



# INNOVATION ABSTRACTS

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## SCIENCE LABORATORY - TEACHING CONCEPTS AND CONTENT

As a physician who entered the teaching world, I was surprised about the trend away from hands-on lab experiences in physiology courses, especially at the community college level. Some courses included only three hours of lab per week. Others used lab time for computer tutorials or extra lectures. Courses that combined anatomy and physiology seemed to emphasize more anatomy than physiology in lab work.

My goals, as a new physiology instructor, were to emphasize scientific thinking and hands-on experimentation, and to allow enough time to increase the students' fund of knowledge. This was accomplished by a reworking of the lab experience, funded by a NSF grant and implemented by Yuba College staff.

Our outmoded pen recorders, circa 1975, were replaced with a networked computer system, using software and hardware from BIOPAC Systems. The Biopac Student Lab System included a 4-channel A-D data converter, assorted transducers and sensors, user-friendly software, and versatile student lessons to capture and manipulate real physiologic data.

How was computerized data acquisition better than the old pen recorders? A side-by-side comparison of both systems was made using typical physiology students ( $n=29$ , 86% female, average age 28 years). The time required to perform an ECG experiment was roughly identical (29 minutes for the pen recorder, 26 minutes for the Biopac system), and students felt they obtained the same results with both machines. However, 3 to 1 preferred the computerized system as a better teaching tool and felt it was more applicable to their future work.

In addition to being more applicable, the Biopac system expanded and enlivened experimental opportunities. The ability to record and manipulate high quality data, such as EEG, EMG and pulmonary function, were now possible. Experimentation became personal—and, therefore, interesting—when students recorded their own ECG and pulse, and saw the changes caused by

exercise. Imagine the animation as students did deep knee bends in laboratory!

Students developed an appreciation for subject variability, measurement errors, and procedural precision. Often, they wanted to repeat their measurements to improve the quality of their data and expressed concern if the results did not fall within normal range.

Scientific thinking was further advanced through semester-long projects, utilizing group and individual experimentation. Physiology students, with six hours of lab per week and an emphasis on experimentation, showed a greater increase in scientific proficiency and scientific self-confidence than did a control group of introductory biology students, with only three hours of lab per week and a traditional curriculum.

Using the Biopac Pro (formatable) software, I was able to offer a powerful lab exploring the effects of drugs on frog heart rate and contraction strength. Students invested in the lab through the careful preparation of their frog subject, followed by application of common drugs, including caffeine, nicotine, and potassium. This topic could have been covered by CD tutorials, but the living organisms taught the students about subject variability, atypical responses, and the cumulative effects of multiple drug toxicities. The learning was real, not *virtual*.

Easier equipment set-up and rapid data manipulation gave students more time to experiment, review, and reflect. Underlying principles were elucidated, laboratory content was increased, the students' knowledge bank was expanded, and their scientific thought process was enhanced. This curriculum model used computers to enhance, not replace, experimentation. It emphasized both concepts and content. It produced extraordinary learning and could serve as a model for improved science laboratory instruction.

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## DEVELOPING CRITICAL READING SKILLS USING PRINT MEDIA

Many students believe that what they read in news magazines and newspapers and what they hear on the nightly news is a steady diet of facts. Going over the basics of what constitutes facts and opinions covers the concepts, but my students have trouble applying the theory to practice. In an effort to help students make the application, I required them to bring in news articles, editorials, and movie reviews to class. They had no other guidelines.

During the next class session, we reviewed the basics in a comparison/contrast chart, item-by-item. We decided that a fact could be proved or verified, was objective, utilized concrete and denotative words, and occurred in the past or present. An opinion could not be proved or verified, was subjective, utilized abstract words and connotative words, and occurred in the past, present, or future. The other rule we established was that if a statement contained both facts and opinions, we would consider the statement to be a statement of opinion. We discussed how opinions might or might not be based on facts.

The class was divided into groups of three students each; each group had one of each type of article to analyze, and a worksheet and instructions. The students were to count the number of paragraphs in each article; and if the article had more than four paragraphs, they were to use the first four paragraphs. Then, they had to count the number of sentences in each paragraph. Finally, they had to determine which sentences were statements of fact and which were statements of opinion. Lively group discussions developed around the contents in most articles. Students discussed the dearth of facts most articles contained. They realized that even factual articles sometimes contained few facts and that some opinions masqueraded as facts—eye-openers to most!

I worked with each group and then the class as a whole. The students were involved and motivated. The class came to the general conclusion that editorials were mainly opinion and that some of the editorials did not present any facts to support the author's viewpoint. We then moved on to the movie reviews and discovered only a few facts, such as the names of movies, the actors, the names of any other personnel involved in the film, and the plots. We also concluded that the best way to determine a movie's worth was to observe it directly. The news article was the biggest eye-opener. Students were surprised that many articles were merely collections of opinions. They were most amazed with the way

the authors used words to give the impression that their opinions were facts.

The students and I agreed that this was an interesting and useful way to interpret fact and opinion. Even students who did not like working in groups or who did not seem motivated were excited about this activity. Additionally, it fostered a feeling of collaboration; students were able to share their viewpoints and have other students, and the professor, reward good work and point out fallacies in reasoning.

This assignment was the perfect introduction for the next unit, "Author's Purpose and Tone." The three types of articles generally corresponded to the three types of author's purposes: to inform (news articles), to persuade (editorials), and to entertain (stretching it slightly with some reviews). We were able to link tone and purpose to article type. The students identified the objective tone of the articles and were quick to notice when part(s) of an article switched to the subjective. They labeled the reviews and editorials as subjective, were able to determine if the articles were positive or negative, and identify the connotative words, which were the clues.

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