

AP Physics Workshop at Carleton College

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For the last 31 years Carleton College has hosted a summer teaching institute for Advanced Placement (AP) teachers.¹ The original purpose of the workshop was to rejuvenate high school teachers within the subject of their discipline. As the popularity of AP has expanded, numerous educational, curricular, and political issues have found their way into the workshop syllabus. Here we report on our workshop and present observations for high school physics teachers. We discuss successful topics covered in our workshop and note some issues that were not constructive. Those interested in our institute or in hosting similar seminars are invited to contact us.

The Workshop

Physics teachers have various levels of experience, and that is reflected in the composition of our attendees. There are new and inexperienced teachers, experienced physics teachers, and teachers with biology or chemistry training who have been thrown into the physics classroom. The best part of a workshop is bringing the teachers together to learn through mutual interaction.

The topics for physics *rejuvenation* depend on the wishes of the attendees. It is important to cover subjects that the teachers have trouble teaching. Probably the most fun and exciting part of the workshop is the presentation and sharing of good physics demonstrations. In addition to the demonstrations we present, attendees are asked to bring and display one item from their repertoire that they have found to be particularly successful. Also, we lead the atten-

dees to demonstration resources that can be found on the Internet. The University of Maryland has a vast, well-organized library of demonstrations,² as does the online Physical Sciences Resource Center of the AAPT.³

–Technology. New technology creates exciting opportunities for physics teachers. We display and discuss various physics software that supplements instruction and helps the teacher. Most texts for AP Physics come with software; we found the accompaniment to Serway's text⁴ to be very helpful. Most teachers of advanced physics courses are successfully using some type of computer interfacing in the laboratory, often from Vernier Software⁵ or PASCO scientific.⁶ Teachers new to interfacing took time to work with Vernier's newest interface, the LabPro. These devices provide efficient methods to make precise measurements in the typical lab setting.

At one recent workshop, we introduced teaching physics using digital video technology. This presents exciting opportunities for experimental analysis. Students can make a video of some type of motion of interest, and then use the computer to analyze the situation. One example was an analysis of a falling Slinky™.⁷

–Course Content and Testing. At the workshop, the group discussed many issues associated with the teaching of an AP course. One critical topic was the general layout of the topics covered in the course. The syllabus for a typical high school physics course can be very different than that for an AP Physics course geared for preparing the students for the AP exam. We be-

lieve that for an AP course, the best rule of thumb is to divide the curriculum subject time in accordance to the percentages of topics set for the AP exam. The College Board lists the percentage of the AP exam that addresses particular topics,⁸ but it can be difficult to adhere to this breakdown in the classroom. Mechanics accounts for 35% of the AP questions, but many teachers feel that having only 35% of the total course time is inadequate to establish an effective foundation of physics knowledge. Topics in mechanics are fundamental to understanding more complex concepts in other areas. It was advised that teachers should create a syllabus for the entire year (including all homework problems) beforehand, and stick to it. This allows one to keep a good handle on the calendar as the AP exam approaches.

There was discussion on the day-to-day organization of work within the AP course. Some teachers use a problem-driven class and start with the students attempting to solve these problems, and then use lecture time to talk about the physics. Some teachers give weekly quizzes drawn exclusively from the assigned homework; this diminishes homework copying and forces the students to do and understand the problems. Experienced AP teachers were in agreement that

previous AP exam questions are a valuable resource. Educators can obtain several exam questions directly from the College Board's website.⁹ The questions can and should be used on tests given in the AP course, but they can also be used as the focus of an individual class.

Our teachers agreed that regular classroom tests be made longer than is reasonable to complete in the time allotted, so that students become accustomed to working under time pressure. When students are faced with the actual AP exam, it will be of the magnitude they are used to. Several teachers suggested that it is important to include problems from previous physics topics; this forces the students to keep the topics fresh in their minds.

-AP or Honors. There was extended discussion on the pros and cons of teaching an honors (rigorous but not AP) versus an AP course. This dialogue also encompassed the issue of the proper number of labs that a comprehensive course should have. Due to the extensive list of topics that the AP-B exam covers, it can be difficult in an AP course aimed at AP exam performance to do justice to experimental physics. An honors course can afford more time with labs and extended special projects. Team projects serve

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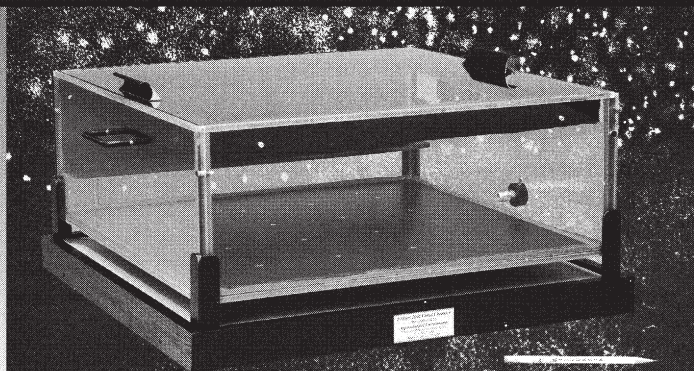
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many beneficial purposes; they can encourage independent thinking and provide an opportunity to practice communication skills. Teachers with successful honors classes fear losing unique educational opportunities when they are pressured to convert their class to AP. It does seem possible, however, to strike a balance in an AP class. One of us has had good results in an AP class with 1 to 1.5 days of lab per week, with 2 to 2.5 days of lecture and discussion, with the remainder going to problem-solving work. An experienced AP-C teacher reported excellent results with a second-year physics class that included few labs. In this case, the first year of physics is more lab intensive than the second.

–AP at College. Most teachers in attendance were anxious to know what the expectations of colleges are of AP Physics and how student results are treated. In spite of the uniformity of the AP exam and (potentially) the curriculum of the courses, there seems to be no standard on the part of the colleges. Some colleges will excuse students from introductory courses, but many will encourage the students to commence at the start of the college sequence. Most colleges will accept the AP credits toward graduation requirements, and AP success will almost always help with admission. AP high school students should keep a good portfolio of completed lab reports so that they can justify their experimental experience to the college faculty. Students commencing with their tertiary studies and having AP credits should definitely consult with a physics faculty member before registration. It has been noted, “the best indicator for college degree completion is the intensity of the high school curriculum, and not standardized test scores, grade point average, or class rank.”¹⁰

Comments

Almost all of our workshop experiences have been positive, but there are a few areas where we

can advise caution. Try not to let any one attendee dictate the direction of the seminar, but instead develop a consensus. Do not be too rigid with the workshop syllabus; spontaneous projects have been a great success. Assuming that participants have a wealth of physics knowledge is not prudent; the fact they are planning to or have been forced to teach an AP Physics course does not necessarily indicate knowledge. Some of the teachers we have worked with needed a good conceptual grip on the basics.

The AP Physics workshop at Carleton College is an invigorating experience for all who participate. Assembling dedicated educators together for a week provides a unique opportunity to exchange ideas and techniques. It is important for all physics teachers to experience new teaching opportunities, and a workshop allows teachers to learn more about them.

References

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