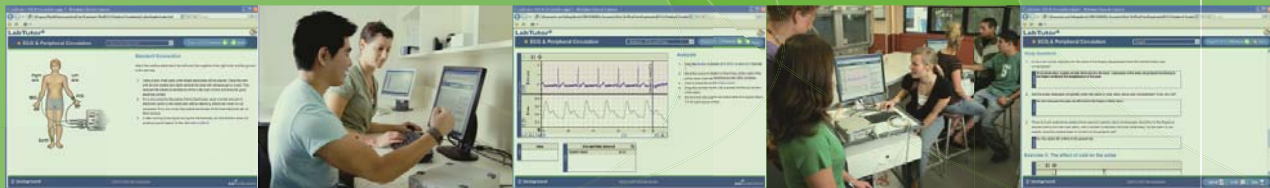


# LabChart Case Study



**Client:** West Chester University, Pennsylvania, USA

**Situation:** The Department of Biology at West Chester University needed a data acquisition system that would enable seamless implementation of inquiry-based physiology laboratories in three of their undergraduate major and nonmajor classes.

**Solution:** PowerLab LabChart Teaching Systems

**Successful Implementation of Inquiry-Based Laboratories Made Possible with PowerLab, a Powerful Computerized Data-Acquisition System That Enables Students to Easily Collect and Analyze Data.**

For the past three years, Dr. Casotti and physiology educators at West Chester University in Pennsylvania have been utilizing PowerLab LabChart Teaching System to implement the inquiry-based learning approach in their major and nonmajor physiology labs. A paper outlining the success of this approach was recently published in the *Advances in Physiology Education Journal*.

According to the authors, the curricular modification to inquiry-based learning approach improves the teaching of physiological concepts and scientific approach. The inquiry-based approach differs from traditional approaches by focusing on learning through discovery. Students learn how to generate an experimental hypothesis, design an experiment and perform an experiment to test the hypothesis. The purchase of PowerLab data acquisition systems enabled students to collect and analyze data easily. The use of PowerLab data acquisition systems in this approach enhances student understanding and grasp of physiological concepts, promotes creative thinking and improves students' critical and analytical-thinking skills.

Around 300 nonmajor students and 12-20 major students were enrolled in physiology courses utilizing the inquiry-based learning approach. In the beginning of all courses, students were given a PowerLab tutorial to familiarize themselves with the data acquisition system. Students then read course materials, literature or text books prior to laboratory classes and generated experimental hypotheses. Students then designed and performed various experiments to test their hypotheses using the PowerLab data acquisition system and gain hands on experience writing scientific reports.

The inquiry-based approach was comprehensively assessed through formative (laboratory exams, oral presentations, and reports) and summative evaluations (surveys, laboratory notebook, and major project). Results from both forms of evaluations were positive with students indicating increased confidence when generating experimental ideas and hypotheses, performing experiments and generating scientific reports.

The article can be accessed at <http://advan.physiology.org/cgi/content/full/32/4/286>

## Background information

**Courses:** Comparative Vertebrate Physiology (majors), Human Physiology (majors) and Human Anatomy and Physiology (nonmajors).

**Educators:** Dr Giovanni Casotti, Dr Maureen Knabb and Loretta Reiser-Danner.

**Students using PowerLab LabTutor systems:** 300 students in non-major course and 12-20 students in major courses.

**Experiments performed:** Introduction to inquiry-based learning and PowerLab tutorial, Psychophysiology I, Psychophysiology II, Cardiovascular Physiology I, Cardiovascular Physiology II, Respiratory Physiology, Integrative Exercise Physiology I, Integrative Exercise Physiology II

**Lab time for each experiment:** For nonmajor course, two hours of lab time are allocated with students spending one hour to conduct experiments, thirty minutes to analyze their data, results and discussion slides and the final thirty minutes for oral presentations. For major courses, three hours of lab time is allocated with two and half hours for students to complete their experiments, analyze data and finalize their presentation and thirty minutes for oral presentation of their findings.

## Abstract from G. Casotti, L. Rieser-Danner & M. T. Knabb, *Advances in Physiology Education* 32:286-296, 2008

Recent evidence has demonstrated that inquiry-based physiology laboratories improve students' critical and analytical-thinking skills. We implemented inquiry-based learning into three physiology courses: Comparative Vertebrate Physiology (majors), Human Physiology (majors), and Human Anatomy and Physiology (nonmajors). The aims of our curricular modifications were to improve the teaching of physiological concepts, teach students the scientific approach, and promote creative and critical thinking. We assessed our modifications using formative (laboratory exams, oral presentations, and laboratory reports) and summative evaluations (surveys, laboratory notebook, and an end of semester project). Students appreciated the freedom offered by the new curriculum and the opportunity to engage in the inquiry process. Results from both forms of evaluation showed a marked improvement due to the curricular revisions. Our analyses indicate an increased confidence in students' ability to formulate questions and hypotheses, design experiments, collect and analyze data, and make conclusions. Thus, we have successfully incorporated inquiry-based laboratories in both major and nonmajor courses.

## Excerpts from G. Casotti, L. Rieser-Danner & M. T. Knabb, *Advances in Physiology Education* 32:286-296, 2008

"Inquiry-based curricula are challenging to write, maintain, and coordinate. They are also more challenging for the students than are more traditional teaching approaches, but they offer clear benefits in terms of the development of student skills and critical thinking. As educators, we have a responsibility to provide our students with the best possible building blocks for their future careers in science. Inquiry-based curricula enable us to meet this responsibility."

"New laboratory activities developed for each physiology course were designed to enhance student inquiry, help students learn skills to "think like a scientist," and promote creative and critical thinking. These activities enabled students to acquire familiarity with the data generated using PowerLab. Once familiar with data generation, students read the literature (i.e., primary literature or textbooks), came up with hypotheses to test, and then designed experiments to test predictions."

“These changes were made possible with the purchase of PowerLab, a powerful computerized data-acquisition system that enabled students to collect and analyze data easily.”

“Modifications were made to our major laboratory curriculum including an introductory laboratory on inquiry-based learning, a PowerLab tutorial, and the addition of six inquiry-based laboratories. In addition, a laboratory on how to effectively present scientific data and laboratories dedicated to independent projects and oral presentations were also included.”

“The rewards of incorporating inquiry-based learning were worth the effort. Not only did the instructors gain insight into student interests but they were surprised at the students’ novelty and diversity of ideas. A faculty laboratory meeting sometimes turned into a ‘bragging session’ about which project was the most creative the previous week. Thus, although modification of the laboratories from a traditional to an inquiry-based approach was challenging, it was a rewarding experience for both faculty members and students.”

## Student feedback

“I felt that I was able to perform my own experiments and get my own results. I thought it was great.”

“We learned how to explore problems by allowing us to create our own variations in the lab. By allowing us to do our own individual group projects we were able to explore how different factors affected an animal. An example of this would be how a drug affected our frog heart such as acetylcholine and epinephrine.”

“The exercise labs helped us understand the lecture material. It accomplished this because we had to design our own experiments and understand the results.”

## Biography

Dr. Giovanni Casotti is a Professor in the Department of Biology at West Chester University. His research interest is focused on the examination of how birds osmoregulate in different environments. As an educator, Dr Casotti has been working closely with ADInstruments in developing inquiry-based learning at West Chester University and conducting several teaching workshops for North American educators from different institutions.