

Alternative to Traditional Physics Instruction: Effectiveness of Conceptual Physics Approach

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Abstract

Background of Study: It is widely accepted that students' pre-existing conceptions about the scientific phenomena affect their learning of accurate scientific principles. A conceptual approach promotes meaningful learning in students regarding science concepts.

Purpose of Study: The primary purpose of this study was to compare the relative effectiveness of a conceptual approach to physics and traditional teaching for ninth grade, private high school students' understanding of and attitudes toward simple electricity.

Methods: The population of the study consists of all ninth grade private high school students who study science courses in English in the Çankaya district of Ankara in Turkey. There were four high schools, with 33 classes and 660 students, satisfying this condition in the district. We chose one school and four classes, comprising 73 ninth grade students. The students in the sample correspond to approximately 11 % of the students in the population. For a conceptual physics approach, we adapted Paul G. Hewitt's ideas about conceptual physics to high school physics instruction in simple electricity. For the study, various learning materials were prepared with a conceptual physics approach in mind. Two physics teachers and their four classes were enrolled in the study. Each teacher had two classes; one was assigned as an experimental group and the other was assigned as control group. Two groups of students ($N_1=34$) were instructed with the conceptual physics approach, while the other two groups ($N_2=33$) were instructed by the traditional method. For the study, two measuring tools were used; the Achievement Test about Simple Electricity (ACT) and the Attitude Scale about Simple Electricity (ATS). The ACT and ATS were administered to both experimental and control group students as pre-tests before the instruction and as post-tests after the instruction. The study

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continued for three weeks; students in both groups completed instruction designed for them.

Findings and Results: The main effects of treatments were analyzed by using MANCOVA and follow up ANCOVA techniques. These analyses denoted that the conceptual physics approach led to a better understanding of simple electricity than did the traditional method. Also, the students instructed with the conceptual physics approach developed more positive attitudes than the students instructed according to the traditional method.

Conclusions and Recommendations: The conceptual physics approach led to intensive teacher-student and student-student interactions and a larger commitment of instructional time to individual exploration. Hence, conceptual physics enabled students to understand the main concepts and encouraged them to think critically. In conclusion, the conceptual physics approach should be used in physics lessons.

Keywords: Physics education, conceptual approach, conceptual physics, conceptual change