Program Review 2021-2022

Engineering

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A. **2021/2022 Program Review** (Form)

Form: "2021/2022 Program Review"

Created with : Taskstream
Participating Area: Engineering

2021/2022 Program Review

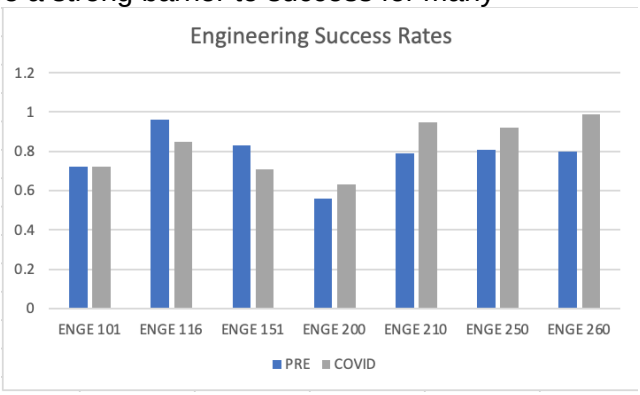
(REQUIRED) Name of Lead Writer and Manager/Service Area Supervisor

Lead Writer: **Morteza Mohssenzadeh**

Manager/Service Area Supervisor: **Paloma Vargas**

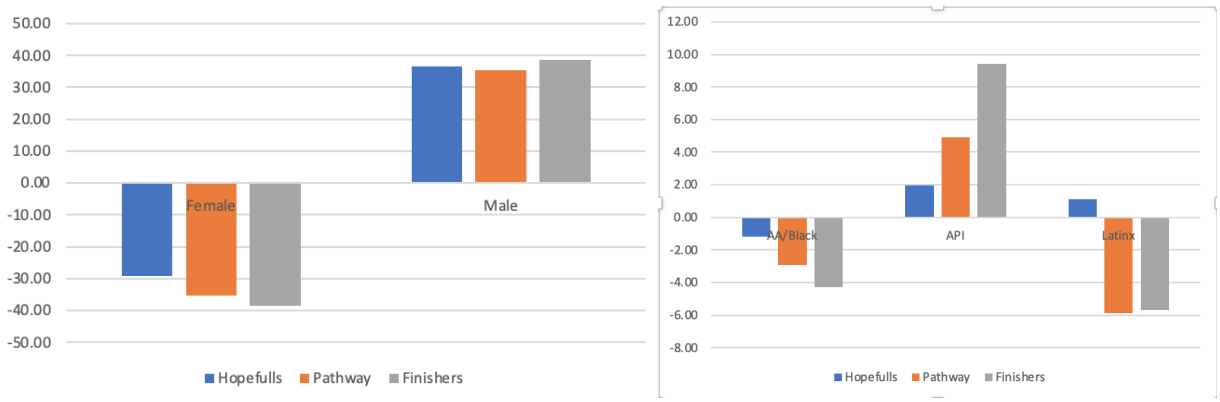
(REQUIRED) In what ways (if any) did changes to an online/remote modality due to COVID-19 impact student success and equity in your area/program? Please provide evidence.

For the past two years the coronavirus (COVID-19) pandemic has been having a profound impact, not only on student's health, but also on how they learn, work and live. Among the most important challenges created by COVID-19 has been how to adapt a system of education built around physical schools to one that is online. This is especially true for courses in Engineering, Science, and Math. The COVID-19 pandemic also meant that students from diverse backgrounds who are more at risk are less likely to receive the support and extra services they need. The gap between students that experience additional barriers and those that do not might widen. Closures can also have considerable effects on students' sense of belonging to schools and their feelings of self-worth which are key for inclusion in education.
During the pandemic, all Engineering courses were put into a remote modality. Some courses were taught synchronously and some asynchronously. Success rates were collected from the Data Dashboards from Pre-Pandemic semesters leading to Fall 2019 and then Pandemic Semesters of Fall 2020 and Spring 2021. Courses in the program had an increase in success during the pandemic overall (75% Pre Pandemic to 81% during Pandemic). Breaking this down by course shows that the increase in success rates was seen primarily in courses that come later in the Engineering Pathway (ENGE 200-260). Success rates were lower for students in the beginning coursework. We see this as significant because getting to those upper level courses tends to be a strong barrier to success for many



students.
According to the Data Dashboards, we see equity gaps emerge as students travel along the Engineering pathway. The equity gaps in students hoping to earn an engineering degree are very small indicating that ethnic groups are well represented in that population. Equity gaps emerge among students who actually take the engineering coursework and deepen again

among students who earn engineering degrees at Mesa College. Representation gaps were calculated by taking the percentage of students in certain groups declaring ENGE educational plans and subtracting the percentage of students in the entire student population at Mesa College in that group. These gaps show places where student groups are over- or under-represented in Engineering versus in the college as a whole. These are classified as the "Hopefuls" in the bar chart shown since these are students who declare an intent to pursue an ENGE degree. The same method is used to calculate gaps in using Course Success data. These are "Pathway" students on the chart because they are enrolled in ENGE courses on a path to an Engineering degree. Finally, student data from the Awards dashboard are classified as the "Finishers" in the chart because these are the students who complete the degree. Although all ethnic groups are represented equally among students with the intent to earn an Engineering degree, equity gaps emerge among students who actually take the engineering coursework and deepen again among students who earn engineering degrees at Mesa College.



We can repeat this data collection for gender gaps in much the same way and results are shown in the chart. Not surprisingly, female students are severely under-represented in both the initial population and among those who finish. In addition, the gap between male and female representation widens between "pathway" and "finishers" in the same way as representation of African American/Black and Latinx Finishers.Engineering is a very difficult degree to earn partially because of the rigor of the coursework, but also because ENGE courses have many prerequisites (math, physics) which means that students are unlikely to take ENGE courses until late in their academic pathway. We see this problem in the chart data above. The students start with enthusiasm, but fall off along the way. Engineering has math and physics at its foundation. Most students graduate high school with no formal instruction in physics. Among those graduating high school in 2000, only 26% of African Americans and 26% of Hispanics took any physics classes. In comparison, 62% of African Americans and 56% of Hispanics took chemistry courses (http://www.nsf.gov/statistics/seind06/append/c1/at0118.pdf). Research suggests that K–12 schools largely attended by minority students have higher proportions of instructors teaching subjects they were not trained to teach (http://depts.washington.edu/ctpmail/PDFs/OutOfFieldRI 012002.pdf).

(REQUIRED) What practices has your area/program implemented since the last program review cycle that you would like to improve/continue? Identify impacts on student success and equity.

Before COVID we have never offered engineering courses online. The online modality was the impetus for most of the changes that we have made over the last 18 months. Many faculty, as a part of adapting courses to remote instruction during the pandemic, have created videos. These videos serve to introduce concepts, demonstrate problem solving skills, or provide problem solutions. Post pandemic, faculty have been able to offer these to students to offer another resource for students. In some courses, they are available for students to consult for problems integrating (pun intended) course material and prerequisite mathematics. For other faculty, they are used as pre-lecture viewing for in-person classes. Having all lectures pre-recorded and uploaded on Canvas still works out well for a lot of students, since they have the ability to learn the material at their own pace. Office hour sessions were also offered online and recorded, which proved to be super helpful for students who could not make it to one session (with them not missing important discussions and announcements). I believe the online modality helped my students keep better track of upcoming assignments as well. The availability of lecture videos, in addition to the office hours and weekly quizzes have had a positive impact on the students. They now can watch the lecture and OH videos as many times as they want until they are confident in their knowledge of the subject, and if there are any questions, they can ask them during office hours. The online module has made it easier to plan the semester accordingly. Weekly assessments are now more easily assigned and graded compared to previous in-person semesters. I believe the online module has also been very helpful for students with social and speech anxiety. Many students feel more comfortable presenting when they are in a familiar environment like their own rooms. Students with speech anxiety/disability also have the opportunity to use text-to-speech technology to present their ideas, which would have been harder in an in-person environment.

(REQUIRED) What practices has your area/program implemented since the last program review cycle that you would like to change/discontinue? Identify impacts on student success and equity.

As discussed in this document, the greatest change that we have implemented is online instruction. None of the Engineering courses were offered in a remote modality pre-pandemic. We have seen success rates increase and engagement decrease. Most of our instructors are experienced online educators skilled in creating student centered learning in the REMOTE online environment. However, the greatest challenge was to produce the same level of active engagement as we had in face to face courses. In the zoom classrooms, many students option not to have their cameras on and not to actively and meaningfully participate in the breakout rooms or class discussion portals such as Pronto, discussion board etc. All of our faculty are dedicated to help students succeed but in the online REMOTE environment, confusion on a student's face is not readily available feedback. Students can hide themselves behind turned off cameras and not seek help when they need it. This is not to say that we cannot have meaningful discussion and conversation in the online environment - we can - but it is always with far fewer students than in the f2f class. All the classes I taught and observed had only a few students actively involved in the discussion with instructors who were often very encouraging of participation. While some student breakout rooms can be very active, others would have absolutely zero participation or interaction by any of the students assigned to that room. This can never happen in the face to face courses. In addition,

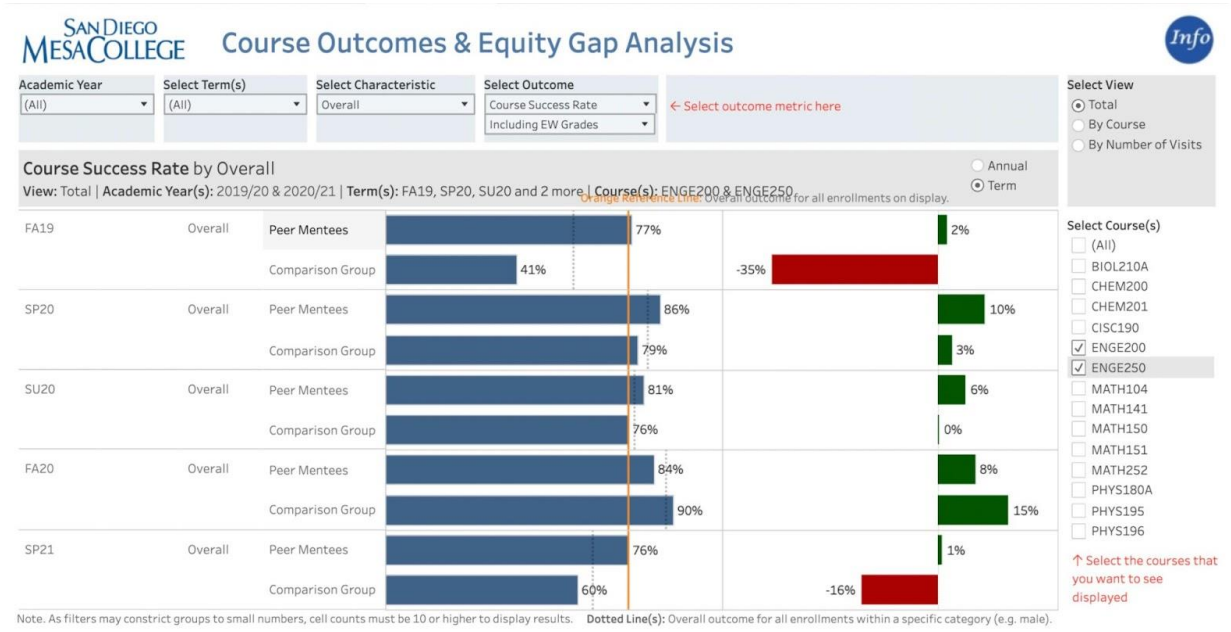
traditionally our faculty encourages students to persist in their college path or particular career. As is documented, minority and female students need more encouragement than white males. Many students optioned to keep themselves out of sight making this task challenging online and thus hard to close the equity gaps. In asynchronous WEB classes few students ever show up for office hours to ask an instructor a question. Most students will never join their instructor on zoom. This is definitely something that we intend to discontinue. We do not feel that remote learning has been good for our students' learning or mental health. We feel strongly that remote learning has impacted our most vulnerable students who need to be on campus. We acknowledge that for some students, being on campus is a privilege. It is an opportunity for them to take time to focus on themselves as a student, not a parent, child, caregiver, or worker. Our goal is to make sure that every minute that they spend in class is valuable for them because we also consider it a privilege to be their instructors. We understand that remote learning may work for some courses, but feel that the evidence presented supports that engineering is not one of them. For ENGE 151, the CAD class had a challenge of itself. The CAD software code was given to every student so they could download it to their PC. Unfortunately a number of students had Mac and the CAD software could only be downloaded to PC, this was a financial burden on our students to buy a PC. We might offer online one section of ENGE 151 out of three sections that we normally offer every semester, this could benefit those students that are working full time. However, we acknowledge that remote learning may have been successful for some students. We will continue to keep an open mind and will reassess our success and enrollment data as it comes.The online platform was mostly challenging when it came to hands-on projects for Engineering Design. Even though students had the opportunity to collaborate and present their ideas and projects using online tools, it would have been more valuable had they had the opportunity to perform some of the projects and experiments in person. For instance, one of the projects of this class revolves around building and testing a solar powered street car. The students could not unfortunately build the car and test it to gather data; however, they were able to analyze data sets provided by previous semester's experiment and draw conclusions on why the car performed the way it did based on the data. Most of the hands-on projects are currently performed up to the design phase, except for some. I would like to be able to extend this to the build and test phase, so that the students see the results of their hard work. Being back in an in-person environment will also help shape the students' leadership and teamwork skills.

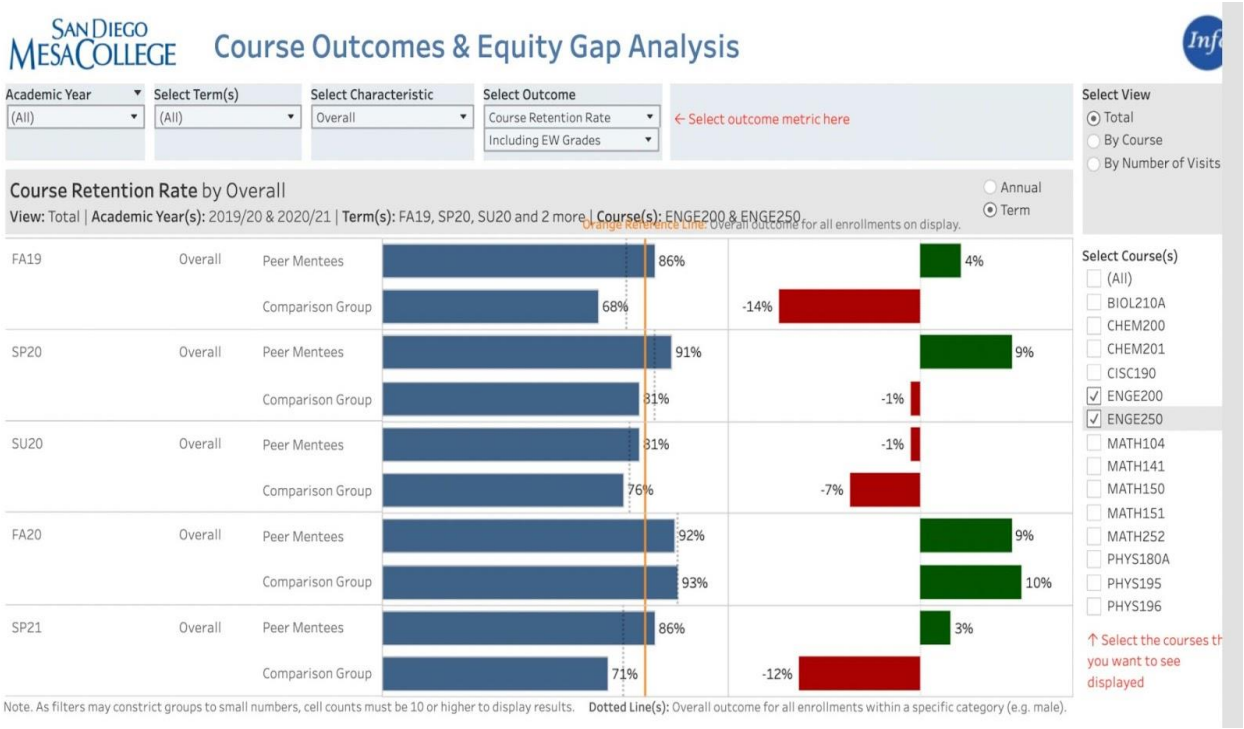
(REQUIRED) What college-wide practices implemented since the last program review cycle have affected your area/program positively or negatively? Identify impacts on student success and equity.

Our Dean SusanTopham has requested to develop the guided pathways as a pilot program for the Engineering back in 2018. Professor Mohssenzadeh and Patty Rodriquez worked on the Engineering guided pathways for several months. After the completion of our task we were asked to set up workshops to share our experiences of developing the Engineering Guided Pathways with other programs at Mesa. Our engineering students benefited so much from this clear direction of completing all the required courses at Mesa before making a plan to transfer to a four-year institution. In the Spring 2020 with support from the MESA's HSI grant, we piloted Engineering Workshops. In association with Mesa College's new *STEM E*^{3} grant, we are hoping to expand 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. Student testimonial “I really enjoyed the workshops! I feel like I learned a lot and have a new appreciation for Engineering that I did not have before. I am very appreciative that it could continue after the semester went online. It was always a nice escape for a little while! (Spring 2020)”.

The STEM Peer Mentoring program funded by the HSI grant was piloted in the Fall of 2018 and it has become a primary way for engineering students in ENGE 200 and ENGE 250 to get academic support. We will continue to use this program as it provides a partnership between physics faculty and mentors in supporting engineering students. Engineering students had the opportunity to meet with their peer mentors twice a week via zoom. Data shows that both retention and success rates were higher for students that participated in peer mentoring programs.





In the future we hope to be able to hire additional engineering faculty to aid the development of the program. Currently the engineering program doesn't have enough institutional support in terms of contract faculty to provide equitable outcomes for all of our students. Experimentation with curriculum and instructional models, including student-centered strategies increase the number and diversity of students succeeding in engineering. All of these developments have not been implemented in a standardized fashion in the engineering program since we currently don't have such specialists in our department and no engineering faculty has been hired in nearly twenty years. Since we are the leading college of equity we need to invest in full time faculty in the disciplines that have big equity gaps to close such as engineering. The research shows that having contract faculty teach is key to students success, because contract faculty have more opportunity to connect with students. Contract faculty are often more accessible than adjunct faculty to students outside of the allotted classroom time, often making themselves available for additional help and often creating additional learning opportunities for students through outreach events and research experience. Currently, we struggle to find skilled adjuncts that can teach engineering classes. As a consequence, the single full-time engineering faculty is required to consistently teach at 1.4 FTEF load even with all of our adjuncts at maximum loads. The consequence of having a single Contract Faculty member is a program in stagnation. Although the need for Engineers in San Diego is growing and interest in the program remains high, the program can not grow. Outreach and connections to the San Diego engineering industry are essential to a healthy program. In addition, equity gaps remain in enrollment and success, but can't be fully addressed by current staff. Finally, the program itself needs to diversify offerings. The majority of courses at Mesa College are for transfer to Mechanical Engineering programs. Since the program was established it has only had one contract faculty with a background in Mechanical Engineering to teach all seven courses in engineering. We need new contract faculty to provide vision, leadership, outreach and to expand the engineering program. Other specialties that can diversify course offerings into electrical and civil engineering would be desired. This is where students' needs are not met at Mesa and where we see potential for growth.