PSME
Dean's Summary
Annual Program Review Update
February 13, 2020

Description of Division

The Physical Science, Mathematics, and Engineering (PSME) Division is comprised of the Departments of Astronomy, Chemistry, Engineering, Geology, Mathematics, Meteorology, and Physics. In addition, the Division is home to the STEM Success Program, which currently is staffed by three full time counselors, two Instructional Support Technicians, student tutors, and a STEM Success Director. The STEM Success staff provide direct support to the Math Performance Success Program (including embedded math counseling and tutoring) and also promotes equity and success in the larger College STEM community.

The PSME Division coordinates, supports, and maintains four dedicated computer labs that serve the entire Division. In addition, the Division supports and maintains separate laboratories and facilities dedicated to individual astronomy, chemistry, engineering, geology, and physics departments.

Enrollment Trends

Key PSME Enrollment Data:

- 2018-19 total enrollment: 26,866
  - Last year change
    2017-18 to 2018-19: -9.8% (DA -5.4%)
  - Previous year change
    2016-17 to 2017-18: -5.9% (DA -7.2%)
  - Five-Year cumulative change
    2012-13 to 2018-19: -19.2% (DA -19.8%)

PSME enrollments peaked in 2015-16, then declined slightly (-2.7%) in the 2016-17 year and declined a little more (-5.9%) in the 2017-18 year. These declines were less than but reflective of College wide enrollment declines of -6.1% and -7.2% during the same periods. However, during the 2018-19 year there was a dramatic decline (-9.8%) in yearly Division enrollment.

Given that the mathematics department enrollment predominates total Division enrollment, historically accounting for approximately 72% of all PSME enrollment, the sudden 2018-19 PSME decline coincided with the first implementations of changes necessitated by AB705 and its effects on mathematics enrollments. Previous to 2017-18 the Division enrollment was relatively impervious to the long-term College enrollment decline, but in 2018-19 the Mathematics department began a significant reduction in the numbers of sections of developmental mathematics in order comply with AB705 mandates. In 2017-18 the department offered 83 fewer sections than in the previous year, a reduction of 13% in one year. This resulted in a net loss of 2,934 students in mathematics, which almost exactly accounts for the net loss of 2,932 students for the Division as a whole.

The 2017-18 decline in enrollment was accompanied by many other side effects that severely affected our Division. In 2017-18 the mathematics department, in response to AB705, opened enrollment of its most popular course, Statistics, to all students. It eliminated all pre-requisite requirements for the course. As a consequence, the number of sections of Statistics increased by about 20 sections per quarter and the Statistics enrollment increased by about 75% for the year. However, during the same time period, the elimination of the prerequisites reduced the numbers of students registering in basic skills sections. Since many students had previously taken multiple levels of those prerequisite courses and now were no longer required to take any, there was a subsequent reduction in basic skills math of about 45 sections per quarter. The net effect, in addition to the enrollment decline described above, included a drastic elimination of many assignments, a shift in our instructional needs toward statistics teaching (which many faculty have never taught), and a change in the nature of the statistics student population who for the most part no longer have had a previous college level math course. In addition, although the first transfer level courses (including statistics) had been opened to all in 2017-18, the math department did not have time to implement co-requisite support courses to help those students who were now in transfer level math without having had any prerequisite. It wasn't until the fall of 2018-19 that such support co-requisite courses were implemented.

Between 2017-18 and 2018-19 combined enrollment change in all PSME departments other than math was nearly flat; however, a few comments are appropriate for some individual departments:

Astronomy was nearly flat despite the recent retirement of a full-time faculty member
Chemistry had a modest gain of 6% and continued to have exceptionally high fill rates
Engineering had a 19% decline in enrollment for the year. This was for the most part due to a leave of a long-time part-timer and difficulties recruiting suitable replacement faculty.
Meteorology had a 14% gain in enrollment, which was significantly affected by the addition of new online sections.

As we fully implement new curriculum and other responses to AB 705, we will need to provide support and training for faculty and students. We have a significant need for additional faculty professional development, especially in light of the increased need for statistics instructors and the changes in preparedness of students in our transfer level classes. We also need to improve our outreach and recruitment efforts and work more closely with counseling to ensure students are advised as to the best academic paths open to them. We will also continue to closely monitor the effectiveness of our curriculum and to make necessary adjustments to our placement and other policies.

Equity

Equity in PSME has two important components. The first is promoting and ensuring that underrepresented students have equal opportunities for success in Division courses and programs in which they are enrolled. This is generally measured in differences between targeted and non-targeted success rates; i.e. the equity success gap.

The second, and equally important component, is promoting and ensuring that students have equal access and opportunity to choose PSME Division courses and programs. This requires that students are aware of STEM opportunities and the relevance of STEM to their lives and career choices. This measure is generally reflected in the differences in percentages of targeted

and non-targeted enrollments in PSME relative to the general College population sizes; i.e. the equity enrollment gap.

Success Equity
Success rates among targeted populations for the PSME Division grew 1% from 2014-15 through 2018-19 (5 year review period), and was 57% in 2018-19. The non-targeted population success rate grew by 3% during the same period, and was 76% in 2018-19. This results in a current equity success gap of 19%, compared to a campus wide value of 13%.

A closer observation of equity data shows that PSME equity gaps vary greatly by department and course. The following table shows general success rates, success equity gaps, % of target population enrollment, and the proportion of female/male enrollment in a sample of PSME departments and courses.

2018-2019

Dept/Course	% Success	Gap % Success	Target Enroll	Female %	Male %
DA College	78.0%	14.0%	34.0%	48.0%	51.0%
Chem	76.0%	24.0%	28.0%	56.0%	43.0%
Chem 10	51.0%	31.0%	41.0%	51.0%	49.0%
Chem 1A	78.0%	21.0%	24.0%	50.0%	50.0%
Chem 12A	81.0%	14.0%	12.0%	70.0%	30.0%
Engr	90.0%	1.0%	27.0%	19.0%	80.0%
Geol	80.0%	13.0%	41.0%	46.0%	53.0%
Math	67.0%	21.0%	32.0%	41.0%	59.0%
Math 10	64.0%	22.0%	45.0%	50.0%	49.0%
Math 10 MPS	76.0%	18.0%	63.0%	54.0%	45.0%
Math 1A	71.0%	17.0%	17.0%	32.0%	67.0%
Math 2A	82.0%	15.0%	8.0%	26.0%	73.0%
Met	84.0%	9.0%	33.0%	49.0%	51.0%
Phys	63.0%	11.0%	17.0%	31.0%	68.0%
Phys 10	82.0%	6.0%	29.0%	44.0%	55.0%
Phys 2A	58.0%	24.0%	16.0%	51.0%	48.0%
Phys 4A	59.0%	2.0%	14.0%	25.0%	74.0%
Phys 50	60.0%	18.0%	25.0%	29.0%	70.0%

Division success rates in the table vary from 51% to 90%. Several departments, including Astronomy, Engineering, Meteorology have generally high success rates and lower than average equity gaps. For example, engineering has an overall success rate of 90% and an equity gap of 1%. On the other hand, several departments and/or courses have notably low success rates and/or high equity gaps. The GE Chem 10 course's overall low success rate of 51% and large equity gap of 31% calls for particular attention. This course has a very high (especially for a PSME course) proportion of students in target populations; i.e. 41% compared to 34% for the College as a whole, and the Chemistry faculty might work with other PSME departments with similar GE offerings that also serve large numbers of target population students but have significantly higher success rates and far lower equity gaps.

Overall success rates in mathematics are generally lower than the College average, though there is a strong pattern of success rates rising with the level of the course. Low success rates and high equity gaps in Math 10 (Statistics) have a stubborn persistence. Expectations that this situation would substantially worsen with the AB705 elimination of prerequisites to Math 10 have not been observed in the reported rates, but the old problem still remains to be addressed. Success in the Math 10 MPS sections is substantially higher, even though those sections serve a much higher proportion of target population students (65%!) than all other PSME Division courses. This indicates that we do have mechanisms that can effectively address equity issues, but the challenge is to provide the extra resources that we know are effective in the MPS program to all of our math (and other PSME) courses. In order to do this, we need a significant College-wide commitment to provide additional embedded counseling and tutoring services to a wider range of classes and departments and a mechanism for faculty collaboration and mutual support similar to that available in the MPS program.

Several courses within the Division have disproportionately low enrollment of target population students. Overall, 29% of the Division students belong to targeted populations, compared to about 34% for the College as a whole. Although this is not a great difference, it is strongly influenced by the math department which has a targeted population of about 32%. This is mainly a consequence of required mathematics courses for all transfer and certificate students. However, many course sequences, especially those at a higher than GE level show a very significant underrepresentation of targeted students. For example, Physics 4A (14%) and Physics 2A (16%). Similarly, Math 1A (17%) and Math 2A (6% targeted, 82% Asian, 26%/73% female/male). These compare to courses such as Math 10, Statistics, with 45% of the students belonging to targeted populations and Geology and Chem 10 both with 41%, and Physics 10 with 29%.

Although the gender proportion for the campus is 48%/51% female to male, the under-enrollment of women in certain courses is also striking; Physics 4A (17%/83%) and Math 1A (37%/63%), and Engr (17%/83%).

In short, three challenges remain:

1) the overall low success rate for some math and science courses,
2) the general equity gap in success between targeted and non-targeted students who are taking math and science classes, and

3) the low rate of registration of targeted students in many of our Division classes.

Much of this echoes the wider state wide and national educational patterns. General success rates are lower, equity gaps higher, and enrollment of targeted populations lower in PSME disciplines across the U.S. and reflect deep cultural and social sources. That is not to say they should not be addressed, but rather to indicate the difficulty and enormous effort it takes to make substantial change. Part of addressing these issues is to focus in areas where change is most needed. As a more detailed analysis by department and course show, the Division needs to review how the relative success in some GE courses can provide lessons for other less successful similar courses, how approaches (and resources) that have proved effective in the MPS program can be expanded and incorporated over a wider range of courses and departments, and how closer and more effective work with counselors, advisors, and campus learning communities can help encourage targeted populations toward programs in which they are highly underrepresented and to support those students once enrolled.

Closing the equity gap is likely to remain a challenge, particularly in light of the additional curriculum and placement changes necessitated by AB 705. As mentioned earlier, the MPS program has been demonstrably successful in increasing overall success rates while simultaneously decreasing the equity gap. The expansion of the program to additional courses and into the pre-calculus and calculus domains is promising, however, much of the current support is due to time limited grant funding. In order to take advantage of the successful lessons of MPS, the College will need to make a far greater commitment to embedded counseling, tutoring, and other support services that the MPS Program relies on. I would hope that the College considers expanding our STEM Success program to include additional counselors and support activities throughout the STEM curriculum.

New curriculum, including corequisite support courses, have been developed and approved during the past year, and are being taught this year (2019-20) for the first time. We look forward to reviewing the results of these new curricular efforts and their impacts on success and equity.

All departments have engaged in program level activities aimed at reducing the equity gap, and these efforts are ongoing. Some of the activities include retreats and workshops and department and division meeting discussions. Mallory Newell has provided excellent data support that is helping refine our curriculum and placement policies, and she has made “personal” section level success and equity statistics available to faculty for their own classes. I will be promoting departmental discussions of (anonymous) individual faculty success rates and equity statistics with the hope that this may result in some consensus of effective approaches to improving student success and equity.

Commendations

The general decline in enrollment and the extraordinary impacts of AB 705 on our programs have caused a high level of anxiety and stress for our faculty and staff. The Math Department has had to completely revamp its placement policies, significantly alter is curriculum offerings, and transform a basic skills approach that has existed for decades. This has not been an easy process, but the faculty and staff have responded by devoting many, many hours to meet these challenges. I would like to commend the entire math faculty for their efforts, and make a special call-out to the many part-time faculty who have made extraordinary efforts to participate, despite the few direct financial rewards available.

Other departments have had their individual challenges; in the recent past Astronomy, Chemistry, Mathematics and Meteorology departments have all lost long-term faculty to retirement or resignation and have managed to maintain enrollment and spirit, even in the face of declining funding and lack of replacement faculty. The earth and planetary science faculty (Astronomy, Geology, and Meteorology) have all worked together – especially in the area of increasing our online course offerings and quality, and the result is a general increase in enrollment and a strong recruitment of underrepresented students and reduced equity gap. In engineering, outstanding part-time instruction has resulted in exceptional success rates and a nearly zero equity gap. The physics department, despite continuing years of less than needed equipment funding and loss of classified technical support continues to increase enrollments and to effectively recruit and mentor new part-time faculty. In chemistry, the previous lack of laboratory technical personnel has finally been ameliorated, and the faculty and staff will be assisting in hiring a new full-time laboratory technician that will help meet the very high demand for chemistry courses.

Once again, kudos to the faculty and staff who have managed to maintain excellence in the face of many challenges.

Staff and Faculty Levels

In general, changes in total FTEF have closely mirrored changes in FTES. However, the proportion of assignments taught as FT load is far below desirable levels, and is very low in several major departments. For example, in Chemistry only 32.7% of all course assignments were taught as FT in 2018-2019, in Math only about 41.6%, in Physics 42.1%, and in Engineering, with no full-time faculty, 0%.

This is a general problem since the overall quality of our educational services depends upon the critical contributions that full-time faculty offer in the form of curriculum, governance, hiring, mentoring, etc. When we overly rely on part-time instructors many of the necessary support services provided by FT faculty cannot be sustained. In addition, rising levels of overloads threaten faculty burn-out and interfere with the participation of FT faculty in their other duties. The PSME Division is especially affected by the great difficulty recruiting the large number of part-time faculty required at the current low proportion of FT assignments. We are attempting to recruit in a highly competitive regional tech marketplace where salaries for candidates with STEM Master's Degrees are often two or more times our starting FT salary and many more times than our PT salaries. Over the past years we have scoured all regional community colleges in our recruiting efforts and contacted Berkeley, Stanford, Santa Clara, UCSC, and San Jose State in efforts to recruit lecturers and graduate students who meet minimum teaching qualifications.

To make matters far worse, the already low proportion of FT faculty assignments reported in this year's program review are for the 2018-19 year, and do not take into account the very large number of FT faculty retirements and resignations that occurred at the end of 2018-19. The generous retirement conditions offered at the end of the 2018-19 year led to a much larger than normal retirement of FT faculty in our Division. Since last spring seven full-time PSME faculty retired or resigned. Six of those were in the math department alone. The math department already had a backlog of 5 positions that had never been filled, and even with three new potential hires for the 2020-21 year, the math department the math department has lost a very significant proportion of its FT staff.

Our current staffing situation, especially in math, is worse than I have ever experienced in my 13 years as dean. The nearly complete depletion of sources of potential part-time instructors coupled with the recent loss of so many full-time faculty leaves us in a very

precarious staffing situation; unable to find enough part-time instructors to staff our existing classes and with too few full-time instructors to effectively carryout many necessary departmental duties.

The challenge in other departments is not quite as dire as in math; however, the loss of an unreplaced FT Astronomy faculty member and the continuing growth of demand for chemistry enrollment, without any net increase in FT faculty, create a great need of additional FT faculty for these two departments.

Resource Requests

All disciplines in the physical sciences and engineering rely fundamentally on the direct observation of physical phenomena and on the consequent organization and interpretation of those observations. In order to teach in these disciplines we must rely on the physical instruments and equipment required to make observations and on computers and software needed for the recording and interpretation of those results. In short, equipment resources are a basic requirement in our disciplines, and the long-term dearth of funding to support equipment resources has had a significant deleterious effect on our educational mission.

The following is a general commentary on the list of requested resources made by individual PSME departments:

Chemistry: the department has done a thorough and thoughtful job of differentiating between those items which are critical to their immediate needs and those which would enhance their program capabilities. I strongly support funding for as much of those critical items as is possible and a consideration of the remaining items if funding is available.

Engineering: the department has made a modest request for equipment needed as part of a 2 year request for a set of laboratory workstations to serve both Engineering 10 and 37 classes. The less critical request for wearable electronic supplies would allow students to create class projects that are of high interest to many students and a strong incentive for student engagement.

Mathematics: the “Needed” request for matlab software would be used over a wide range of mathematics courses and could be shared by other PSME departments. The software allows the visualization of many mathematical concepts and expresses the mathematical ideas in a mode that significantly enhances student comprehension. We often encourage faculty to ensure that their teaching appeals to a wide range of learning styles, and by providing visual and graphical representations of complex mathematical concepts, this software would be of great value to our curriculum. I would also like to strongly advocate for the “big ticket” item included in the math request. Our current math labs in S42 and S44 were designed more than 15 years ago for circumstances and curricula that are no longer existent. The desks are arranged in such a manner that they face neither the instructor computer station nor the whiteboards. The requested remodel would reorient the student desks and projector so that the room can be used for both individual computer work and lecture style delivery. Currently, many sections have to be scheduled in two different rooms in order to allow both modes of teaching, and a remodel would allow an instructor to move seamlessly between these two modes in the same classroom. This would also improve room utilization by obviating the need for scheduling single sections in different rooms (lab and lecture) and allow more flexible instruction during classroom sessions. The request is very costly, and I would recommend it be split over a two year period with one room being converted each year.

Meteorology: the department has made a modest request for equipment that would enable students a hands on experience in measuring humidity. Direct student use of this equipment enhances student engagement and provides an opportunity to meet the important student learning outcomes for the course. The department has also made a modest request to fund peer tutoring. Both the department and I firmly believe that such tutoring would be an effective tool for improving student engagement and equity.

Physics: again, the department has done a thoughtful job distinguishing critical from desired items. Some of the requests are for equipment that is more than 20 years old and has broken down and is barely operable. The loss of a FT physics Tech several years ago has meant that the maintenance and repair of equipment has not taken place, further justifying the need for replacement equipment. I would highly recommend funding the requested lab experimental equipment.

Submitted by Jerry Rosenberg

And a thank you to Thomas Ray for sharing his clear, comprehensive, and concise format for this report.