan pemberian *pretest* untuk mengetahui kemampuan awal pemahaman konsep mahasiswa. Selanjutnya mahasiswa melakukan praktikum berbantuan *virtual lab* PhET yang memungkinkan mahasiswa melakukan simulasi dan eksperimen secara mandiri sehingga membantu visualisasi konsep listrik dinamis. Setelah proses praktikum selesai, mahasiswa diberikan *posttest* untuk mengetahui peningkatan pemahaman konsep.

Hasil penelitian menunjukkan bahwa penggunaan *virtual lab* mampu meningkatkan pemahaman konsep mahasiswa pada materi hubungan kuat arus, tegangan, dan hambatan. Peningkatan pemahaman terlihat dari adanya kenaikan hasil *posttest* dibandingkan *pretest*. Selain itu, terjadi peningkatan pemahaman pada beberapa konsep, seperti hubungan antara tegangan dan arus listrik, pengaruh hambatan terhadap arus, serta karakteristik rangkaian seri dan paralel. Penggunaan *virtual lab* membantu mahasiswa memvisualisasikan aliran arus, distribusi tegangan, dan perubahan hambatan secara lebih konkret sehingga konsep yang sebelumnya bersifat abstrak menjadi lebih mudah dipahami. Dengan demikian, *virtual lab* efektif digunakan sebagai media pembelajaran untuk meningkatkan pemahaman dan mengurangi miskonsepsi mahasiswa calon guru fisika.

Kata kunci : pemahaman konsep, *virtual lab* PhET, rangkaian arus searah

ABSTRACT

IMPROVING CONCEPTUAL UNDERSTANDING THE RELATIONSHIP BETWEEN CURRENT, VOLTAGE, AND ELECTRICAL RESISTANCE USING A VIRTUAL LAB

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This study aims to determine the improvement in the conceptual understanding of the relationship between current, voltage, and electrical resistance using the PhET virtual lab.This study employs a quantitative method with a pre-experimental design in the form of a one-group pretest-posttest design. The research subjects were students in the Physics Education Program at Sanata Dharma University from the 2024 and 2025 cohorts. The research instruments consisted of a multiple-choice diagnostic test (one-tier diagnostic test) administered before and after instruction using the PhET virtual lab, as well as worksheets as supporting instruments for the laboratory sessions.

The research process began with a pretest to assess students' initial understanding of the concepts. Subsequently, students conducted a laboratory session assisted by the PhET virtual lab, which allowed them to perform simulations and experiments independently, thereby aiding the visualization of dynamic electricity concepts. After the laboratory session concluded, students took a posttest to assess the improvement in their conceptual understanding.

The results of the study indicate that the use of virtual labs can improve students' conceptual understanding of the relationship between current, voltage, and resistance. This improvement is evident in the higher posttest scores compared to the pretest scores. Additionally, there was an increase in understanding of several concepts, such as the relationship between voltage and electric current, the effect of resistance on current, and the characteristics of series and parallel circuits. The use of virtual labs helps students visualize current flow, voltage distribution, and changes in resistance more concretely, making previously abstract concepts easier to understand. Thus, virtual labs are effective as a learning medium for improving understanding and reducing misconceptions among prospective physics teachers.

Keywords : *conceptual understanding, PhET virtual lab, direct current circuit*