

COMPILATION: AP science program critique by NAS

Date: Thu, 21 Feb 2002

From: Paul Gregg Swackhamer <pswackhamer@GLENBROOK.K12.IL.US>

A very good critique of the AP and International Baccalaureate programs was just released (2/14) by the National Academy of Sciences. It is worth a read, especially given the widespread misunderstanding of what the AP program really does for us. Here's the URL:
<<http://www4.nationalacademies.org/news.nsf/isbn/0309074401?OpenDocument>>

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From: Jane Jackson <jane.jackson@ASU.EDU>

[For you who don't have time to visit the web, I copied/pasted the article that Gregg Swackhamer posted about. Some modelers told me it's excellent, so I looked it up and decided it's important! I suggest that you forward it to your school and district administrators. - Jane]

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For Immediate Release:

Advanced Study Math, Science Programs in U.S. High Schools Should Offer Greater Depth and Be Available to More Students

WASHINGTON -- *High school courses for advanced study in mathematics and science should focus on helping students acquire in-depth understanding* rather than the more superficial knowledge that comes from covering too much material too quickly, says a new report from the National Academies' National Research Council. Educators also should work to make such courses available to more students who could benefit, especially minorities and those attending rural and inner-city schools.

"The primary aim of programs such as Advanced Placement and International Baccalaureate should be to help students achieve deep understanding of the content and unifying ideas of a science or math discipline," said Jerry P. Gollub, co-chair of the committee that wrote the report, and professor of physics, Haverford College, Haverford, Pa. "In advanced chemistry, for example, students should not only explore the atomic nature of matter, but also learn how it can explain chemical bonding that holds molecules together, as well as the widely varying tendency of different materials to react. On the whole, well-designed advanced programs must

provide opportunities to experiment, critically analyze information, argue about ideas, and solve problems. *Simply exposing students to advanced material or duplicating college courses is not by itself a satisfactory goal.*"

Accelerated classes that cover a smorgasbord of topics and final examinations that devote insufficient attention to the integration of important ideas cannot produce superior learners, says the report, which concentrates on biology, chemistry, physics, and mathematics in Advanced Placement (AP) and International Baccalaureate (IB) programs in U.S. secondary schools. AP and IB have raised the level of mathematics and science education in the United States. However, their efforts to emphasize the key concepts in science disciplines have been largely unrealized because of the excessive number of topics covered in each subject.

Today advanced study is practically the norm for secondary students seeking admission to the most competitive colleges, which view enrollment in demanding courses as an indication of a student's willingness to work hard. But access to such programs is limited for many students who are poor or minorities, the report says. For example, the number of AP programs in a school tends to decrease as the percentage of minority or low-income students increases. Even when college-level courses are available, studies show that such students may not be sufficiently encouraged to take them, or nurtured to succeed after enrollment.

A lack of well-prepared teachers and the inadequacy of students' prior schooling are two factors that shrink the number of prospective participants. "Improvements on these fronts could significantly enlarge the population that the programs could serve well," said committee co-chair Philip C. Curtis Jr., professor emeritus of mathematics, University of California, Los Angeles.

In addition to recommending that courses be designed for in-depth learning, the report calls for several other changes to boost quality and expand access. At the outset, *advanced courses in mathematics and science should not be designed primarily to replicate typical introductory college classes, which may not take into account the best current practices in education.* The way many advanced courses are taught also does not reflect the recent explosion in scientific understanding about how people learn. Research indicates, for instance, that encouraging students to learn by engaging in active problem solving and discussion, as scientists do, is an effective teaching tool. Yet rote memorization of facts, one of the least effective approaches, seems to be stressed in many advanced classes. Furthermore, teachers should work harder to build on students' prior knowledge and address misconceptions.

Students learn more from teachers who know their subjects well and can convey that knowledge clearly, the committee noted. However, the New York City-based College Board and the International Baccalaureate Organization, located in Geneva, Switzerland - which oversee the AP and IB programs, respectively - support professional development of teachers only to a limited extent. *Schools and school districts offering advanced study should provide frequent opportunities for teachers' professional development.* The AP and IB organizations should clarify the knowledge and skills that are needed by beginning teachers of advanced courses, and

provide models of professional development likely to foster high-quality instruction. This is an admittedly major task.

The College Board also should exercise greater quality control by spelling out standards for what constitutes an AP course, the kind of student preparation expected, and strategies for ensuring equity and access, the report says. As AP has taken on more weight as a perceived measure of excellence and school quality, some schools have sponsored AP classes without providing proper laboratories or other teaching and learning resources.

The committee pointed out that academic preparation for advanced study actually begins in middle school. At that level, however, mathematics and science courses often lack focus, may be repetitious across grades, and are taught inconsistently. To address the problem, *education officials should weave advanced study into a coherent plan that integrates coursework from middle school through the last year of high school*. Furthermore, classes with reduced academic expectations should not be options for most students. Too many youngsters are steered toward such offerings, leaving them unprepared for advanced study in high school or later in college. School administrators also should make additional efforts to persuade parents of the long-term benefits of having their children participate in rigorous academic programs, and to increase students' access to skilled guidance counselors and mentors.

Developed by the College Board in 1955, AP is now the country's predominant program for accelerated high school courses. It offers 11 separate classes in eight areas of mathematics and science alone, and is built around voluntary, end-of-course exams. Many colleges and universities use qualifying scores from these national exams as a basis for awarding academic credit to incoming students or making course-assignment decisions after admission has been granted. AP originally served only the very top students from select schools, but is now offered in approximately 62 percent of high schools.

IB was developed in the late 1960s to provide an international standard of secondary education for the children of diplomats and others stationed outside their home countries. The International Baccalaureate Organization must endorse participating schools. It also administers final exams, which students must pass to receive a full-fledged IB diploma. Some colleges grant academic credit based on IB participation in high school. IB currently is offered in 1,270 schools in 110 countries.

A major problem with both programs is the lack of detailed research about what their examinations actually measure, the committee found. In particular, not enough is known about what kind of thinking the exams elicit. Given this data gap, colleges and universities should view AP and IB test scores as only one of many sources of information needed to accurately assess each student's capabilities and level of understanding. The governing bodies for both programs should provide better guidance to educators, policy-makers, and the general public concerning proper uses of their exam scores for college admission, placement decisions in college, and evaluation of those who teach AP and IB courses.

At the same time, *educators and researchers should explore the development of alternative programs for advanced study in the nation's high schools, and evaluate new and promising approaches. The availability of more alternatives could increase students' access to advanced study and lead to innovative and effective teaching strategies.* The study was sponsored by the U.S. Department of Education and the National Science Foundation. The National Research Council is a private, nonprofit institution that provides science policy advice under a congressional charter granted to the National Academy of Sciences. .

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[The entire report can be ordered, or it can be read on-line at
<<http://www4.nationalacademies.org/news.nsf/isbn/0309074401?OpenDocument>>]
