



Chemistry Placement at the University of Michigan: Burdening At-Risk Students while Propelling Others?



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The Michigan Model

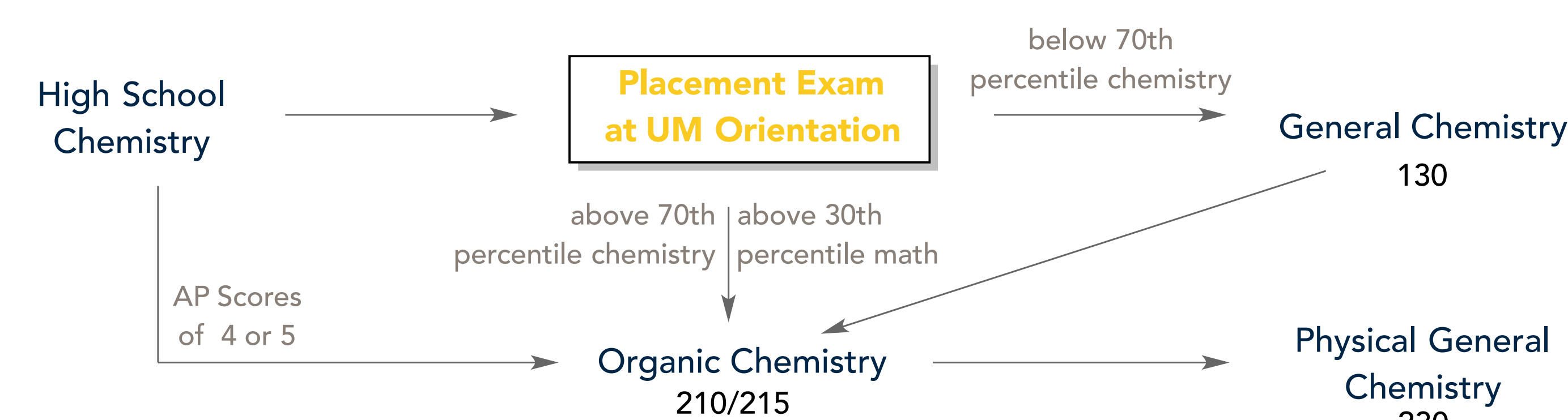
Since 1989, the University of Michigan has employed a curriculum model that allows well-prepared freshman students to opt out of the first semester of general chemistry.¹

Chemistry and math placement exams are routinely given during orientation and used to determine placement. If a student performs above the 70th percentile in chemistry and the 30th percentile in math or if they have a chemistry AP score of 4 or 5 they are advised to take organic chemistry first. If not, they are advised to take general chemistry.

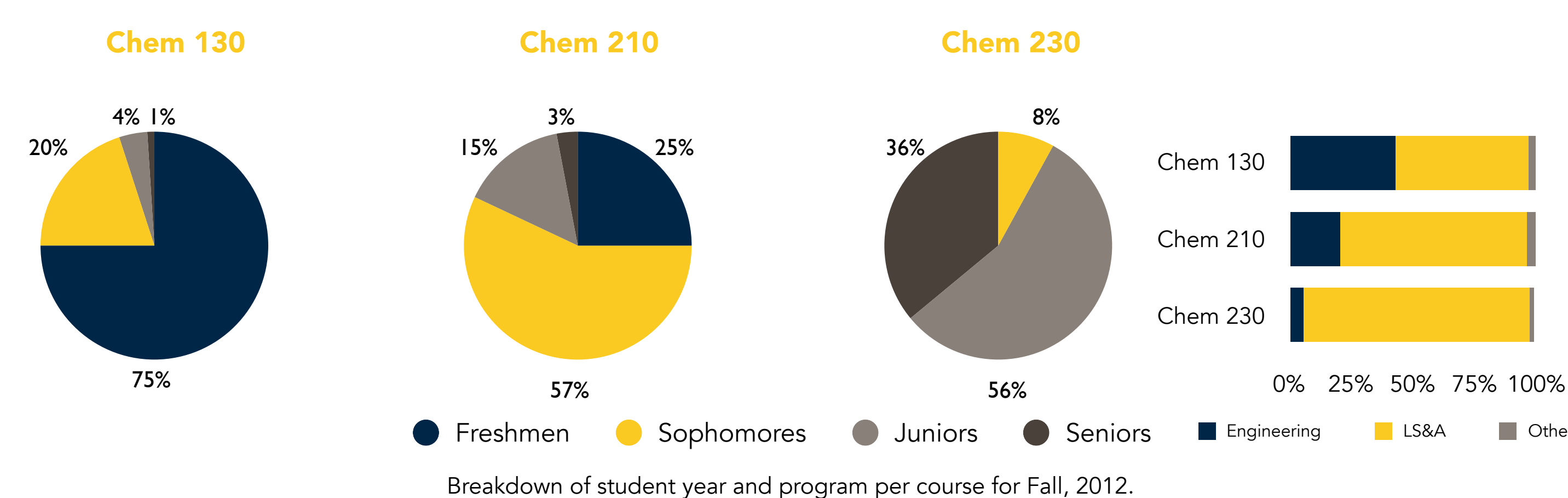
General chemistry (Chemistry 130) stands alone, as it either fulfills the chemistry requirements for disciplines like engineering or it strengthens the background of students who did not meet departmental standards for direct placement in organic chemistry.

We report the results of a post-hoc analysis of 10 years of archived student data (ca. 26,000 students) who have taken chemistry courses from Fall 2002 - Fall 2012.

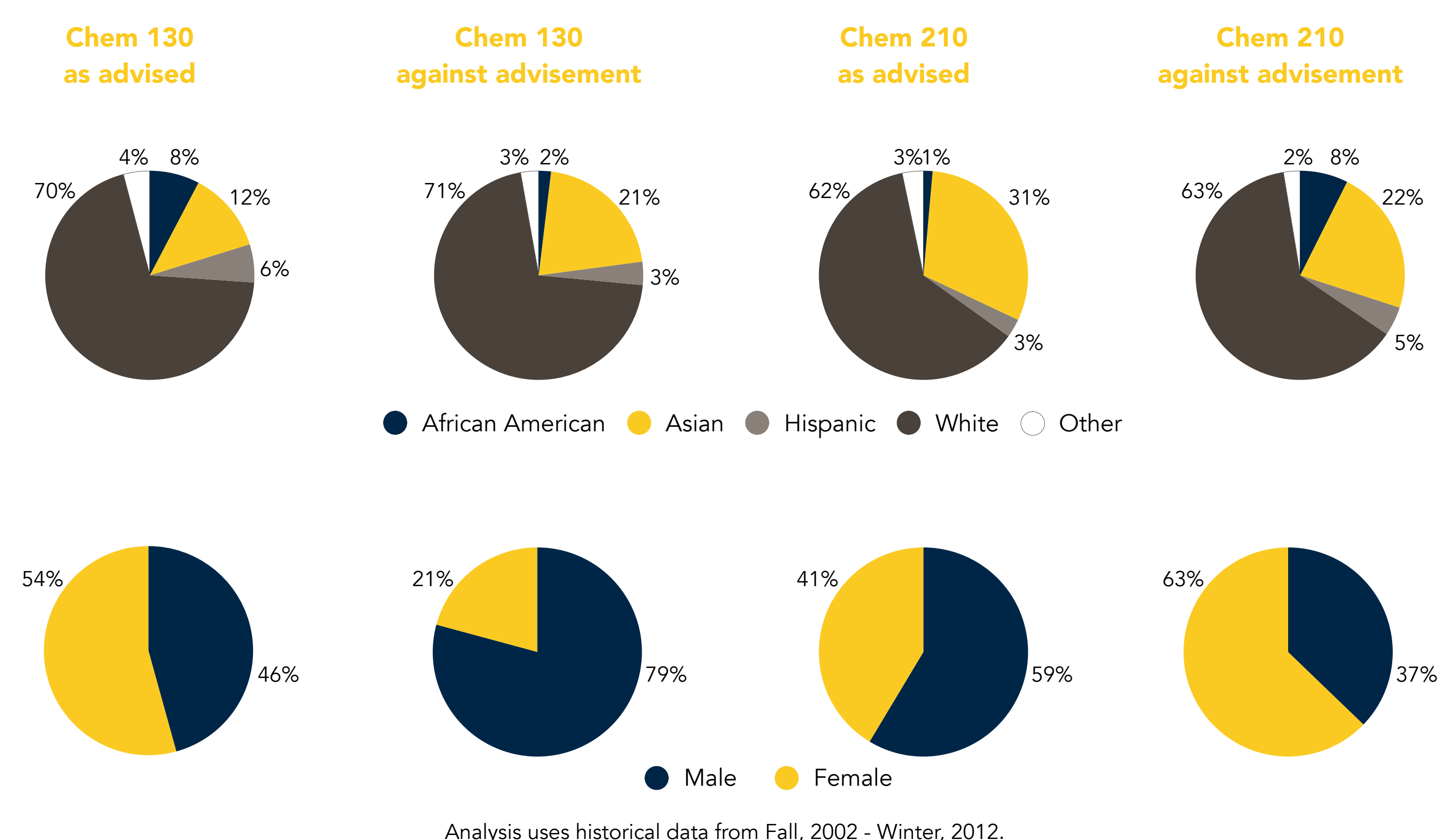
1. Ege, S. N.; Lawton, R. G.; Coppola, B. P. *J. Chem. Ed.* **1997**, *74*, 74-83.



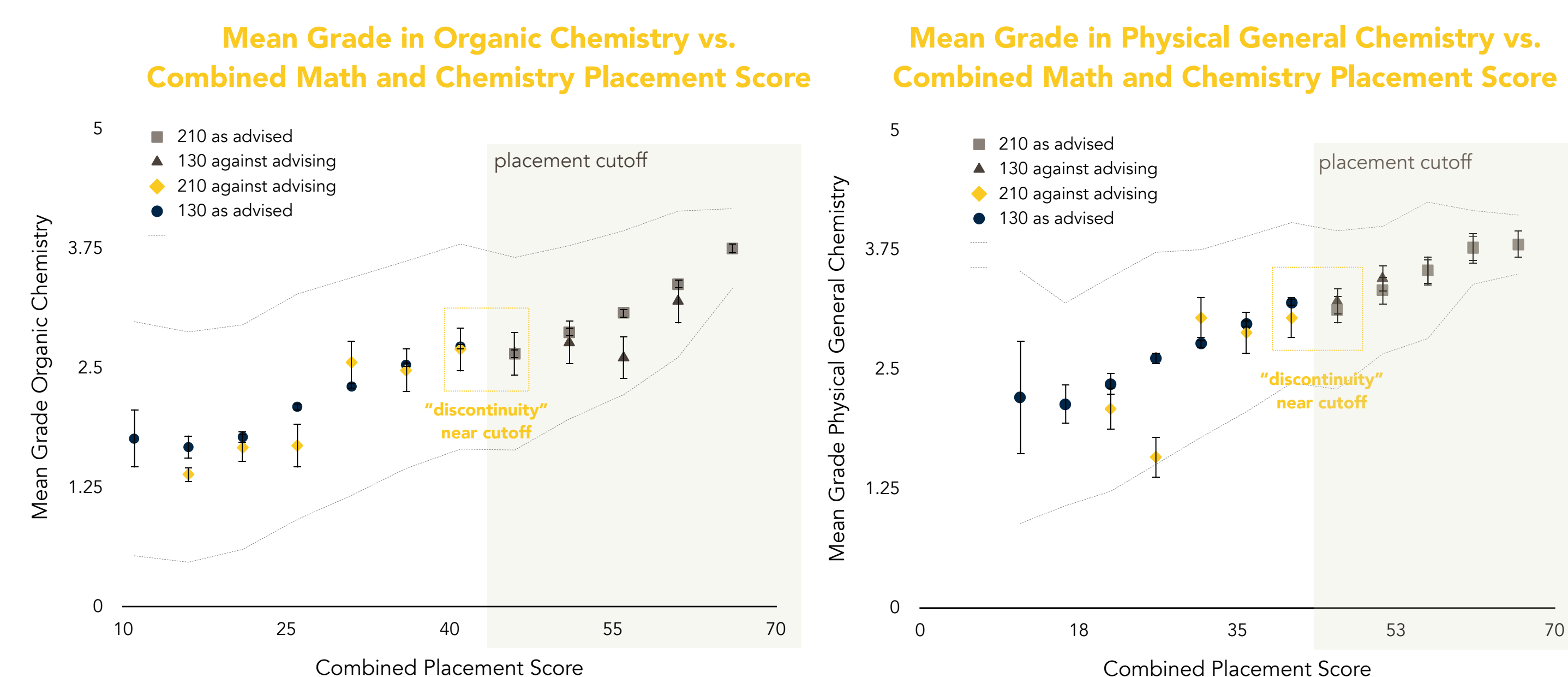
Who took introductory chemistry courses?



Who followed the placement advice?

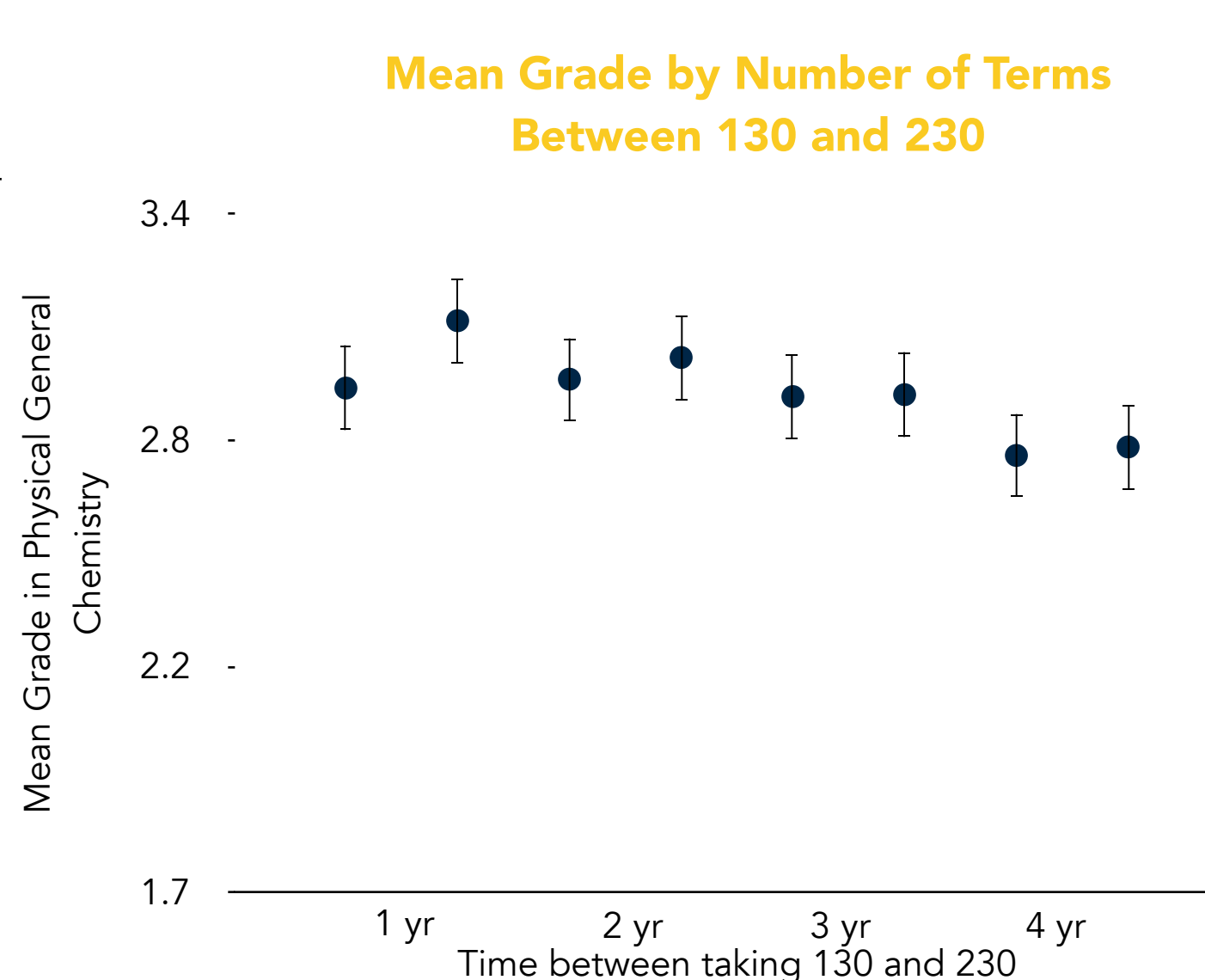


Does taking Chem 130 help students in their subsequent chemistry courses?



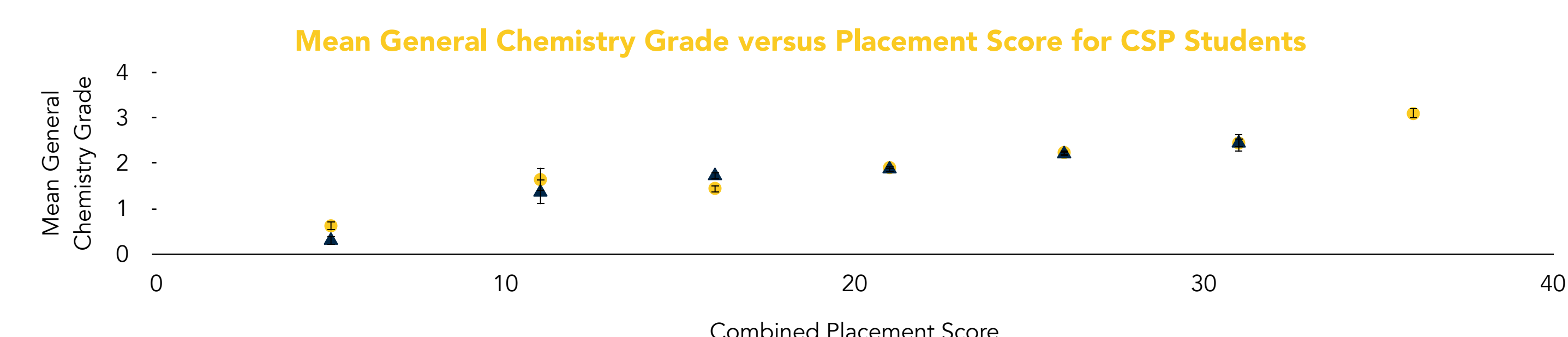
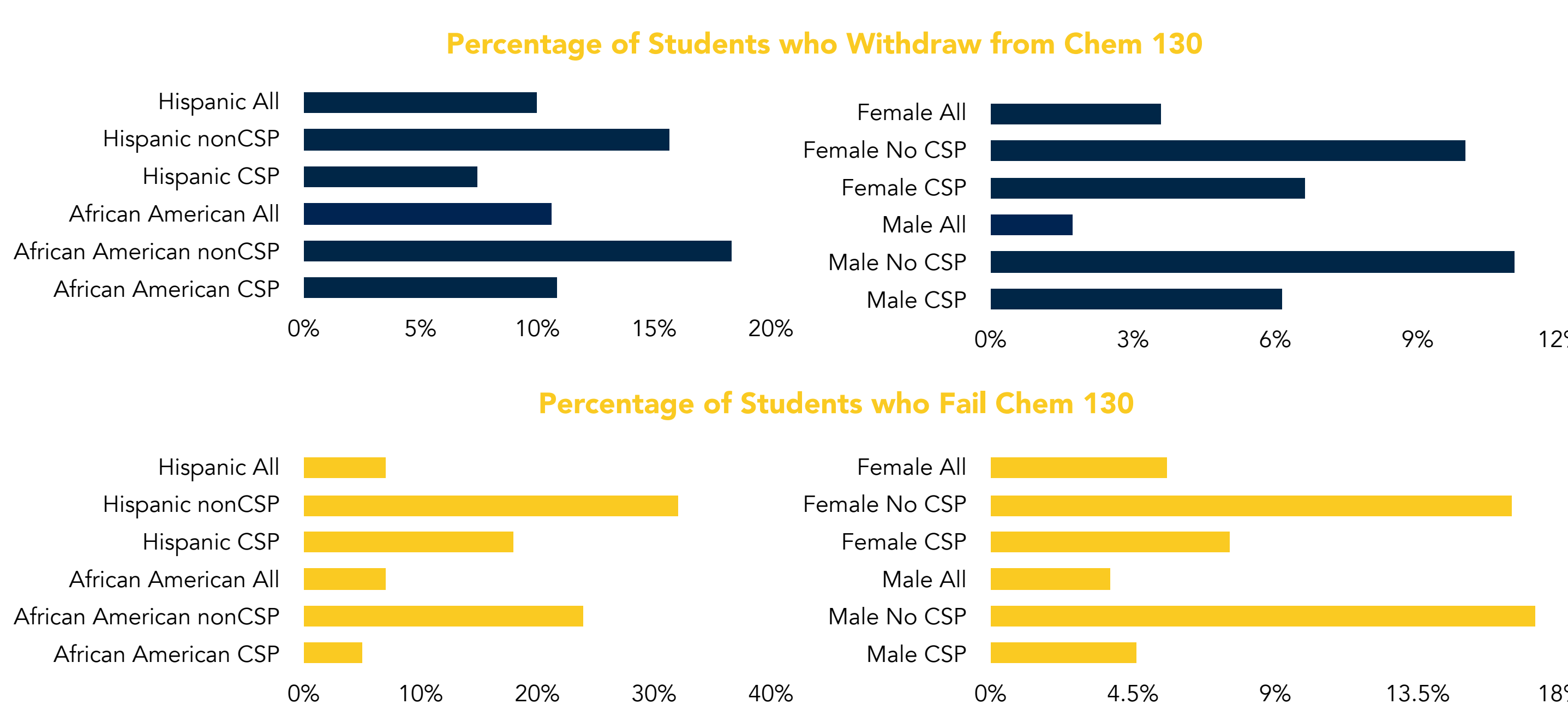
| Pre-test | Grade Chem 130 | Grade Chem 210 | Grade Chem 230 |
|---------------------|----------------|----------------|----------------|
| Math Placement | 0.466 | 0.336 | 0.336 |
| Chemistry Placement | 0.388 | 0.254 | 0.281 |
| AP Score | 0.406 | 0.417 | 0.377 |
| Grade CH 130 | -- | 0.549 | 0.458 |
| Grade CH 210 | -- | -- | 0.483 |
| ACT Math | 0.073 | 0.090 | 0.047 |
| SAT Math | 0.141 | 0.084 | 0.086 |

Pearson Correlation of pre-college examinations with grade performance in introductory chemistry. All are significant at the 0.01 level.

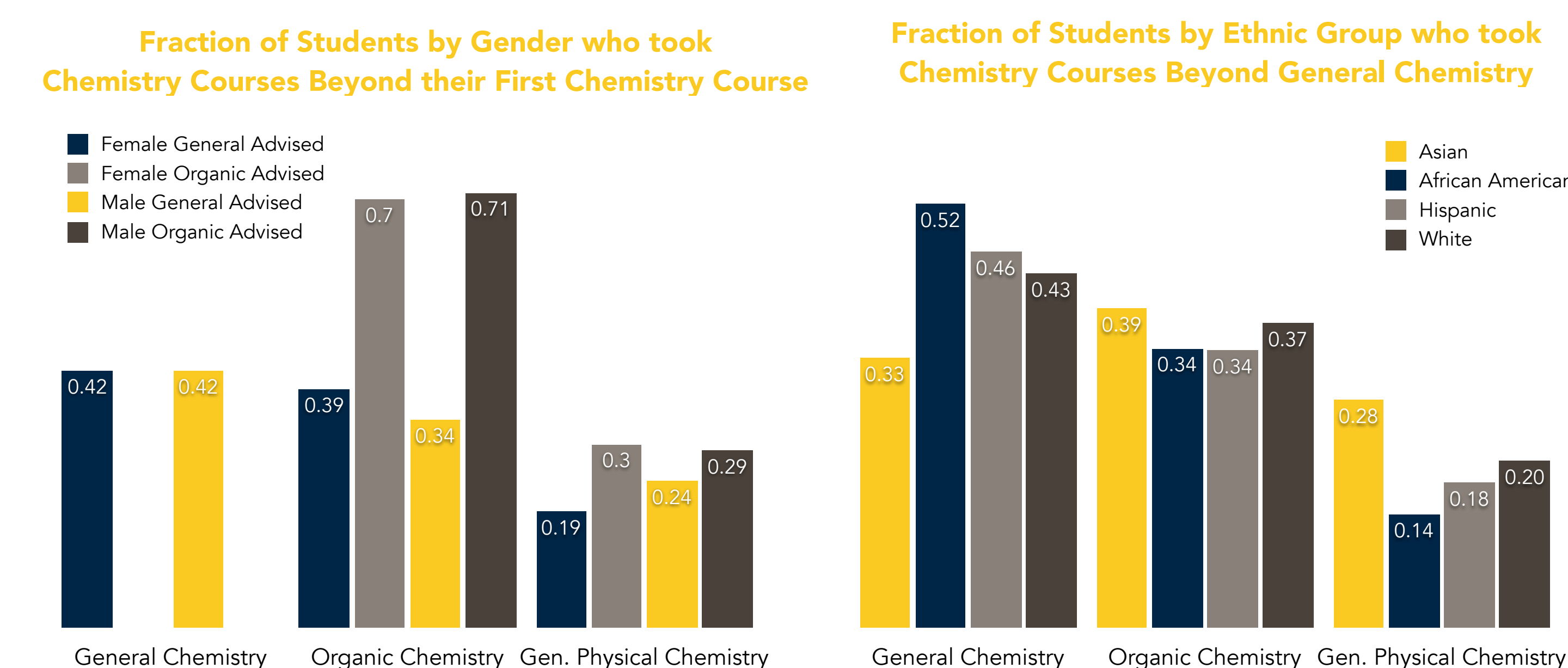
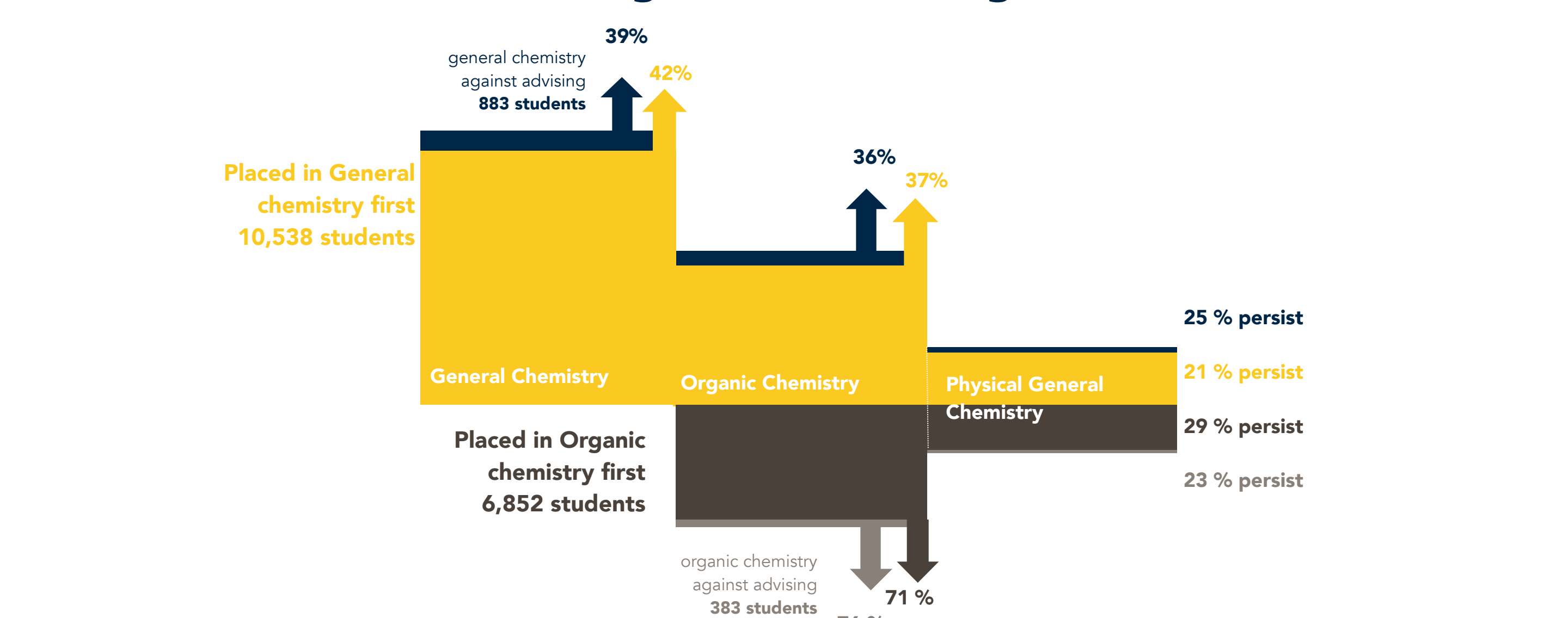


How does CSP affect students?

The Comprehensive Studies Program (CSP) was established to support and retain undergraduate students from diverse populations. Many CSP students are the first in their family to go to college, come from populations historically underrepresented at the University or attended under-resourced high schools. Some students are advised to take the CSP section of general chemistry, but not all students follow this advice.



What happens to students as they navigate introductory chemistry courses?



Conclusions

1. Women, African American and Hispanic students were often placed into Chemistry 130. White males and Asian students were more often placed in Chemistry 210. Males were more likely to take Chemistry 130 against advising, even when the engineering students were removed from the set. Females were more likely to skip Chemistry 130 against advising.
2. Student who opted to skip Chemistry 130 and take Chemistry 210 first, paid a small but noticeable grade penalty in both Chemistry 210 and 230 relative to students who performed similarly on the placement exam. This is also observed when the same comparison is made with only sophomore students, accounting for differences in college experience.
3. Students who took CSP as advised performed similarly in Chemistry 130 as the students who did not take it against advising. Importantly, students in at-risk ethnic groups who took CSP had lower failure and withdraw rates as compared to those who did not.
4. Students who skipped Chemistry 130 against advising were the most likely to earn failing grades/withdraw from Chemistry 210 and the least likely to persist to Chemistry 230. Students who took Chemistry 130 as advised had the second highest failure/withdrawal rate in Chemistry 210 and were the second least likely to persist to Chemistry 230. Students who took Chemistry 130 against advising had the lowest withdrawal and second lowest failure rates. Hispanic and African American students, have the highest failure and withdrawal rates of any ethnic group in all three course and were the least likely to persist to Chemistry 230.

Acknowledgements



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