

Improving STEM Education Through the Redesign of the Advanced Placement Science Courses

Background

To stay strongly aligned with college credit policies and to prepare AP students for college and subsequent STEM careers, the AP Program recently redesigned several science courses. The purpose of such a redesign is to help students increase depth of understanding of essential concepts and develop capacity to use critical skills by limiting breadth of content covered. Additionally, the purpose of the AP Science redesign included the goal of preparing students for success in college-level courses within disciplines and stimulating them to consider careers in those disciplines.

The AP Science redesign draws upon current research and theory on learning, instruction, and assessment and infuses such redesigned courses with topics drawn from cutting-edge research and emerging issues. Such research recommended the redesign of the AP Science courses focus on establishing coherence within and across the disciplines by organizing curriculum, instruction, and assessment using unifying themes and creating learning programs accessible to students from a broad range of backgrounds.

As a result of the AP Science redesign process, teachers now have access to learning objectives embedded in a well-articulated set of curriculum frameworks for AP Biology, AP Chemistry, and AP Physics 1 and 2. As the redesigned AP Science courses launch, teachers will have access to additional support resources such as practice exams, course planning and pacing guides, sample syllabi, and associated professional development.

Documented Results

As a result of engaging subject matter experts, pedagogical experts, and both higher education faculty and secondary education AP Science teachers in the redesign process, the redesigned courses articulate the appropriate amount of content; emphasize the essential knowledge, key concepts, and thinking skills valued by colleges and universities; and provide learning objectives that describe the knowledge and skills students should develop through the courses. A review of the research in the NRC 2011 report *Successful K-12 STEM Education* report reveals a more focused set of standards and skills that provide transparency to teachers and students about what students should know and do to be successful in such courses. Furthermore, each of the redesigned AP Science courses requires teachers to engage students in inquiry-based labs to apply science practices for the purpose of personally discovering and strengthening their understanding of scientific concepts. Such practices include:

- Generating representations and models
- Developing strategies for collecting data
- Making connections across scales, concepts, and domains

A substantial body of research reveals that requiring an inquiry component in the instruction of such courses strengthens students' retention of foundational and required content as well as increases students' development of the skills that practicing scientists use to advance knowledge within the various fields of science. Accordingly, the AP Science course redesign addresses the

recommendation of *Successful K-12 STEM Education* to improve STEM curriculum and instruction by engaging students and raising standards.

Potential Applications

In collaboration with the National Science Foundation and eminent educators nationwide, the AP Program has spent several years reviewing and redesigning several AP Science courses. This collaboration has led to a set of robust courses, with an emphasis on reasoning, analytic, and inquiry skills. Higher education faculties have endorsed these courses as designed to offer students a solid foundation for further college coursework in science. The redesigned AP Biology course launched in fall 2012, with the redesigned exam to be administered in May 2013. AP Chemistry will launch fall 2013, with the redesigned exam to be offered in May of 2014. AP Physics 1 and AP Physics 2 will launch fall 2014, with the redesigned exam to be administered May 2015.

For AP Science teachers and students, the redesigned courses have associated curriculum frameworks and support documents that promote differentiation and provide teachers with a well-defined set of learning objectives. These objectives support teaching for deeper understanding in a variety of instructional settings and address a variety of student differences.

Additionally, the AP Exams will be congruent with the learning objectives of the provided curriculum frameworks. Such transparency pertaining to the exam design will help teachers and students (of varying levels of content knowledge and skills) achieve appropriate learning goals to help students become successful in the course and the exam. Such success can lead to continued student interest in the sciences and to student motivation to continue coursework in the sciences in college. Accordingly, the redesigned courses will increase interest and success within a new population of students who can then contribute to both science education and the practice of science.

For More Information

For more information on the redesigned AP Science course curriculum frameworks and additional teacher support documents, visit the Advances in AP website:

<http://advancesinap.collegeboard.org/>