

Project Report – Hewlett Packard Technology for Teaching Grant

Program or Funder: Hewlett Packard Mobile Computing In Higher Education

This project, funded by Hewlett Packard, has enabled the development of modified studio style instruction in introductory physics courses.

Year: 2004

Faculty: Dr. Bruce Barnett

CER Staff: Theron Feist

School and Department: Krieger School of Arts and Sciences, Department of Physics and Astronomy

Pedagogical Issue: Dr Barnett wanted to encourage better student attendance, increase student understanding and performance, spark interest in the subject matter and potentially increase the number of students who pursue a B.S. in Physics.

Solution: Dr. Barnett transformed his physics courses using in-class voting, online homework, and laptops provided by Hewlett Packard.

Project Abstract: In 2004 The Johns Hopkins University received an HP Technology for Teaching grant to encourage the transformation of student learning and teaching. Using HP mobile technology, Dr. Bruce Barnett - Physics and Astronomy professor – is actively engaging students in his large introductory physics courses. In the past two years, Dr. Barnett has transformed his physics courses using in-class voting, online homework, and laptops provided by Hewlett Packard.

1. Lectures are now interactive with students engaging in active problem solving and other active learning during lectures. Dr. Barnett uses in class voting to gauge students' grasp of lecture materials. He is then able to make real-time adjustments to best meet the needs of his students.
2. Students submit all homework problems via the Web Assign online homework system. This frees up large amounts of TA time formerly spent on homework development, collection, and grading.
3. Each conference section uses HP laptops to engage students with interactive online physics problems. TAs are able to spend conference sections assessing student knowledge of materials and focusing on gap areas.

Bruce Barnett's work to improve his physics course has culminated in the receipt of a 2006 Excellence in Teaching Award: <http://krieger.jhu.edu/teachingawards/past-winners.html>

Implementation (Pedagogy): As an incremental step towards a deeper transformation of the traditional lecture hall into a studio physics classroom, we began deployment of the HP mobile computing solution into small-group settings such as conference and lab sections. At Hopkins (as at almost all other universities), sections constitute a primary opportunity for small-group interactions within large lecture courses. Introducing common structure for section meetings enhances the uniformity of their effectiveness. In addition, TAs for who English is a second language often teach such sections. Sometimes this creates communication challenges. Integration of a computer- based, interactive

curriculum into the sections reduces the difficulties of communication and increases the effectiveness of the "section" concept as a teaching strategy.

Implementation (Technology): With limited time and resources to redesign the entire lecture format of the course, the laptops, tablet pc, and projector were integrated into the four weekly conference sections that accompany one of the large general physics lecture courses. In every meeting, TAs present materials using the projector and tablet, and students use the laptops to work through interactive exercises and view simulations. The weekly conference sessions made sense as the first deployment area, as they are the appropriate size and format to take advantage of the 20 laptops, tablet PC, and digital projector granted from HP. Each conference section was comprised of 20 of the 80 students in the Introductory Physics Course. Conference sessions have typically been used as a forum for TAs to explain concepts and work through problems with students.

Impact on Teaching: The impact on teaching has been two-fold. TAs, resistant at first, have grown to relish the role of facilitator as opposed to lecturer. By observing students actively engaging with course concepts by solving problems, TAs are better able to assess gaps in knowledge and address them. Bruce Barnett has continued to evolve the lecture to include increased student engagement using in-class-voting systems from eInstruction.

Impact on Student Learning:

- high levels of attendance at conference sections
- nearly 100% engagement of students in activities
- full use of 50 minute conference sections
- full attendance, engagement, time utilization even for less adept TAs

Quick Facts: The project has affected one faculty member, 4 TAs, about 160 students in one Introductory Physics Course.

Contact Information: Bruce Barnett, Professor, Physics and Astronomy Department (bab@jhu.edu)
Steve Wonnell, Physics Instructional Resource Manager (wonnell@pha.jhu.edu)
Richard Shingles, Senior Lecturer, Biology Department / Instructional (rshingles@jhu)

References:

Physics Education Research, Department of Physics, University of Illinois, Urbana-Champaign:
<http://research.physics.uiuc.edu/PER/>, Interactive Examples:
<http://research.physics.uiuc.edu/PER/ie.html>