Why Are Some Fields So Male Dominated?

Examining Physics, Philosophy, Aerospace Engineering, and Computer Science…

Tim McKay: Physics, Astronomy and Education; Ken Powell: Aerospace Engineering

Faculty Communities for Inclusive Teaching, 2015

Project Overview

Women and minorities remain significantly underrepresented among bachelor's degree recipients in a range of academic disciplines. In a few fields, this problem is extreme – women complete degrees in these fields at less than half the rate one might expect from the college in which the disciplines reside.

In the College of LSA, where women make up 55% of all fourth-year students, philosophy graduates are 24.6% female and physics graduates are 26.3% female. In the College of Engineering, women are underrepresented overall, making up only 25% of fourth-year students. In Aerospace Engineering and Computer Science, women make up only 11.0% and 11.3% of all graduates. These four fields stand out as the only substantial majors where the representation of women is less than half that of their college as a whole.

Participants

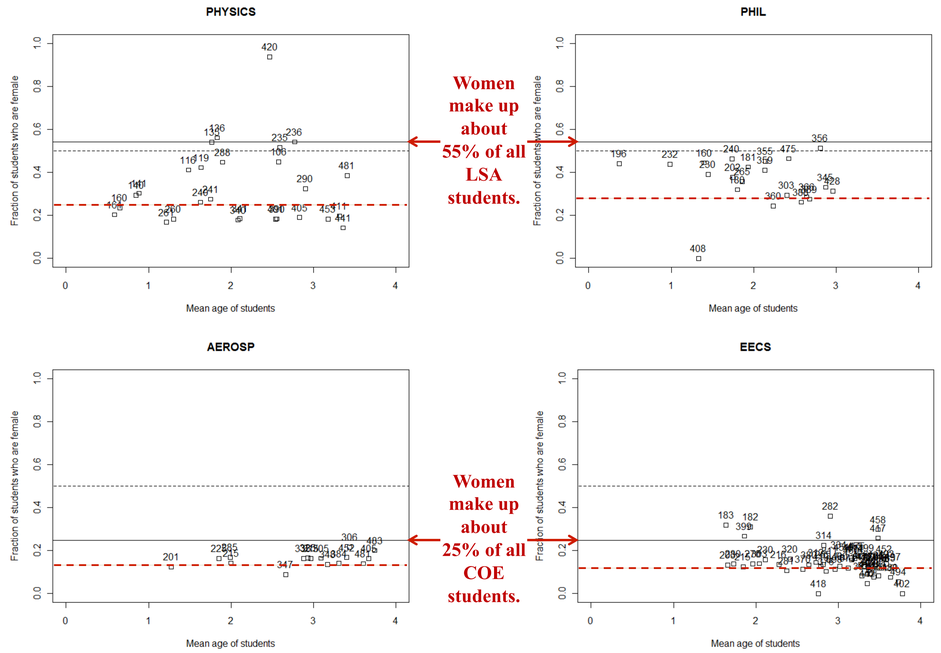
These four departments are all engaged in activities to recruit and retain women. Philosophy has founded a chapter of the international MAP (Minorities in Philosophy) organization which brings in external speakers to discuss diversity. Physics has a vital Society of Women in Physics and last winter hosted the Midwest Conference for Undergraduate Women in Physics for 180 young scientists. The Society of Women Engineers (SWE) at Michigan is especially vital and works with both Aerospace and Computer Science.

Still, many faculty members in these fields feel a sense of crisis. This project began in conversations between Tim McKay from Physics and Ken Powell from Aerospace Engineering. They have been joined in the planning process by colleagues from Philosophy and Computer Science, and we expect conversations to begin in Winter 2016.

To begin, we have been gathering data and exploring the pathways and performance of students in these fields. In the central panels of this poster we show two portraits of each department. The first set of figures show the representation of women in the courses offered by each department, with each class plotted in a position representing the average 'age' on campus of the students. Courses taken *early* in student's careers have the opportunity to recruit them to a major. Some are taken too late to convert a student. The second set of figures compares grade penalty and gendered performance difference for each course in each department. Courses with large grade penalties and/or gendered performance differences are likely to discourage the participation of women.

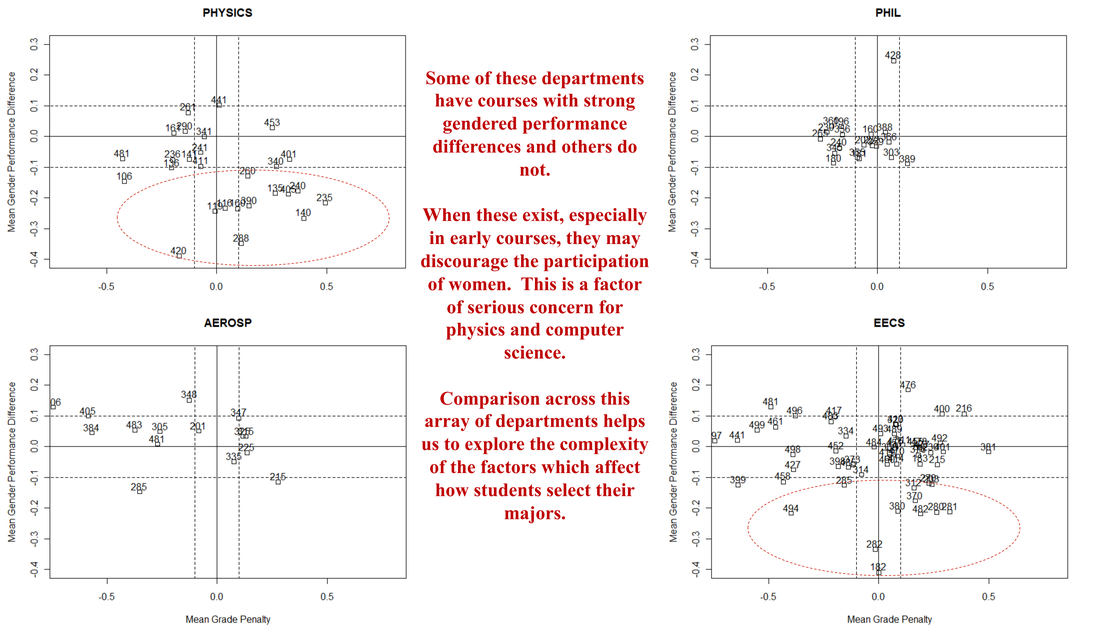
Key Insights

Pathways: Representation of women in courses



The representation of women varies across each department's curriculum. Should new pathways for recruiting students be considered?

Environment and performance: Grade penalties & gendered performance differences



Some of these departments have courses with strong gendered performance differences and others do not.

When these exist, especially in early courses, they may discourage the participation of women. This is a factor of serious concern for physics and computer science.

Comparison across this array of departments helps us to explore the complexity of the factors which affect how students select their majors.

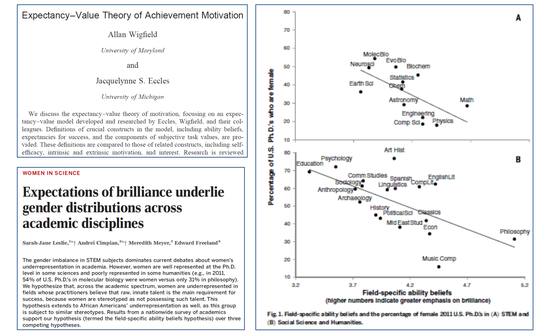
"Grade Penalty": Average <GPA – Grade>

"Gendered Performance Difference": GP_{male}-GP_{female}

Resources

One of the challenges for this project is that most faculty members in these fields are largely unaware of either the detailed processes which are involved in student selection of majors or of the extensive research which has been done about factors which affect student selections of major fields in college. An important purpose of this faculty community will be to explore this literature.

One topic we feel it is important to discuss is the expectancy-value theory of student motivation and choice in the work of Jacquelynne Eccles and her colleagues. Too many STEM faculty members focus their attention on student achievement, ignoring the importance of student choice in the process. We also plan to explore recent work on field-specific ability beliefs – exploring the connection between perceptions of fields as requiring "genius" and the representation of women.



Next Steps

We are beginning a set of faculty conversations aimed at developing a plan of action for each department. These conversations will begin during the winter term with sessions held locally in each department. These will be followed by a session bringing together Physics and Philosophy in LSA, and Aerospace and Computer Science in Engineering. Discussions at the college level are important, as the nature of the student experience and demographics are so different in LSA and Engineering. Finally, during the early summer we will host two conversations bringing all four departments together. From these final meetings we expect a plan of action for each department to emerge.

We believe that this combination of local attention in each discipline and comparison across disciplines will make these conversations especially useful. Over the last two years, the field of philosophy has begun a national conversation about diversity, and looked to the STEM disciplines for insights into what to do. Tim McKay has participated in these conversations, giving talks at national philosophy meetings and in the philosophy departments at both Michigan and NYU. Thinking together with philosophers about why Physics and Philosophy stand out in diversity measures has been fruitful. Similar comparisons are likely to be useful for Aerospace Engineering and Computer Science.