

## ***Program Information & Executive Summary***

### **1. Describe the successes and challenges your unit has faced since the last comprehensive review.**

The Engineering Program is beginning a new era. A new contract faculty member was added to the department in Spring 2023 to help to plan and enact the future of the program. Engineering faculty have been involved in many curricular reforms and updates and have specific future plans to increase enrollment, shrink equity gaps and preserve the health of the program.

In terms of curriculum, Engineering faculty have been meeting with the HSI-STEM E3 curriculum group. The Curriculum Workgroup has been tasked with clarifying STEM pathways. This work has involved aligning content with other STEM disciplines, especially Physics and Math. Engineering faculty have been working with Physics and Math instructors to review math and physics prerequisites to verify that they are appropriate for the Engineering courses. The Engineering program awards Certificate of Achievement, Associate of Arts and Associate of Science degrees. These degrees were updated this past semester to remove MATH 141 since it is being deactivated. At this time, faculty also reviewed the 2-Year pathway to make sure that it was achievable for students. Engineering also took advantage of the transfer of outcomes review to Nuevenative to revise their PLO's. The PLO's are more applicable to Engineering and include an objective regarding technology.

Mesa Physical Sciences Faculty have also been meeting with faculty and administrators from transfer partners to revise curriculum to make it easier for students to transfer. After a long contentious period, ENGE 151 has been updated and approved to transfer to San Diego State. As part of the agreement, we are updating to Solid Works and including use of our new 3D printers. The 3D printers were purchased from the HSI-STEM E3 grant and are integral to the advancement of the Engineering program. Currently, faculty are learning how to use and best integrate the printers into their curriculum. As a result of meetings with our transfer partners and changes to enrollment at City College, Engineering faculty have decided to activate ENGE 240: Digital Systems. This year, CRC has also approved a new lab course: ENGE 211: Properties of Materials Lab. We hope to develop this lab more fully to offer it in Fall 2024. Finally, our Engineering Workshops, also sponsored by the HSI-STEM E3 grant, continue to be popular with students. We are entering a new phase of the workshops with them being taught by a new faculty member. Students in the workshops increase interest in Engineering and gain valuable skills that enhance transfer and get hired for internships.

### **2. Please confirm that the department has reviewed the Course Learning Outcomes listed in CurricuNet for each course and verify accuracy.**

Reviewed and accurate

Reviewed not accurate, update in progress

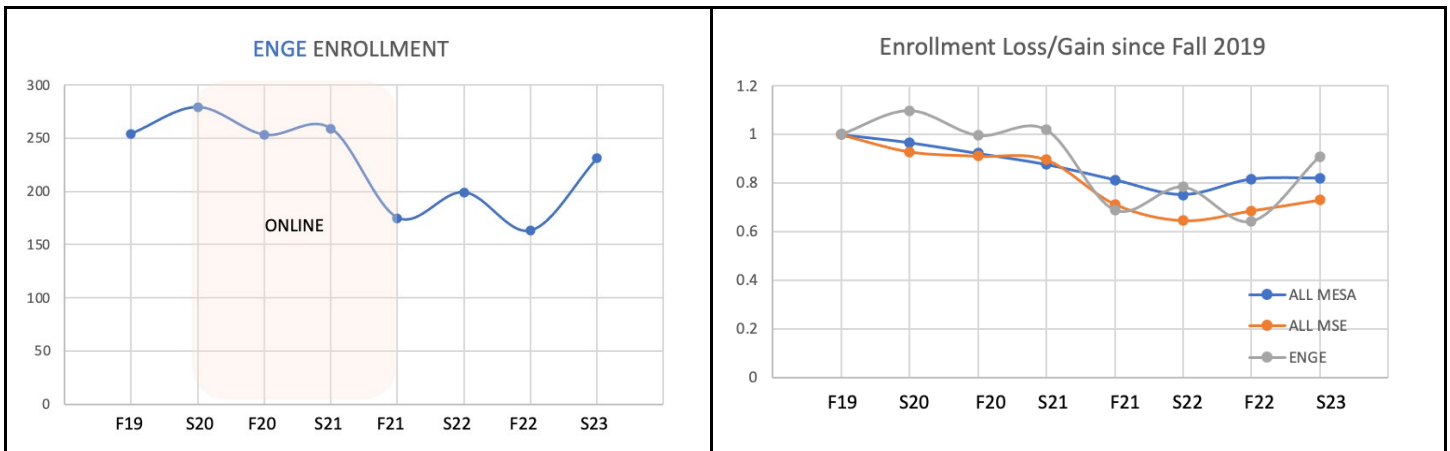
Reviewed not accurate, need support

## ***Data Reflection***

### **1. Describe the trends you see in your program/service area's data (Instructional Data you may consider: enrollment trends, course & program learning outcomes, Institutional Learning Outcomes, course success and retention rates, degree completion, transfer, employment, labor market analysis, other data relevant to your unit's work).**

Enrollment in ENGE courses has dipped since the pandemic as can be seen in the graph at left below (please keep in mind that only Fall and Spring enrollments are shown in the graph). ENGE courses are beginning to rebound but are not at the level that they had been pre-pandemic. We do

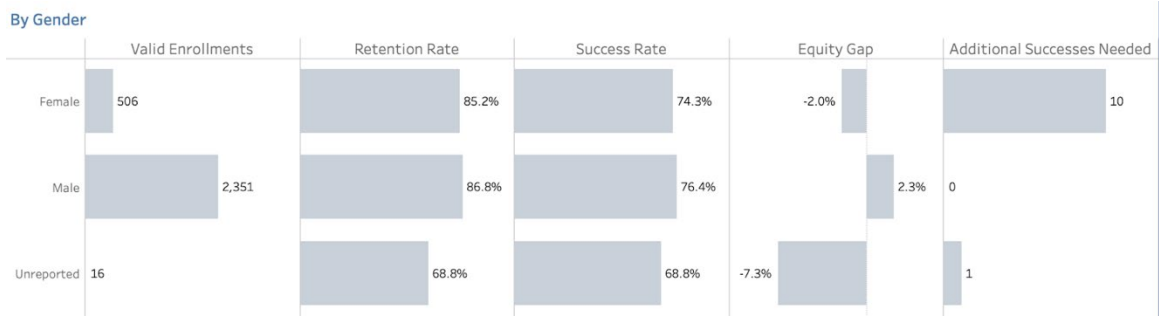
not think that this enrollment trend is based on modality since the enrollment drop occurred during semesters when courses were still online. However, we have put in petitions for Distance Education online approvals to have the options of offering online and hybrid options. We suspect that this will be particularly helpful for Summer courses. The drop in enrollment for some ENGE courses could be due to a “kink” in the pipeline leading students to these courses. Many ENGE courses have prerequisites that also have prerequisites. A drop in new student enrollment during the pandemic would cause a delay for when new students would be able to take these upper-level courses. We are seeing a rebound in Spring 2023 and are hoping that this trend will continue. Finally, a different look at these losses can be seen in the Enrollment change graph below right. This graph compares the enrollment changes since Fall 2019 for Engineering (Grey), all Math, Science, and Engineering courses (in Orange), and Mesa College (in Blue) as a whole. The Engineering courses follow the same trends as the college itself, which means that the enrollment decline may not be specific to Engineering courses.



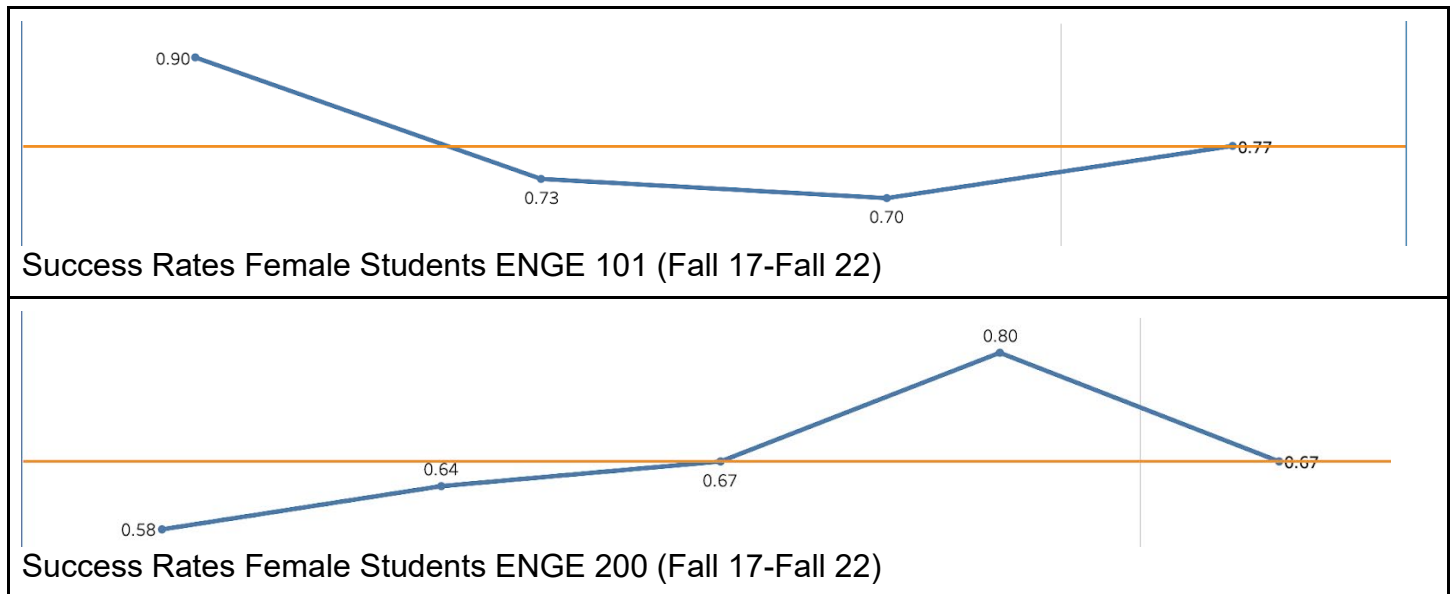
There are several types of Engineering courses with different audiences and purposes. Success rates in ENGE courses overall are fairly high (above 70%) with the exception of ENGE 101 and ENGE 200. ENGE 101 is a course to introduce students to the Engineering profession. The low success rates are concerning, but we noticed that they declined during the pandemic and have begun to rise again. ENGE 200 has both a Physics and Mathematics prerequisite. This is a course in which students begin to apply the science and math that they’ve learned to engineering problems. It is typically a difficult course for students because of this higher-level thinking. We notice that success rates in subsequent courses are much higher.

**2. Describe any equity gaps you see in these data. Are there differences and/or patterns observed by demographics (e.g. race/ethnicity, gender, age, etc.)?**

Data Dashboards show few overall equity gaps in success data as seen below. Engineering struggles with the success of Latinx students according to these data. Other gaps are not reported as significant, however, the gap for Black/African American students is larger than we would like. Comparison of success by gender also shows insignificant differences.



This data may be slightly misleading. Whereas there are few equity gaps in terms of student success, there are equity gaps in relations to student enrollment. This can be seen in the success rates for Female students in ENGE 101 (top) and ENGE 200 (bottom). The interesting trend here is not the success rates themselves (which are pretty good!), but the fact that for the terms listed (Fall 17, Spring 18, Fall 18, etc.. until Fall 22) that there are only three terms in which there were female students in the course. ENGE 116 shows no female students for any of the semesters listed. Similarly, there are no African American/Black students listed for most of the ENGE courses in the last 5 years.



This is very problematic. We know that Female and Black/African American students are underrepresented in the Engineering program. We addressed this issue in Program Review last year. This is an equity issue but is also an enrollment issue for Engineering. Engineering can't rely on the enrollment of male students to maintain the health of the program and must attract a more diverse student body.

### **3. Describe the discussion(s) that took place about the unit's learning outcomes assessment data.**

Discussions of SLO's focused primarily on the skills that students bring into the classroom. Engineering is not the first course that a student will take on their pathway. Most courses currently have Math prerequisites and/or corequisites. Those math courses often have prerequisites of their own. Students do not usually come to us without some success in STEM courses. We see very high success rates in some upper-level courses for this reason. However, math and physics continue to be a roadblock for courses such as ENGE 200. This discussion is not particularly new, but faculty have reported a decrease in math skills in terms of basic algebra and calculus. It is not clear if this is due to courses taken during the pandemic or impacts from AB1705. Something new is that faculty are reporting seeing problems with students' reading skills. Often students need to read and identify information from problems descriptions with multiple sentences. It appears that students are having trouble focusing and extracting the information that they need. It appears to go beyond the expected problem of students having difficulty translating written language into mathematical formulas. These are big concerns for Engineering and Physics students.

#### ***Practice Reflection***

##### **1. Describe current practices your unit has engaged in that you believe impact the above data trends and equity gaps. (Items to consider: new actions specifically focused on issues of equity, major curricular changes, professional learning, policy or process changes, data-informed unit dialogue, community outreach.)**

Engineering faculty are beginning to address these issues by way of curricular changes, outreach, and student support. To support students in the pathway, Engineering faculty participate in Peer Mentoring for many of their courses. Student participation in Peer Mentoring has been strong as a whole this past year. ENGE faculty have also been working at different outreach events such as Jump Start and STEM Success days to encourage students to enroll in Engineering at Mesa College. The Engineering Club has returned to campus to keep students interested in the engineering pathway. In association with Mesa College's new *STEM E<sup>3</sup>* grant, we have expanded upon Mesa's three existing pilot experiential learning workshops: the Engineering Simulation Virtual workshops, the Mechatronics Virtual workshops, and the Python Workshop Series; each is a series of ten workshops designed for sequential learning. The workshops provide students with the opportunity to learn about the software that is in demand in the STEM industry and are taught by STEM industry leaders and attended by current working STEM professionals, allowing students to network with STEM professionals. Students who complete all ten workshops in each series receive a Certificate of Completion, which greatly improves their chance at landing further work based internship opportunities offered by our four-year college partners.

##### **2. What other factors (internal or external) might also impact the above data trends and equity gaps? (Items to consider: legislative changes, fiscal changes, staffing changes, recruitment, hiring, and retention practices.)**

We expect that there will be strong implications on physics courses from AB1705. As discussed previously, Engineering courses rely heavily on math prerequisites. Any change in math curriculum will directly affect Engineering success. This is why engineering faculty are working closely with math faculty. To clarify, this alliance is to ensure that math faculty understand what engineering faculty expect students to know and for engineering faculty to know whether those expectations are reasonable. Neither party expects to dictate curriculum to the other. Instead, the aim is to open

communication for each to see the effect on student success. We will continue to work with our excellent colleagues in the math department to serve students better in our courses. As discussed previously, faculty are also reporting issues with students' ability to read and write. This problem appears widespread among the courses, but undefined. As with the difficulties with MATH, it is unclear where these problems are coming from and what their nature is. We plan to investigate this more fully in the coming year. Again, in relation to AB 1705, integration of basic skills into all coursework is more important than it was before. We intend to offer more opportunities for students to practice reading and writing skills.

### ***Unit Goals and Action Plans***

Goal 1: Increase enrollment in ENGE courses with an emphasis on ENGE 101 and ENGE 116.

Goal 2: Increase Student Success in ENGE 200.

Goal 3: Decrease Enrollment gaps for Female and Black/African American students in ENGE

### **Mesa2030 Roadmap Strategic Objective (SO) Alignment**

Goal 1: Increase enrollment in ENGE courses with an emphasis on ENGE 101 and ENGE 116.

- Completion 3: Design and promote programs and services that intentionally target a reduction in equity gaps in completion outcomes.
- Pathways and Partners 3: Increase community engagement, experiential learning, integrated career planning, and workforce training to prepare students for future careers.
- Scholarship 2: Evaluate and improve Diversity, Equity, and Inclusion practices in classroom environments, campus activities, departments, schools, and administrative units.
- Scholarship 3: Assess impact of prerequisites and corequisites on student success and revise curriculum, as needed.
- Scholarship 4: Expand the use of innovative and high-quality teaching, learning, and support practices that achieve equitable outcomes and increase student success

Goal 2: Increase Student Success in ENGE 200.

- Stewardship 3: Increase student access and schedule efficiency by coordinating schedules among departments/ disciplines.
- Scholarship 2: Evaluate and improve Diversity, Equity, and Inclusion practices in classroom environments, campus activities, departments, schools, and administrative units.
- Scholarship 3: Assess impact of prerequisites and corequisites on student success and revise curriculum, as needed.
- Scholarship 4: Expand the use of innovative and high-quality teaching, learning, and support practices that achieve equitable outcomes and increase student success

Goal 3: Increase Enrollment gaps for Female and Black/African American students in Engineering courses.

- Completion 3: Design and promote programs and services that intentionally target a reduction in equity gaps in completion outcomes.
- Scholarship 2: Evaluate and improve Diversity, Equity, and Inclusion practices in classroom environments, campus activities, departments, schools, and administrative units.
- Scholarship 3: Assess impact of prerequisites and corequisites on student success and revise curriculum, as needed.
- Scholarship 4: Expand the use of innovative and high-quality teaching, learning, and support practices that achieve equitable outcomes and increase student success

**Identify specific actions your program/service area will engage in to accomplish this goal.**

Goal 1: Increase enrollment in ENGE courses with an emphasis on ENGE 101 and ENGE 116.

1. Participate in outreach events such as JumpStart and STEM Student Success and prepare written materials for advising events
2. Explore different course offerings in terms of time and days to attract different students
3. Complete Lab Curriculum for ENGE 211.

Goal 2: Increase Student Success in ENGE 200.

1. Expand Peer Mentoring Program.
2. Continue work with the STEM Curriculum workgroup to explore Math prerequisites and connections to other disciplines and clear pathways for students.
3. Identify more clearly reading and writing problems for students in ENGE courses.

Goal 3: Increase Enrollment gaps for underrepresented students in Engineering courses.

1. Participate in outreach events such as JumpStart and STEM Student Success and prepare written materials for advising events.
2. Explore different course offerings and modalities.
3. Explore connections with Transfer Partners to connect students to engineering clubs such as Society of Women Engineers.
4. Purposefully recruit and retain students from underrepresented groups in introductory courses such as ENGE 101.