The Education Series - AP courses

David Kristofferson from The Highlands · 11 Feb 2016

The AP class rat race is getting national attention. The December 2015 cover story of The Atlantic

http://www.theatlantic.com/magazine/arch...

talked about the extremely serious problems right in our back yard at Gunn High School in Palo Alto. Pressure from intense Silicon Valley parents is cited as a primary cause which leads to those problems, but, fortunately, it is also obvious that the vast majority of students go through the AP system without it leading to such tragic results.

The elite institutions are finally starting to wake up. Here is a link to a recent NY Times article called to my attention by my friends John and Michele Phua:

http://www.nytimes.com/2016/01/20/opinio...

The following link gives a few selected reader reactions,

http://www.nytimes.com/2016/01/26/opinio...

and the report referred to in the Times story can be found at

http://mcc.gse.harvard.edu/files/gse-mcc...

Since Harvard, Yale, Princeton, et al. have created this problem, I have long said that it won't go away until they take action. Unfortunately, the top schools appear to be only talking about the issue at this point.

Let me say from the start that individual AP courses can be both challenging AND interesting. However, I have grave reservations about the tendency of such classes to become exam prep classes instead of meeting students' learning needs.

The biggest problem stems from students feeling the need to take large numbers of AP classes to get in to top schools.

The University of California campuses (not Berkeley) are largely on the quarter system. 16 units was usually considered a full load when I went to college, perhaps 18 max. That would correspond to 4-4.5 hard classes. Given this, why should a high school student take 5+ AP classes plus other classes for a total of 7? The reason is NOT to learn subject matter, but to prove one's superhuman abilities.

Almost every year I have advanced calculus students (some of the best in the high schools) ask me shyly when

no one is looking, “Why when I am doing

$$\frac{x+5}{5}$$

can I not just cancel the 5’s?” They get A’s on the calculus tests. I have brought this up to other high school teachers numerous times, and their experience is similar. Students become adept at learning methods (sometimes unethical as I mentioned in an earlier article) to pass exams for their own sake. Unfortunately learning is not the goal; the goal is getting over the hurdle.

These math foundation problems stem from issues in elementary and middle schools which I will address in my next article in this series.

My intent in this article is to offer advice about specific AP math/science classes to parents of children coming up through the system. It is limited to math and science AP classes. This advice stems from my experience tutoring local students. I am sure that it will not apply to all students, and each parent will have to tailor (or ignore ;-) it for their individual cases.

OBVIOUS, but necessary, WARNING - be careful not to overestimate the ability of your child. There is always a struggle to find the right balance between challenging a student and overwhelming them, and unfortunately life usually lets a person rise until he/she hits a wall. The best thing to do is to take corrective action early if this happens, but unfortunately high schools do not always let students change classes in midstream. My opinion is that there should be additional add/drop flexibility for AP classes, but there are always resource limitations. Be sure to know what your school’s policy is BEFORE your child embarks on a challenging set of courses.

SECOND WARNING - Kids often impose the AP burden on themselves due to subtle peer pressure. They take classes because they want to “keep up with the other smart kids.”

Let’s start with science, and I will use Aragon as my example since it is our local high school.

I am only going to mention one teacher name in this article because she deserves special credit for her outstanding dedication. Please note that there are several excellent AP teachers at Aragon, but I do not want to get into “playing favorites,” especially when my focus is primarily on math and physics.

Katie Ward, the AP biology teacher, is one of the crown jewels at Aragon. Fortunately, she is still young, but it will be a very sad day when she eventually retires from the school. She has inspired many students, my younger daughter included, to pursue careers in the life sciences.

Please note, though, that the AP biology class has a very high workload. I am not sure what the current schedule is, but I believe that students have to attend early morning labs before school, so I would think carefully before combining this class with precalculus (which is not an AP class) or other AP classes.

The AP physics program at Aragon is also quite good. My personal preference is that students take regular physics first and then take AP physics. Those who go straight into AP physics often get caught up in memorizing formulas and trying to use the "these are the variables I know; what formula on my formula sheet uses them?' approach to physics. Regular physics attempts to teach students how to visualize what is actually happening in a physical situation instead of immediately jumping to mathematics. It is my understanding that Einstein stood out above his peers because of his excellent "physical intuition" more so than his mathematical expertise. (Aside - He WAS good in mathematics despite anecdotes to the contrary, but colleagues like the mathematician Minkowski commented sarcastically that "physics was too hard for the physicists" when Einstein was developing general relativity. In the end Einstein was almost beat to the punch by the mathematician Hilbert.)

I know people will immediately say, "How many students take two physics classes in high school?" and that is true. Nevertheless I believe it is important to lay a solid foundation first, and thus my recommendation above. Some high schools are now beginning with regular physics in 9th grade, but I think this requires a really excellent teacher to pull this off successfully, so results with "Physics First" can be mixed at different schools.

Despite this recommendation, many students at Aragon go straight into AP physics and do well. I find, though, that the ones who take both classes tend to understand the AP material better, though this is not always the case.

I also do NOT recommend that AP physics at Aragon or anywhere else be used for AP credit to skip the introductory college physics class for the following reason: Colleges have much larger budgets for lab equipment. Very few high school AP courses will give a student the lab experience that they will receive in a college course, so it would be another foundational error to use high school AP physics to skip introductory college physics. This same reasoning applies to AP classes in any other experimental science.

I do not have comments on AP chemistry. Surprisingly, although I have had several regular chemistry students over the last four years, I have rarely received a request for help with AP chemistry which I assume is a good sign.

Now for math!

There are students at Aragon who have started their freshman year in precalculus, gone next to Calculus BC (which is officially supposed to mirror SECOND semester college calculus), then took Multivariable Calculus (3rd semester college calculus) as a junior, and finally had to take other subjects or go elsewhere for math as a senior.

No one should protest that Aragon does not offer its students accelerated math options!

However, students such as the above are clearly the exceptions and should NOT be the basis for general educational policy decisions. When "good" or "very good" kids try to keep up with these geniuses, the results are often disappointing.

Now for the controversy — Common Core is apparently attempting to slow things down to strengthen students' math foundations, but is getting a lot of flak from parents with advanced kids. I respectfully suggest that such parents quietly accelerate their kids through the system or go to a private school if they can't get satisfaction here, instead of giving the schools a hard time at public meetings when the high schools are trying to solve the much greater problem of poor mathematical foundations among their incoming students.

Personally, although I know that the multivariable calculus class at Aragon is a matter of school pride and is taught by a good teacher, I would much rather see students emerge from high school with a solid math foundation and take this subject in college rather than rushing through the math program to score resume points. I believe that schools like Berkeley require their students to repeat calculus anyway, even if they have taken AP calculus.

However, clearly, my bias is towards learning, not resume-building for Harvard.

So what should a "good" or "very good" student take? I would say that, AT MOST, precalculus as a sophomore, calculus AB as a junior, and calculus BC as a senior.

It makes no sense to me to have students, except in rare instances, skip the first semester of college calculus (which is AB) and go straight to BC from precalculus. This latter option is only made possible by the fact that the BC course rushes through the AB material in the first semester and then moves on to additional topics. This puts a lot of demands on students who choose this option, often because their friends are doing it.

Calculus is not only an important foundation for the physical sciences (and, increasingly, other fields such as economics or financial engineering), but it is a beautiful and interesting topic in its own right. Unfortunately the Educational Testing Service (ETS) has turned it into a rat race to learn test-passing tricks at the expense of comprehension.

*** Students would be much better served *** if the teachers taught the subject at the rate at which their individual classes are absorbing the material, slowing down and repeating topics if needed, *** rather than turning the class into a fast-paced, trick-filled, examination test prep course which HAS TO cover all of the material and then also leave time for review at the end of the second semester before the AP exams in EARLY MAY, well before the end of school!! ***

NOTE - This is NOT a criticism of the Aragon AP teachers!!! They are doing their job as required to teach these classes. If you want to blame someone, blame the ETS and Harvard et al., for promoting this style of education.

Having mentioned the precalculus, AB, BC option above, frankly I think the great majority of good students would be doing well if they just took geometry as a freshman, Algebra II (called 3/4 at Aragon) as a sophomore, precalculus, and then calculus AB. A slightly more modest sequence would just be Algebra I, Geometry, Algebra II, and precalculus, but students should not feel that they are irretrievably behind if they choose these options. In the long run, they may very well end up with a *** much better *** understanding of

mathematics and not be burned out by the subject.

I have one final note about combining Algebra II with precalculus which I assume is currently being done in response to parental pressure due to discontent with Common Core changes. Precalculus has been a notoriously difficult class at Aragon, and, as you know, I have serious concerns about the modifications made to the precalculus curriculum this year. Trying to cram Algebra II together with precalculus is a recipe for disaster for many students, in my not so humble opinion. If you feel the need to have your student take advanced math courses, then hopefully taking the prerequisite classes during summer school, or at CSM if possible, would be a better option instead of cramming two years worth of instruction into one!!

So that's it. I'm done with my comments about AP.

Did I just hear someone yell, "Incoming!" ???