#8

COMPLETE

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Page 1: I. Program Overview and Update

Q1

I.1. Department(s) Reviewed:

Engineering

Q2

I.2. Lead Author:

Keenan Murray

Q3

I.3. Collaborator(s) - List any person that participated in the preparation of this report:

Miriam Simpson, Misha Kutzman

Q4

1.4. Dean/Manager:

Pam Kersey and Kim Dudzik

Page 2: II. Program Reflection and Description

Q5

II.1. Provide your program's mission statement:

Our program aims to expose curious minds to the field of engineering, to provide an engaging hands-on engineering education to prepare students for transfer to 4-year universities and their careers, and to share engineering with the community.

Q6

II.2. How is this program advancing the college mission, vision and values?

Guided Student Pathways

The engineering program is active in the STEM Guided Pathway program, being involved in the follow activities:

- The STEM Mentor & Mentee Program
- The Embedded Learning Assistant Program
- Advocating for students to engage in STEM student cohorts
- Hosting and advocating for students to participate in workshops to expose students to industry STEM careers and transfer to 4-year universities

Student Validation & Engagement

- The engineering program is advancing its curriculum to be even more hands-on and project-based to improve student engagement. Many of these projects expose the students to equipment and technology that many of them may not have access to in their personal lives or previous educational experiences.
- The engineering program is developing new approaches to validate/assess engineering students. We have developed explicit rubric feedback for assignments and are investigating and have tried video grading to provide feedback to students with explicit details and verbal feedback

Organizational Health

In 2019 we hired two full-time engineering instructors to help create a forward-thinking engineering program that is focused on student success and is more consistent for students

Equitable Access

The pursuit of an engineering education is costly, both in time and financially. We are building a program focused on supporting new students interested in engineering with the goal of students not changing their academic focus due to time and monetary constraints. Additionally, we note that our engineering program is primarily enrolled by white male students who also have the most success in engineering courses. Looking forward, we are looking towards finding ways to reach out and engage other groups of students, including reaching out to our community.

Individual Student Success

Our program is focused on providing students with engineering experiences and preparing students for transfer to a 4-year university. Most practicing engineers have at least a B.S. in engineering, so our main goal for students is to transfer. Since most of our students transfer to SDSU, we have designed our program to articulate with SDSU.

Academic Excellence and Innovation/Creativity

We are developing our curriculum to be further project-based and hands-on to provide experience and knowledge in the engineering field that many other institutes do not provide. We are currently developing a Makerspace on campus that will allow students to build projects for academic courses and provide students and the community a space where they can be creative and pursue manufacturing their own designs.

Q7

II.3. How does your program support the college's strategic goal of implementing guided pathways?

Clarifying the Path

- The engineering program has collaborated with the development of Meta-Majors (we fall under the STEM Meta-Major)
- We advocate for our students to collaborate with STEM academic counselors to clarify the path for each engineering student, taking into consideration each individual student's needs.
- We participate in the STEM cohorts that assist students with clarifying their path.

Keeping Students on the Path

- We advocate for our students to collaborate with STEM academic counselors to ensure the students are "on the Path".
- We are involved in the STEM Mentor & Mentee program to directly engage students and to support students outside the classroom about topics such as internships, careers, curiosity of different engineering (and STEM) fields, and fostering a sense of community and support.
- We support STEM cohorts that facilitate students building supportive relationships among students.
- We are developing hands-on curriculum to engage our students.
- Our faculty participate in workshops to improve their courses and to make them more equitable.

Ensure Learning is Happening

- We are developing our curriculum to be even more project-based and hands-on. This allows us to visually determine if students can apply concepts learned in the classroom.
- We are exploring different methods of assessment and feedback, from creating explicit rubrics in Canvas to video grading to provide specific verbal and visual feedback.

Q8 **Yes**

II.4. Is the program description in the current college catalog up to date and accurate?

Page 3: II. Program Reflection and Description continued

Q9 **Respondent skipped this question**

II.4a. What steps will you take to revise the college catalog description?

Page 4: III. Course Curriculum, Assessment and Student Success

Q10 **Yes**

III.1. Access the Five Year Curriculum Review Cycle (requires GCCCD login). Have all of your active courses outlines been reviewed within the last five years?

Q11

III.2. What is your program doing to prepare students for successful transition (e.g. transfer and career readiness)?

Since most of our students are transferring to San Diego State University (SDSU), we are maintaining our course articulation agreements with SDSU to better serve most of our population.

Q12

III.3. Please list any planned changes for curriculum and the rationale for those changes:

Our main engineering room, F-301, has equipment that can be used in several of our courses such as ENGR-100 Introduction to Engineering and Design, ENGR-120 Engineering Computer Applications, ENGR-210 Electric Circuits, and ENGR-270 Digital Design. However, as our program is continually growing, the main engineering room is completed booked with classes Monday-Thursday. Therefore, ENGR-200 Statics, ENGR-220 Dynamics, and ENGR-260 Engineering Materials are typically taught in a classroom with no equipment. This results in the courses being taught on a theoretical basis because we did not have a dedicated room and access to equipment.

Thanks to the STEM NSF grant and the collaboration of faculty, administration, and students, we have begun to clean-up the Engineering Prep Room adjacent to our main engineering room, F-301. The prep room was previously used by the Chemistry program, but as they now have additional resources and labs from the STEM NSF grant, we have been cleaning and preparing to turn the prep room into a Makerspace . We are currently working with the grant to acquire the equipment needed for the Makerspace; otherwise we could not pursue our intended new application-based curriculums for ENGR-200 and ENGR-220. We are in the process of developing a Lab course for ENGR-260 that will benefit from the Makerspace as well.

Below are some proposed new projects for ENGR-100, ENGR-200, and ENGR-220 that will be possible with the new Makerspace:

Course: ENGR-100 Introduction to Engineering and Design

Project: Mini-elevator competition

Build a mini-elevator to compete in lifting as many ping pong balls from ground level to a bin ~1 foot high. The project will be broken down into the following components:

- Design and build an elevator shaft
- Design and build the elevator cart and cable system
  - Student group will verify at this point that they can properly control the ascension and descension of the elevator cart using an Arduino
- Design and build an apparatus to load the ping pong balls into the elevator at ground level.
  - Again, the group will verify they can control the loading apparatus using an Arduino

Required Equipment

- Arduino
- Laser cutter
- 3D Printers
- 2 Computers in the Makerspace
- CNC Mill

Arduino’s are already incorporated into this course, this would be a great opportunity to control DC motors with the Ardiuno.

The Laser cutter will allow students to cut pieces from acrylic. One of the downsides of 3D printing is they have a difficult time printing a thin flat layer. The Laser cutter fills this need

The 3D printers will allow students to build the elevator shaft and cart in SOLIDWORKS and print them!

We have 1 old computer in the Makerspace; if we are going to have students performing work in the Makerspace outside of class time, we need at least two more computers in the Makerspace so students have access to SOLIDWORKS and 3D printing software to achieve these new curriculum goals

This is a great opportunity to introduce the CNC mill to students early in their education! They will use the CNC mill to build a pulley

system to lift/lower the elevator cart and potentially for the apparatus to load the ping pong balls into the elevator

Project: Enhanced Puzzle Cube Project

We currently have the students design a puzzle cube game for children and build a prototype with wood cubes. The students hand-glue the cubes together to make the puzzle cube parts. Many times the puzzle cubes do not fit well together and need to be sanded down due to the tolerances of the wooden cubes.

Using the new and reliable 3D printers, students will instead design the puzzle cubes in SOLIDWORKS where we can include tolerances to allow the puzzle cube pieces to neatly fit together and further expose the students to using 3D printers.

Required Equipment
- 3D Printers
- 2 Computers in the Makerspace

The 3D printers will allow students to 3D print their puzzle cubes!

We have 1 old computer in the Makerspace; if we are going to have students performing work in the Makerspace outside of class time, we need at least two more computers in the Makerspace so students have access to SOLIDWORKS and 3D printing software to achieve these new curriculum goals

Course: ENGR-200 Statics

Project: Building a Bridge

Student groups will design mini-bridges that are expected to hold their professor's weight when he steps on it, but if another person joins them, the bridge should fail! The project will demonstrate that students know how to properly design trusses for real world applications! The project will be broken down into the following sections
- Design and build sample truss members with 3D printers.
- Test the material properties of the sample truss members using a Universal Testing Machine
- Design the bridge to hold the professor, but break if another human joins them on the bridge.
- Build the bridge using a hinge and roller support system designed and built by the professor
- Test the bridge!

Required Equipment
- Laser cutter
- 3D Printers
- 2 Computers in the Makerspace
- CNC Mill

The Laser cutter will allow students and the professor to cut pieces from acrylic. One of the downsides of 3D printing is they have a difficult time printing a thin flat layer. The Laser cutter fills this need.

The 3D printers will allow students to print truss members so they can build their bridge!

We have 1 old computer in the Makerspace; if we are going to have students performing work in the Makerspace outside of class time, we need at least two more computers in the Makerspace so students have access to SOLIDWORKS and 3D printing software to achieve these new curriculum goals

The CNC mill will be used to create the hinge/roller support system for the bridge and the joints of the trusses

Course: ENGR-220 Dynamics

Project: Bluetooth Mini-Race Cars

Student groups will design a mini-race car that will be controlled by an Arduino via Bluetooth. The students will then race their cars in a competition! The project will be broken down into the following components:

- Create a gearbox to properly change the angular velocity/acceleration of the DC motor to the drivetrain of the RC car
- Design and build a drivetrain with a universal joint
- Design and build a rear differential for the mini-racer car so the wheels can properly turn
- Design and build the body of the car, including a mount for the Arduino, DC motor, and power supply
- Design and build tires that will allow proper traction and acceleration
- Assemble the car!
- Race!

Required Equipment

- Arduino
- Laser cutter
- 3D Printers
- 2 Computers in the Makerspace
- CNC Mill

Arduino's will be incorporated into this course for the first time! They will control the mini-racer cars.

The Laser cutter will allow students to cut pieces from acrylic. One of the downsides of 3D printing is they have a difficult time printing a thin flat layer. The Laser cutter fills this need

The 3D printers will allow students to design and build the body of the car and the tires!

We have 1 old computer in the Makerspace; if we are going to have students performing work in the Makerspace outside of class time, we need at least two more computers in the Makerspace so students have access to SOLIDWORKS and 3D printing software to achieve these new curriculum goals

The CNC mill is pivotal to this project! It will be used to create the gear box, drive train, rear differential, and axels

We are developing the projects for these courses to emphasize the application of the concepts taught in the courses with a hands-on approach. In past semesters, ENGR-200 and ENGR-220 were taught mostly as HW/Exam courses with little to no real application of the covered concepts. With the Makerspace, we can bridge the theoretical knowledge and concepts to real world applications while engaging our students in activities they would most likely not have access to in the public domain.

Page 5: III. Course Curriculum, Assessment and Student Success continued

Q13

III.4. Please upload the most recent version of your program's course SLO assessment plan. Click here for an Assessment Plan Template

SLO Assessment Plan SP21.docx (16KB)

Q14

III.5. Please provide a high-level analysis of your SLO findings over the past year and what changes, if any, were made as a result:

All SLOs for the active engineering courses have been reviewed and consolidated down to ~3 SLOs per course over the past 2 years. Keenan Murray and Misha Kutzman were hired in 2019 as full-time engineering instructors and we collaborated with Miriam Simpson to consolidate the SLOs and attempt to make them “more meaningful” for analysis. With COVID-19 impacting our courses Spring 2020-present, we have not assessed the new SLOs. Therefore, it is imperative that we follow the SLO plan attached to make sure we evaluate the new SLOs in the next two years.

Q15

III.6. What student learning-related successes and challenges have SLOs results revealed for your department?Note: If SLO data are not offering useful feedback regarding student learning, and are not currently informing program improvements, please instead discuss the specific steps you plan to take to make learning outcomes and assessments more meaningful.

The SLOs for all active engineering courses have been updated in the past two years and have not been evaluated yet. Thus, we need to make sure we evaluate SLOs as planned for the next two years

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Page 6: III. Course Curriculum, Assessment and Student Success continued

Q16

III.7. How was the department of discipline's success rate across all courses changed within the past 4 years (the time frame covered in this comprehensive program review)?

Before we begin looking at the success rate, there are 4 major events that have occurred in the engineering program over the last 4 years that should be noted:

1. Dr. Keenan Murray and Mz. Misha Kutzman were hired as full-time engineering instructors in the Spring and Fall of 2019, respectively.
2. Dr. Duncan McGehee (the previous full-time engineering instructor) retired in Fall 2019
3. As of Spring 2019, every engineering course ran through the engineering program is offered every semester. In previous years, some courses were only offered in Spring or Fall.
4. Spring 2020 courses were switched to Emergency Remote Teaching due to COVID-19

Figure 1 ENGR-100 Introduction to Engineering & Design student enrollment, retained students, successful students, and retention/success rate of students

The number of students enrolled in ENGR-100 has grown from ~60 students Fall 2015 to over 100 students Spring 2020. From Fall 2015 to Fall 2017, the retention rate of students grew from ~85% to above 90% while the success rate of students rose from ~60% to ~80%. Starting in Spring 2019, there is a notable increase in the enrollment of students; however, the retention rates and success rates dropped from above 92% and 83% Fall 2018 to 81% and 51% Fall 2019, respectively (Figure 1). Since I (Keenan Murray) taught the ENGR-100 courses in Fall 2019, I reviewed the final grades to determine why the success rate was significantly lower than other semesters. 23 of my students across three sections of ENGR-100 earned grades below 55% with many as low as 10-20%. Simultaneously, each section of the course had students who earned 90% or higher in the course. Essentially, these 23 students stopped participating in class and maybe should have dropped the course but did not. If I adjust the 23 students to have dropped the course, the adjusted retention rate and compared to the success rate of students is 56% and 51%. Based on the adjusted retained students, 90% of the adjusted retained students were successful. This tells me there was an issue with keeping the students engaged and active in the course!

My curriculum for the ENGR-100 course was adopted from my predecessor, so it is unlikely that the content of the course itself is to blame for the lack of engagement of the students in Fall 2019 because it was not an issue in previous semesters. Therefore, it could be an issue with how I presented/involved the students with the curriculum. Fall semester is the time of tenure review and I did not receive any excessively negative feedback from students and my tenure committee approved of my teaching methods when I was reviewed. Of course, it is possible the students who were displeased did not complete the student survey. Another possible contribution to the drop in retention and success rate in Fall 2019 is the dramatic decrease of full-time students in the engineering program. Spring 2019 we had 107 (35%) part-time and 197 (65%) full-time engineering students; Fall 2019 we had 113 (44%) part-time and 145 (56%) full-time engineering students, a significant drop of full-time students while the part-time students partially grew. The full-time engineering student population rebounded in Spring 2020 as we had 159 (49%) part-time and 163 (51%) full-time engineering students with the success rate of ENGR-100 rebounding back to 64%. Therefore, there could be a correlation between student success and full-time student enrollment for ENGR-100. This potential correlation is not as strongly or not seen in other engineering courses.

However, it should be noted that Spring 2020 was the beginning of the COVID-19 Emergency Remote Teaching and I only taught 2.5 of 4 sections of ENGR-100 compared to the 3 sections of ENGR-100 in Fall 2019, so there are too many confounding variables to make a clear determination of the drop in success rate. Therefore, the retention and success rate should be closely observed in the coming semesters.

The engineering program is currently working with a STEM NSF grant to install a Makerspace that will be used for students to develop/machine projects for ENGR-100 to better engage students and provide them with tactile learning opportunities. Our hope is to implement the new curriculum in Fall 2021.

Figure 2 ENGR-120 Engineering Computer Applications student enrollment, retained students, successful students, and retention/success rate of students

The number of students in ENGR-120 has grown from ~30-40 every spring semester to between 20-30 every semester. The retention and success rate for prior to Spring 2018 was erratic, being 94% and 83% in Spring 2016 and 41% and 41% in Spring 2017. Post Spring 2018, the retention and success rate was slightly more stable ranging from 60-83% and 52-81%, respectively. The noticeable drop in retention and success rate post Spring 2018 was Spring 2019 with a retention and success rate of 60% and 52% (Figure 2). Spring 2019 was taught by an adjunct professor and the retention and success rate rebounded when the following semesters. Spring 2020 when I (Keenan Murray) taught the course, the success rate dropped below the 77% success rate goal for the college, which may be a result of the COVID-19, my teaching practices, and/or expected randomness of the student population.

Figure 3 ENGR-200 Engineering Mechanics-Statics student enrollment, retained students, successful students, and retention/success rate of students

Despite ENGR-200 often being called a “weeder” class for engineering programs, the course has shown consistent enrollment on a per-semester basis (more enrollment in Fall semesters). Since Fall 2015, the course has shown continued improvements in retention and success rate, starting at 76% and 58% Fall 2015 and ending at 92% retention and success rate in Spring 2020 during the COVID-19 Emergency Remote Teaching (Figure 3). It appears the retention and success rate for the course are above expectations.

Figure 4 ENGR-210 Electric Circuits student enrollment, retained students, successful students, and retention/success rate of students

Enrollment in ENGR-210 has increased from 17 and 40 students in the Fall and Spring of 2016 to 30 and 60 in Fall 2019 and Spring 2020. The retention and success rates for the course have stabilized for the course since Spring 2017 with rate ranges of 87-95% and 83-92%, respectively (Figure 4). The success rate of the course is now consistently well above the goal of the college. Due to the transition to remote learning as a result of Covid-19, we were able to find a free, online version of Multisim. This web-based platform was more updated and easier to use than the antiquated version installed on the classroom lab machines. As a result, less class time was used for troubleshooting software problems and more time was used for exploring and discussing lab topics.

Figure 5 ENGR-220 Engineering Mechanics-Dynamics enrollment, retained students, successful students, and retention/success rate of students

ENGR-220 enrollment lags ENGR-200 enrollment by 1 semester and ENGR-200 is the prerequisite for ENGR-220.Starting Spring 2019, ENGR-220 has been offered every semester instead of alternate semesters. Historically, the success rate has been above the college goal of 77% with the exception of Spring 2018 and Fall 2019. Spring 2018 was prior to my employment in the engineering program, so I do not have information readily available for me to explore the lower retention and success rate of the course Spring 2018. Fall 2019 was the first fall semester we offered the dynamics course and I (Keenan Murray) taught the course. The course success rate was 76% despite the 94% retention rate. Enrollment for the class was 17 students, with 1 student dropping (Figure 5). Of the 16 remaining students, 3 of the students earned grades of 1-35% for the semester; they were not engaged or active in the course much in the same manner as ENGR-100 for Fall 2019! Due to the smaller number of students enrolled in the course, the percentage change of retention and success rate are substantially larger on a per-student basis.
To further engage our students in ENGR-220, we are planning on using the new engineering Makerspace to have students design and machine remote controlled cars for a class project. We hope to implement the new project in Fall 2021.

Figure 6 ENGR-260 Engineering Materials student enrollment, retained students, successful students, and retention/success rate of students

ENGR-260 has had erratic retention and success rate over the past 5 years. Once we started offering the course every semester, the retention and success rate appears to have improved. Starting Fall 2019, the course has been taught by the same adjunct faculty

retention and success rate appears to have improved. Starting Fall 2019, the course has been taught by the same adjunct faculty, which may also explain the increased retention and success rate for Fall 2019 and Spring 2020. However, the success rate for the course has not been above the college goal of 77% except for Fall 2018 and Spring 2020 (Figure 6). Therefore, we should continue to observe the success rate of the course to ensure it continues to grow similar to the past 3 semesters.

Figure 7 ENGR-270 Digital Design student enrollment, retained students, successful students, and retention/success rate of students

ENGR-270 enrollment has been relatively consistent, even after we started offering the course every semester starting Fall 2017. Over the past 5 years, the success rate for the class has met or exceeded the college goal of 77% except for Fall 2017 when the success rate dropped to 72% (Figure 7). Based on the relative consistency of the success rate of the course, I do not believe there to be any immediate concerns for this course to meet the college success rate goal.

Q17

III.8. The College has set a 2024 goal of reaching a 77% course success rate (students passing with a grade of A, B, C, or P out of those enrolled at census) for the College as a whole. What is your department or discipline's four-year (2024-25) goal for success rate across all courses in the department or discipline?

Many of our courses are meeting or nearly meeting the 77% success rate for students. ENGR-100 Introduction to Engineering and Design, however, has been consistently below the 77% success rate. This introduction course is designed for freshman students to explore the engineering field and to introduce the students to Computer Aided Design (CAD). This course is very involved with several projects performed virtually via computer software. With the new Makerspace, we will be furthering developing and adding projects that will allow students to manufacture their designs and even compete against each other in classroom contests. We believe this sort of student engagement will increase the retention and success rate of the course. In fact, we are developing curriculum in Spring 2021 to add machining projects to not only ENGR-100, but ENGR-200 and ENGR-220 as well to improve student engagement and provide hands-on expertise.

In short, the engineering program not only wants to achieve the 77% success rate for students but is adapting curricula to exceed the 77% success rate goal.

Q18

III.9. Please review the college-wide and program data sets, which have identified equity gaps based on the following criteria: 3% n=10 students/enrollments. Which groups are experiencing equity gaps in your program?

Student representation in Engineering

Figure 8a/b – Race/Ethnic groups represented in Engineering compared to Campus demographics. The bottom plot is zoomed into the 0-12% range to analyze our minority groups

Engineering is currently serving more White, Multiple Races, and Asian student groups on a Campus-wide percentage basis while under-serving the African-American, American Indian, Hispanic/Latino, Middle Eastern or North African groups (Figure 8).

Figure 9 - Gender groups represented in Engineering compared to Campus

Engineering is currently providing services predominately to male students, even though most students at Cuyamaca identify as female (Figure 9).

Student Retention and Success in Engineering
Over the past 4 years, the Engineering program has had equity gaps in retention AND success of students in the following populations for more than 1 semester:

- African-American
- Asian
- Hispanic/Latino
- Middle Eastern or North African
- Multiple Races

Q19

III.10. What department/discipline (or institutional) factors may be contributing to these lower rates of success for these groups of students?

- Engineering courses are typically more time consuming compared to other courses, requiring more investment of time/effort that more disadvantaged populations may not have available due to other obligations (i.e. familial, financial).
- Engineering courses tend to revolve around a lecture style classroom with HW packets and exams. This style of visual/auditory learning is not ideal for all students.

Q20

III.11. What action will the department or discipline take to address these equity gaps in the short-term (next year) and long-term (next four years)?

Long Term

- We are updating our curriculum to be more project based so students can use tactile learning to engage in the material. These projects will span over most of the semester with sub-assignments to engage the students and allow them the chance to apply what is discussed in lecture in a nearly synchronous manner.

Short Term

- We are supported by a NSF grant to begin purchasing equipment for a Makerspace that we can use in development of the project-based curriculum. We currently are aiming to implement new hands-on projects in ENGR-100, ENGR-200, and ENGR-220 Fall 2021 (COVID-19 permitting).
- I (Keenan Murray) am currently enrolled in the Equity-Minded Teaching and Learning Institute (EMTLI) that started Fall 2020 and will end Spring 2021. One of the topics of discussion in EMTLI is incorporating assignments into our curriculum that addresses/celebrates diversity in the engineering field. Spring 2021 I will be piloting several HW assignments around identifying engineering professionals from around the world to acknowledge and celebrate diversity in the engineering field.

Q21

III.12. What other qualitative or quantitative data (from any source) is the program using to inform its planning for this comprehensive program review?

None

Q22

OPTIONAL: Please use the upload button to attach any supporting documentation you would like to include.

SP21_Figures.pdf (1015.4KB)

Page 7: III. Course Curriculum, Assessment and Student Success continued

Q23 **Yes**

III.14. Does your program offer courses via distance education (excluding emergency remote teaching in 2020)?

Page 8: III. Course Curriculum, Assessment and Student Success continued

Q24 **Yes**

III.15. Are there differences in success rates for distance education (online) versus in-person sections?

Q25

III.16. If there are differences in success rates for distance education (online) versus in-person classes, what will the program do to address these disparities?

We started DE courses Fall2020 and have no data for analysis

Page 9: III. Course Curriculum, Assessment and Student Success continued

Q26

III.17. What mechanisms are in place to ensure regular and effective contact (see the Guide to Best Practices in Online) within online courses across the discipline or department?

- Open office hours where students do not need to schedule an appointment with the professor, they can just join the Zoom meeting
- Weekly discussion threads
- Assignment rubrics and explicit assignment feedback

Q27

III.18. What innovative tools and strategies are you using in your online courses to engage students and support student success?

For ENGR-200 Statics and ENGR-220 Dynamics, we have created video solutions to HW assignments. Students can find or have someone solve HW problems online for them; however, these solutions can be wrong or prevent students from engaging in the solution. By providing video solutions to HW problems, we are hoping to engage the students in an environment like what is created by the professor. This will also help incentivize students to not cheat on HW because we emphasize the solution is provided and the HW is not a large portion of the course grade. Spring 2021 we are hoping to further remove the incentive to cheat by grading student HW on effort, not correctness. That way students can take the time to try and solve the HW problems without feeling like their grade is in jeopardy. Since we incorporate “Daily Class Activities” in the course based explicitly on lecture content, we will assess these assignments for “correctness” instead.

Page 10: IV. Degree and Certificate Programs

Q28 **Yes**

IV.1. Does your program offer any degree/certificate programs?

Page 11: IV. Degree and Certificate Programs continued

Q29

IV.2. Please upload for each degree and certificate indicating how many awards were conferred in the past five years

Engineering_Degree_Cert_Awarded_20_21.pdf (66.4KB)

Q30

IV.3. Please indicate when each degree and certificate was last reviewed and updated (semester):

The degrees and certificates have not been reviewed since Keenan Murray and Misha Kutzman were hired in 2019. We are unaware of when the degrees and certificates were reviewed prior to 2019.

Q31

IV.4. How are these degrees/certificates meeting the needs of students, and/or articulation with four-year institutions?

We heavily emphasize articulation with SDSU since our students primarily transfer to SDSU. Since Keenan Murray and Misha Kutzman have been hired, we have focused on maintaining these articulations. SDSU is currently shifting some of their major requirements for engineering, so it will be imperative that Keenan Murray and Misha Kutzman review the changes to the SDSU major requirements and make sure our courses articulate with SDSU and continue to serve our students.

Q32

IV.5. Are there any changes planned if the degree/certificates are not meeting these needs?

Absolutely! Our program is focused on student success which includes transfer to 4-year universities. We are already working with the Cuyamaca CADD program to adapt to changes in SDSU courses as SDSU has consolidated 2 required engineering courses into 1 course. Cyrus Saghafi of the Cuyamaca CADD program is already designing the Cuyamaca CADD course to articulate with the new SDSU course. In fact, we are fortunate that Cyrus Saghafi has even been teaching the new SDSU course as well, so he has first-hand knowledge of what SDSU expects for the course and for articulation!

Q33

IV.6. Can students complete the degree/certificate requirements within a two-year period?**requirement of Title 5, California Code of Regulations and Accreditation Standard II.A.

Yes

Page 12: IV. Degree and Certificate Programs continued

Q34

IV.7. How are you currently assessing your PLOs?

Currently our PLOs are assessed by corresponding SLOs mapped to each PLO. With Keenan Murray hired Spring 2019 and Misha Kutzman Fall 2019 and COVID-19 remote teaching starting in Spring 2020, we have not prioritized reviewing our PLO assessment method.

Q35

IV.8. Are the PLOs in the catalog an accurate reflection of the department or discipline's current learning objectives?

No - Please briefly explain the plan to revise::
Misha Kutzman and I (Keenan Murray) need to set aside time to review our PLOs and determine how we want to assess them as we have not done so since we have been hired. Since we have not reviewed them, it is not possible for use to determine if we believe they are accurate of the discipline's current learning objectives.

Q36

IV.9. Are the PLOs mapped to the course SLOs?

Yes

Page 13: IV. Degree and Certificate Programs continued

Q37

IV.10. How is your program helping students explore careers in your program area?

In the beginning of Spring 2020, Keenan Murray was working with a local manufacturing company, Veridiam, to explore a partnership where they may be able to provide instrumentation for our school, help us provide directly applicable and hands-on experience in our classroom, and provide internship opportunities. Keenan Murray had a site visit with the company and there are a lot of opportunities at the site for students interested in material engineering (related to mechanical and civil engineering) and CAD. However, with COVID-19, this partnership is on-hold. Yet this potential relationship with local companies is exactly what the engineering program wishes to pursue to enrich student learning and to explore engineering careers.

Q38

IV.11. What do the latest labor market data reveal about the careers (including those for transfer students) for which your program prepares students? Labor market data may be sourced from the Program Review Data webpage and California Employment Development Department. You can also contact the Institutional Effectiveness, Success, and Equity Office to access additional labor market information related to your program.

Using the California Employment Development Department data for the 1st Quarter of 2020 and focusing on the careers most directly associated with either AS or higher degrees (see attached PDF File SDCounty_2020_Employment_Data for selected occupations and calculations), these engineering careers compose 6.12% of employment in SD County while the wages for these careers, on average, is 51.5% higher than the SD County average wage for all careers

Q39

IV.12. What are the labor market implications for the program's curriculum (degrees, certificates, courses)?

The labor market data supports the engineering field is a field of interest in industry (6.12% of employment in SD County) and that the engineering field is competitive and a sought-out expertise (the wages are on average 51.2% higher than the average wage in SD County)

Q40

If your program has labor market data to include in your program review, please use the upload button below to attach the file.

SDCounty_2020_Employment_Data.pdf (69.8KB)

Page 14: IV. Degree and Certificate Programs continued

Q41

IV.13. Please describe your program's strengths:

Faculty

- Keenan Murray and Misha Kutzman were hired in 2019 marking the first time the engineering program has had two full-time instructors. These faculty are not already devoting time to improving curriculum, but also maintain consistency of courses across sections.
- Hamidreza Ghasemi Bahraseman (Hamid), our only adjunct faculty at this time, has been consistently teaching ENGR-100 and ENGR-260 for the past year. Additionally, Hamid has been updating the ENGR-260 curriculum to use the computer model Ansys to engage the students. Also, Hamid is designing and holding engineering workshops not only at Cuyamaca, but at the other community colleges where he instructs. In short, Hamid is an engaging instructor who is continually looking to improve how to teach and engage the students.

Growth/Enrollment

Enrollment has grown 115% from 150 engineering students in Fall 2015 to 322 engineering students in Spring 2020

Articulation with SDSU

All the currently active engineering courses articulate with SDSU or are prerequisites for courses that articulate with SDSU. We use SDSU as our benchmark as most of our students aim to transfer to SDSU.

Q42

IV.14. Please describe your program's challenges:

Classroom Space
We used room F-301 as our main engineering classroom. It has equipment that can be used in all our engineering courses. However, with the 115% growth in enrollment, we are needing to find other rooms to host our engineering courses. These other rooms we use do not readily have access to engineering equipment that could be used in course curriculum, causing some of our courses to be currently taught on a more theoretical basis. We are trying to improve this situation by acquiring equipment that is more mobile (such as high-end laptops that can run engineering software) for use in other classrooms and by creating a Makerspace in the engineering prep room so courses can have access to equipment even while other engineering courses are offered in F-301.

Equity and Diversity
As noted in another section, engineering serves predominately white male students with higher percentages than the campus average. We are trying to implement practices to serve more of our students and the community. Some of these ideas include:

- Creating more hands-on project-based curriculum to engage our students to increase retention and success
- Removing financial barriers from courses by minimizing textbooks costs (requiring only 1 book, at most) and by searching for other sources of financial support to pay for student software rather than asking students to pay for the software.
- Creating the Makerspace so students at Cuyamaca and the community can come and experience engineering in person outside of a classroom setting. We hope this will increase curiosity of the engineering field and the Cuyamaca program. My (Keenan Murray) personal goal is to hold my office hours in the Makerspace so students and the community can come "tinker" in the Makerspace at their leisure. I hope to also collaborate with other instructors for them to hold their office hours in the Makerspace to increase the time it is available to the students and community.

Q43

IV.15. Please describe external influences that affect your program (both positively and negatively):

Positive
We have had a lot of support from other STEM programs and our Dean to increase our enrollment and to support students.

Negative
Even though we have some plans in place to begin addressing equity and diversity issues in the engineering program, there is a larger societal issue of available time and resources to underprivileged student groups that is very noticeable in the engineering program. The pursuit of an engineering education requires extensive amounts of time to be successful, yet the number of part-time engineering students are now nearly the same as the full-time engineering students. I believe, anecdotally, that this is because students have jobs for 20-40 hours a week and other familial obligations that are conflicting with the time required for students to be as successful as they want to be in engineering courses. Obviously, there is no golden solution to this issue, but we should be aware of and still try the best we can to resolve these kinds of issues with student resources and curriculum that is adaptable for students with different backgrounds and obligations.

Q44

IV.16. Given these factors, what opportunities exist for the program to advance student success and equity in the next 4 years?

We are trying to implement practices to serve more of our students and the community. Some of these ideas include:

- Creating more hands-on project-based curriculum to engage our students to increase retention and success
- Removing financial barriers from courses by minimizing textbooks costs (requiring only 1 book, at most) and by searching for other sources of financial support to pay for student software rather than asking students to pay for the software.
- Creating the Makerspace so students at Cuyamaca and the community can come and experience engineering in person outside of a classroom setting. We hope this will increase curiosity of the engineering field and the Cuyamaca program. My (Keenan Murray) personal goal is to hold my office hours in the Makerspace so students and the community can come "tinker" in the Makerspace at their leisure. I hope to also collaborate with other instructors for them to hold their office hours in the Makerspace to increase the time it is available to the students and community.

Page 15: V. Previous Goals

Q45

Previous Goal 1:

Increase student success in sophomore-level engineering courses through increased support for ENGR 100 and all other lab classes

Q46

Goal Status

In Progress - Please describe the goal and action steps in the 4-Year Goals section (Section VI)

Page 16: V. Previous Goals continued

Q47

Please describe the results or explain the reason for the deletion/completion of the goal:

Respondent skipped this question

Page 17: V. Previous Goals continued

Q48

Would you like to submit another previous goal?

Yes

Page 18: V. Previous Goals continued

Q49

Previous Goal 2:

Adapt the engineering curriculum to suit the Transfer Model Curriculum (TMC) for engineering and develop a Materials Lab.

Q50

Goal Status

In Progress - Please describe the goal and action steps in the 4-Year Goals section (Section VI)

Page 19: V. Previous Goals continued

Q51

Please describe the results or explain the reason for the deletion/completion of the goal:

Respondent skipped this question

Page 20: V. Previous Goals continued

Q52

Would you like to submit another previous goal?

Yes

Page 21: V. Previous Goals continued

Q53

Previous Goal 3:

Create Maker Space to support labs, student projects, engineering club, and national competition teams
Goal Status

Q54

Goal Status

In Progress - Please describe the goal and action steps in the 4-Year Goals section (Section VI)

Page 22: V. Previous Goals continued

Q55

Please describe the results or explain the reason for the deletion/completion of the goal:

Respondent skipped this question

Page 23: V. Previous Goals continued

Q56

Would you like to submit another previous goal?

Yes

Page 24: V. Previous Goals continued

Q57

Previous Goal 4:

Partner with CTE and the Career Center to get students better connected to their goals
Goal Status

Q58 **Deleted**

Goal Status

Page 25: V. Previous Goals continued

Q59

Please describe the results or explain the reason for the deletion/completion of the goal:

While we will be pursuing this goal in the future, we are prioritizing 4 main goals moving forward for the next 4 years and this goal is more challenging to pursue during COVID-19 and Emergency Remote Teaching

Page 26: VI. 4-Year Goals

Q60

Goal 1:

Increase student success in sophomore-level engineering courses through increased support for ENGR 100 and all other lab classes

Q61 **Student Validation & Engagement**

Which College Strategic Goal does this department goal most directly support? (Check only one)

Q62

Please describe how this goal advances the college strategic goal(s) identified above:

There is ample evidence to suggest that success in ENGR 100: Introduction to Engineering and Design leads to increased success in subsequent classes. For example, students in ENGR 200: Statics who have previously taken ENGR 100 have historically enjoyed a 6.5 percent grade differential over the class average (which includes the same students, meaning that the advantage over those students who haven't had ENGR 100 is even more dramatic). In response to this clear signal we have increased the annual number of sections
of ENGR 100 from 0, 17 years ago, to 7 in the 2019-2020 school year. In addition, this course would be included as the gateway course in the STEM guided pathways meta-major, hopefully drawing even more students into the program. This costs money, as do other lab classes which we have added over the years. Last year our budget was increased from ~$800 to ~$3,000 to assist with the increase of enrollment. However, the cost of running our engineering courses is increasing due to the development of curriculum to be more project-based. For example, the ENGR-100 course currently uses Arduino lab kits that are $60 if purchased directly from Arduino. With 4 sections of ENGR-100 per semester containing 30 students each, we need to acquire 240 Arduino kits, which would cost ~$14,400 a year to provide these kits to our students. While it would be wonderful for our budget to increase from ~$3,000 to $14,000, I would imagine it is not a reasonable increase in budget and is a topic of discussion with out Dean. Instead, I provide this example of cost to put in perspective that the engineering program has had to and will continue to need to find budget augmentations to maintain supply costs while also requiring the students to pay for some of the supplies. It is not necessarily unreasonable to expect students to pay for supplies and equipment when they get to keep it after the semester, but it does present a barrier for disadvantaged students who may decide to drop engineering courses if they feel they cannot afford the supplies and equipment. Hence, I wonder if we can maybe take a two-pronged approach to help address this issue: 1) Continue to increase the engineering budget (By working with out Dean) due to our increase in projects for our curriculum (not $14,400!) 2) Maybe we can either as a department or a program create a separate budget that provides financial support to underprivileged students where they can submit a simple application for financial assistance buying equipment for courses. Since I (Keenan Murray) am relatively new and this is my first comprehensive program review, I am not sure if this sort of discussion belongs in the review OR if it should be just between the program and the Dean. However, (please correct me if I am wrong) I thought that the idea/thought of creating a separate fund for underprivileged student populations (much like Cuyamaca CARES for COVID-19) is something that I should include in my review of our program.

A lab technician familiar with the class could easily bridge this gap and manage the money and supplies, a cheaper and safer alternative to the current situation where full time faculty try to assist while not preoccupied with their own classes and the running of the program. For example, the full-time instructor who designed the class hand assembled Arduino kits (instead of purchasing Arduino kits completed) including wires and components. Creating 240 Arduino kits is very time consuming and becoming impossible for instructors to perform this task. Now that we run four sections assembling the kits has become more than a full day of work for an instructor and a lab technician who does not have the technical background for this kind of work. Using a full-time instructor to do this work is not a good use of resources and this is only one of many examples that occur throughout the semester.

Q63

Please indicate how this goal was informed by SLO assessment results, PLO assessment results, student achievement data, or other qualitative or quantitative data (from any source):

Our goal has been informed by the increase in engineering student enrollment and the noticeable equity gaps noted in this comprehensive program review.

Q64

Action Steps for the Next Year: If you are requesting resources in order to achieve this goal, please list them below as action steps and specific the type of request (e.g., submit technology request for new laptop computers).

1. Hire an engineering lab technician to help manage the growing lab supplies.
2. Purchase more modern equipment for circuits
3. Investigate the possibility of creating a department/program fund focused on supporting disadvantaged students in the Engineering & Physical Sciences department

Q65

How will this goal be evaluated?

All our SLOs have been updated in the past 2 years and we will be using our future SLO assessments to evaluate the success of the students in various subsections of our courses.

Q66 **Yes**

Would you like to propose a new, 4-year goal?

Page 27: VI. 4-Year Goals continued

Q67

Goal 2:

Adapt the engineering curriculum to suit the Transfer Model Curriculum (TMC) for engineering and develop a Materials Lab

Q68 **Guided Student Pathways**

Which College Strategic Goal does this department goal most directly support? (Check only one)

Q69

Please describe how this goal advances the college strategic goal(s) identified above:

The previous Cuyamaca College engineering faculty has participated in discussions, both in person and by email, on what the TMC would look like. In general our current AS degrees look a lot like most of the proposed ideas for the TMC plus we would like to add one in Environmental Engineering (a rapidly growing field in which one of our full time instructors is trained). However the current draft TMC includes a Materials Lab, which we don't have. This lab would be a REALLY GOOD addition to our course offering whether or not the draft TMC becomes the law of the land. For example, SDSU currently has a materials lab requirement for Mechanical Engineers, which we aren't meeting. The California Polytechnic Universities as well have materials lab requirements. Developing the materials lab will not be trivial. Typically, the equipment in a materials lab runs about $100,000 and we acquired some of the equipment and need to finalize equipment acquisition and develop the curriculum

We also need to form better connections with SDSU to make sure all our courses articulate properly. This will prevent future problems like when Engineering 120 briefly had articulation in question which sent enrollment flocking to Grossmont.

This work has been stalled for the past year due to COVID-19

Q70

Please indicate how this goal was informed by SLO assessment results, PLO assessment results, student achievement data, or other qualitative or quantitative data (from any source):

N/A

Q71

Action Steps for the Next Year: If you are requesting resources in order to achieve this goal, please list them below as action steps and specific the type of request (e.g., submit technology request for new laptop computers).

1. Finish the curriculum
2. Design the course
3. Set up meetings with SDSU's engineering program

Q72

How will this goal be evaluated?

We will evaluate this goal by still being able to transfer engineering students under the TMC and also by looking at student success in the materials lecture once it has a lab component.

Q73 **Yes**

Would you like to propose a new, 4-year goal?

Page 28: VI. 4-Year Goals continued

Q74

Goal 3:

Create Maker Space to support labs, student projects, engineering club, and national competition teams

Q75 **Student Validation & Engagement**

Which College Strategic Goal does this department goal most directly support? (Check only one)

Q76

Please describe how this goal advances the college strategic goal(s) identified above:

A Makerspace would be a lab space that could be used by all engineering courses as a resource but also be open to students outside of class and the campus community at large. Engineers design and build things, and they need practice in a low-stakes environment. Our current curriculum has by necessity been more theoretical than practical which puts our students at a disadvantage versus four-year students who immediately have access to tools and software as part of their tuition and fees. This space would allow our lectures to use applications and our labs to be much more interesting and diverse. Assuming we had staff for this space, student workers and/or a lab technician, we could also open this space up for collaborations with Graphic Design, Art, CADD, CIS's Mechatronics, or anyone else that has an interest. We could also use it to cheaply 3D print equipment for anyone on the campus.

We are already in the process of acquiring some equipment for the Makerspace through a NSF grant and will be creating projects for several courses that will use the Maker Space. We are processing a purchase request for newer and higher end 3D printers for the Makerspace. We are also in the process of purchasing a CNC mill for the Makerspace through the grant. The next steps once we acquire this equipment is for Keenan Murray (funded by the grant) to develop several projects for the engineering courses.

Q77

Please indicate how this goal was informed by SLO assessment results, PLO assessment results, student achievement data, or other qualitative or quantitative data (from any source):

Currently much of our lab space occupies a prep room abandoned by Chemistry over a decade ago There is a nonfunctional refrigerator growing some sort of organism, equipment we can and cannot identify, and a lot of dust and disorder. This space has needed to be updated and maintained for years, but nevertheless has functioned to grow a thriving program. It looks like the messy garage of Microsoft or Apple or Google lore. Unfortunately, although this look has a certain kitschy appeal, it is certainly not the glossy structure that many students have come to expect from those companies now, and, as we have grown to what is now the largest community college program in the county, it has become wholly inadequate to the point of embarrassment. So much so that when the Board and District visited, the tour guide passed off the CADD department as engineering because it looked so much nicer. In addition to this, there is one group that this is disproportionately repelled by this space: women. In an informal survey of random students, women were twice as likely as men to find this room and it's adjacent classroom visually unwelcoming. As the group with the largest gap between college and program representation, this is a huge and disappointing problem.

We received the news that a new F-building is in the process of being designed and built. So instead of renovating the new space, we should focus on cleaning up and organizing the new space for the equipment that we will be receiving

Q78

Action Steps for the Next Year: If you are requesting resources in order to achieve this goal, please list them below as action steps and specific the type of request (e.g., submit technology request for new laptop computers).

1. Acquire a skilled, full time lab technician to manage equipment, assist with labs and projects, and make the space open and welcoming to students, other departments, and the campus community
2. Organization and cleaning of the space to make it a more welcoming space
3. The creation of several projects for engineering courses that we hope to implement in our engineering courses Fall 2021, COVID-19 permitting

Q79

How will this goal be evaluated?

Student success in courses
Transfer and employment rates

Q80 **Yes**

Would you like to propose a new, 4-year goal?

Page 29: VI. 4-Year Goals continued

Q81

Goal 4:

First year Physics/Engineering Major Mentoring

Q82 **Guided Student Pathways**

Which College Strategic Goal does this department goal most directly support? (Check only one)

Q83

Please describe how this goal advances the college strategic goal(s) identified above:

We are looking to reach out to incoming students indicating an interest in Physics or Engineering (most students in physics are engineering majors) and providing them with mentoring. Most of these students do not show up in our classes until their second or third year, and they encounter many barriers before we see them in the classroom. We hope to do this in collaboration with Engineering (obviously), Grossmont, Guided Pathways, and the UC Irvine NSF-sponsored resonance program.

Scott Stambach and Keenan Murray have entered the Cuyamaca STEM Mentoring program where they have been paired with a small group of students (First-year students in Keenan's case). The mentoring program is evolving to meet student needs and then a wider implementation of the mentoring program will need to be initiated across the Engineering & Physical Sciences department to reach the majority of the Engineering & Physical Sciences students.

Q84

Please indicate how this goal was informed by SLO assessment results, PLO assessment results, student achievement data, or other qualitative or quantitative data (from any source):

Looking at our poor demographic representation of certain genders and ethnicities compared to college populations, we feel this would be a good first step to making sure we have cleared barriers to our program for these students.

Q85

Action Steps for the Next Year: If you are requesting resources in order to achieve this goal, please list them below as action steps and specific the type of request (e.g., submit technology request for new laptop computers).

Continue to work with the Cuyamaca STEM Mentoring program and see what we evolve!

Q86

How will this goal be evaluated?

We will monitor student demographics and equity gaps in our program

Page 30: VII. Resources Needed to Fully Achieve Goal(s)

Q87

What resources is your program requesting this year to achieve the program's goals? (Check all that apply)

Classified Resource Needs

Page 32: Final Check

Q88

Are you ready to submit your program review?If you would like to go back and review a section, select a section a click "Next."

I am ready to submit my program review