A “QUICKGUIDE” TO INQUIRY-BASED PHYSICS LABORATORY REFORM

A Dissertation
by
JOHN COCKMAN

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ABSTRACT

A "QUICKGUIDE" TO PHYSICS LABORATORY REFORM
(December 2010)

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Historically, students of introductory physics at Appalachian State University have posted low scores on a Force Concept Inventory-based Diagnostic Tool. In addition, semi-annual Student Laboratory Evaluation Forms indicate that students have generally exhibited poor attitudes toward the physics laboratories. Physics Education Research (PER) has demonstrated that these may be due in part to the cookbook nature of the laboratory activities. The purpose of this study was to test the effect of inquiry-based physics laboratories on student attitudes and diagnostic scores.

Because no prepackaged inquiry curriculum was found that matched Appalachian's educational environment or course structure, Action Research was employed to redesign the introductory physics laboratory using an inquiry-based methodology. For two of the six algebra-based undergraduate laboratory sections, the traditional laboratory activities were replaced with a series of student-centered "QuickGuides" grouped by topical units. These activities were increasingly less guided as the two-semester sequence progressed. In addition to the reformed labs, the laboratory instructor and assistants employed Socratic dialogue in all interactions with students. These interventions significantly improved the attitudes and

behaviors of the students towards physics, as measured by the Colorado Learning Attitudes about Science Survey, Student Laboratory Evaluation Forms, and a video analysis of student-student and student-teacher interactions. It was also determined that the inquiry-based labs were effective in increasing the learning of students enrolled in a non-traditional, Modeling-based lecture section. However, there was no significant increase in scores on the Diagnostic Tool, or in the grades of students enrolled in two traditional lecture sections. Implications from the study, and suggestions for further research, are presented. Although overall results were positive, continued Action Research is necessary to improve the instructional materials and methodology that were developed over the course of this research.