How to Determine the Best AP STEM Course for a Student.

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**Introduction**

Advanced Placement (AP) courses are becoming more and more popular every year. A big part of how high schools are ranked and how teachers are judged is based on the proportion of AP scores that are 3 or higher, the score needed by most colleges in order for a student to be given college credit for the course. According to the College Board, the number of students taking AP exams almost doubled from 2003 to 2013. The number of AP exams in 2013 was almost four times the number of test takers in 2003. The number of students earning a score of 3 or higher on the exam also increased but the percent of increase was less than the increase in the number of test takers. (College Board, 2014)

A study using students from the Georgia Institute of Technology, earning AP credits in high school showed a positive association with a student’s college grade point average (GPA) starting in their freshman year and continuing throughout their college years; college GPA was shown to have a strong and positive correlation with matriculation in a STEM field. This study found the average AP exam score was ‘the single best predictor of academic success after high school GPA (HSGPA). The most important predictors of STEM major persistence were receiving credit for AP Calculus and if the student had successfully completed three or more AP exams in the STEM areas.” (Ackerman, Kanfer, & Calderwood, 2013)

Another study done by the Society of Research on Educational Services showed “taking AP math and science courses have significant positive effects on college outcomes. In previous work, we did not find large effects on college outcomes for taking an AP course, not specifying the subject area of the course.” (Kelley-Kemple, Proger, & Roderick, 2011) Both studies highlight the importance of students pursuing AP math and science courses, especially math, at the high school level. However, not all schools can afford to offer all AP courses or multiple sections of each in order to accommodate the number of students they have that are eligible to take them.

**Research Question**

If a student is only going to take one AP math or science course while in high school, which one should they take? The decision will be based on the grade level the student is in when prepared to take the course: junior or senior year, using the five first year AP level classes: Biology, Calculus AB, Chemistry, Physics B, or Statistics, based on the score distribution: 5, 4, 3, 2, and 1.

**Data Sources**

The data was obtained through the College Board website in the National Summary report that includes the distribution of AP exam scores for every course based on multiple variables. Information regarding subjects other than first year science or math courses was removed. The data were broken down by race, but totals were given for each subject. <http://media.collegeboard.com/digitalServices/pdf/research/2013/National_Summary_13.xls> Only the total number of students who earned each score based on the subject was used.

**Measures**

The data were sorted into two-way tables regarding overall test score distributions based on course and grade level (11th and 12th only). All data came from the 2013 administration of the exam. The proportion of students taking each course and the proportion of students in each grade level based on which course was taken was calculated and displayed in a table in Excel. Conditional probabilities for test score based on the grade level and the course taken were calculated and displayed in another table using Excel.

**Decision Tree**

The decision tree for this project is too large to insert here. It is included in the Excel sheet attached. [Data for STEM by grade level.xlsx](file:///C:\Users\b.morgan\Downloads\Data%20for%20STEM%20by%20grade%20level.xlsx) The first decision node broke the sample up according to the AP exam taken. The next nodes were event nodes splitting the students in the individual AP classes up by grade level, 11th or 12th grade, the test was taken in. The final event nodes breaking off of the grade level nodes were the grade distributions based on the course taken and the grade level of the students who took the class.

The decision tree would be useful for a school to help determine which math or science course a student should take based on how well they would be expected to do given their grade level. Overall, the students that performed the best were the seniors in AP Calculus AB. These students had an expected score of 4.31, well above the score of a 3. It appears the worst options would be for AP Calculus AB during a student’s junior year and for AP Chemistry either year. These three groups of students were the only three that had an expected value below the score necessary to earn college credit.

**Limitations**

The decision analysis could be more useful if the values were from the specific school based on multiple years’ results with the same teachers. This could help to determine the effectiveness of the teachers and to give students an even better picture of which course they can be expected to perform the best in. Other variables could be added in to help with the decision making as well such as GPA, average grade in the pre-requisite math and science courses, and field of interest for the student. However, only the individual schools would have access or the ability to collect this data.

# References

Ackerman, Phillip L., Kanfer, Ruth, & Calderwood, Charles. (2013). High school advanced placement and student performance in college: STEM majors, non-STEM majors, and gender differences: 1. *Teachers College Record, 115, 1-43*. Retrieved from http://www.tcrecord.org.ezproxy.snhu.edu/library/content.asp?contentid=17149

College Board. (2014). *The 10th Annual AP Report to the Nation.* College Board.

Kelley-Kemple, T., Proger, A., & Roderick, M. (2011). Engaging High School Students in Advanced Math and Science Courses for Success in College: Is Advanced Placement the Answer? *ERIC*.