

Comprehensive Program Review Report



Program Review - Engineering

Program Summary

2020-2021

Prepared by: Larry Owens

What are the strengths of your area?: 1. High transfer success for engineering students.

There is a high transfer rate for students enrolled in ENGR 2 and/or ENGR 4. These courses can be used as benchmark courses because most, but not all, engineering students take them and all the students in these two courses are engineering majors. Also, by the time a student takes ENGR 2 and/or ENGR 4 they have completed at least two calculus courses and the first physics course. This would signify the student is serious about engineering as a major.

Thirteen students earned an Associate's Degree for Transfer in Engineering in spring 2020 - up from 9 degrees in the previous year. Most students who receive the AS Engineering also earn additional degrees such as AS-T Math, AS-T Physics and AS-T CSCI because of the breadth of the lower division curriculum required for engineering majors. Not all engineering students who transfer earn an Associate's Degree, but they are encouraged to do so. (2019-20 disaggregated data from Tableau Public)

2. High success rate in engineering courses.

Engineering courses have success rates of 81% or higher and 91% overall (2019-20 disaggregated data from Tableau Public). Student success in upper division courses after transfer also supports the preparation and success of COS engineering students. Success rates in engineering courses based on ethnicity show acceptably high rates for all ethnicities (disaggregated data from Tableau Public). For the most recent academic year available (2019-20), the overall success rate for the ENGR department was 91%. Students identifying as Multi-Ethnic had the highest success rate at 100% followed by Hispanics (89.2%) and Whites (88.9%) at essentially equal levels of success. With these solid success rates across the board, it would appear the approach taken in the engineering courses is working for all groups of varying cultural and ethnic backgrounds.

3. The engineering department has connections with various local organizations and employers resulting in internships and short-term employment for engineering students. Among the local companies and agencies where students have been placed are SERPA Packaging, Tempo Plastics, JM Eagle Pipe, USDA-Natural Resource Conservation Service, Lane Engineers, Tulare County Public Works, and Voltage Multipliers Incorporated. Several of these placements have resulted in permanent employment after the student completed their BS degree.

4. Strong support from COS programs

- The engineering program enjoys a strong relationship with and support from MESA.

MESA is a tutorial and support program specifically designed for students with calculus requiring majors, like engineering, physics, math and chemistry. Many engineering students utilize the MESA study center and tutorial offerings. Currently the engineering faculty member also serves as the MESA faculty advisor.

- Science Engineering and Technology Association (SETA) is a student club which supports all science, engineering, math, computer science and other STEM majors. SETA generally meets bi-monthly on Fridays and has a membership of well over 100 students. The engineering faculty member has been the faculty adviser for SETA since the student organization began in 2003.

- Friday Night Lab (FNL) is a space for students to work on research projects, expand their hands-on skills, experiment with various computer and technology items. FNL started in fall 2015. During the pandemic, FNL had a hiatus but is now developing an online presence with remote activities.

5. Students benefit from a faculty member with the dual strength of a PhD in engineering with research experience coupled with practical experience in the engineering field as a Registered Civil Engineer. This unusual combination of education and practical experience allows the department to support students who may want to go to graduate school and do research as well as students who want to complete a BS degree and begin working as an engineer. The engineering faculty member, Dr. Larry Owens, received the 2020 American Society for Engineering Education Outstanding Two-Year Faculty Teaching Award for the Pacific Southwest Region.

What improvements are needed?: 1. Decrease student barriers to degree completion with improved student-centered course offerings and scheduling.

With only a slight increase in course offerings and student-centered scheduling, barriers to completion of engineering, physics, computer science, math and other programs could be greatly increased. (Engineering, physics, computer science and math have several overlapping courses.) PHYS 57 has been added to the fall schedule as of fall 2020 so each of the three calculus-based physics courses will be taught every semester. Likewise, MATH 80 (Linear Algebra) will be offered in Spring 2021 as an expansion of the upper-level math courses. The addition of MATH 81 to the fall schedule would allow an engineering student (or other major) to take any of the upper-level math courses in any semester. This allows for flexibility in student scheduling and increases the opportunity for students to take a course.

To decrease barriers the engineering, physics, computer science and math course offerings would be: (NOTES: ENGR/CSCI 20: MATLAB is a cross-listed course. * indicates a course that could be added to the schedule to improve student opportunities for degree completion and transfer.)

Fall

Engineering	Physics	Comp Sci	Math
ENGR 1	PHYS 55	CSCI 1	MATH 65
ENGR 2	PHYS 56	CSCI 5	MATH 66
ENGR 110	PHYS 57	CSCI 20	MATH 67
ENGR 20			MATH 80
ENGR: Surveying*			MATH 81*

Spring

Engineering	Physics	Comp Sci	Math
ENGR 3	PHYS 55	CSCI 1	MATH 65
ENGR 4	PHYS 56	CSCI 2	MATH 66
ENGR 20	PHYS 57	CSCI 6	MATH 67
ENGR 1*		CSCI 20	MATH 80
ENGR 110*			MATH 81

We have made progress on this table from one year ago with the addition of PHYS 57 to the fall and MATH 80 to the spring. As engineering enrollments continue to increase, the addition of ENGR 1 (Graphics) and possibly ENGR 110 (Intro) would be the next courses to look at. The addition of a section of MATH 81 (Differential Equations) in the fall semester would also be desirable. There appears to be demand for a fall section since the spring section is above the classroom cap and enrollment in this course has exploded over the last several years. These course offerings could be covered with one full-time engineering faculty, two full-time physics faculty, and one or two adjunct faculty. Eventually, it may be possible to offer every engineering course every semester. This would require the addition of another full-time engineering faculty member or more adjunct faculty.

2. Increase budget to include consumable materials and supply expenses.

Although many divisions and departments received a permanent increase in supply budgets in fall 2018, engineering did not. It

was assumed that engineering had other resources. This is not true. Although engineering does sometimes have access to grant money this access is not permanent and should not be considered part of the engineering base budget. Many of the supplies used in the engineering labs are consumables - solder, electronic components, and filament for 3D printers. The engineering budget has actually decreased from levels of several years ago. The supply budget needs to be augmented to make up for those losses and cover the increase in prices for supplies as well as for supplies that are new needs such as 3D printer filament (approximately \$30-\$40/kg).

Engineering students need to experience and work with equipment they will see and use when the transfer as well as when they work in industry and it takes an adequate budget to support this.

Therefore, we will request a modest increase of \$400 to the engineering budget for consumable supplies used in engineering labs. A significant amount of this is to support the use of the new (over the last two years) 3-D printers. Filament is required to run these printers. 3-D printers are now a common tool in colleges, universities and industry.

3. Develop a surveying course and consider the possibility of a surveying certificate program.

In meetings with the local chapter of the American Council of Engineering Companies (ACEC), the need for local surveyors, surveying technicians, and civil engineers with surveying experience was clearly expressed. In response, I am developing a surveying course and looking into the possibility of offering a certificate in surveying. In addition to engineering majors, surveying should be useful for agriculture, architecture, and construction majors. Progress was made in this endeavor in 2019-2020, but the pandemic has made it difficult to meet with stakeholder groups. More work will be required in this area during 2020-2021.

Describe any external opportunities or challenges.: Faculty involvement with statewide Engineering Liaison Council (ELC) and the Partnership for Engineering Education (a consortium consisting of Fresno State and Central Valley community college engineering programs) has served to develop relationships with other universities and community colleges that provide opportunities for our COS engineering students. For example, I was able to clear up a transfer issue for a student who was denied admission to Fresno State by talking directly with the Dean of the College of Engineering.

The local chapter of the American Council of Engineering Companies (ACEC) has provided scholarships to COS engineering students through the COS Foundation for the last several years. I attend the ACEC meetings a couple of times per year to give updates on the status of the program to these professionals. They give feedback and provide insight into new current practice. They provided considerable feedback on the possibility of a surveying course and certificate and are very supportive of the idea.

The Science Undergraduate Research Group Experience (SURGE) grant through the U.S. Department of Education, of which the engineering faculty was the principal investigator, provided opportunities for engineering students to gain practical and research experiences. With the completion of that grant in September 2017, other opportunities will need to be developed to provide similar experiences for students. The engineering faculty are working with personnel from the REALM grant program and the Dean of Science, Math, and Engineering to identify and develop other grant funding sources to provide similar opportunities. In the meantime, Friday Night Lab continues to provide meaningful hands-on experiences in research and project development. Friday Night Lab receives grant funding through the COS Foundation.

Faculty involvement on the statewide Faculty Discipline Review Group (FDRG) provided the COS engineering department with direct input into the statewide TMC/MC (Model Curriculum) process in order to shape and quickly respond to statewide issues. As a result of engineering faculty involvement in the FDRG, the engineering professor served as the primary reviewer for the statewide C-ID course descriptor system for engineering for the first three years of the program.

Overall SLO Achievement: All course level assessments are up to date. Students assessments indicate that students are generally performing as expected, but there is room for improvement.

Changes Based on SLO Achievement: No additional changes based on SLOs are planned at this time.

Overall PLO Achievement: Program level outcomes have been mapped. A meaningful method of assessing PLOs needs to be developed.

Changes Based on PLO Achievement: No program changes based on program level outcomes at this time.

Outcome cycle evaluation: The engineering program is meeting the assessment cycle requirements. The cycle appears well-designed to regularly assess the engineering courses.

Action: (Completed 2019-2020) Support engineering student retention and success with appropriate technology

Program Review - Engineering

Replace the 35 outdated laptop computers in the engineering lab with computers capable of running the latest versions of SolidWorks, MATLAB and other engineering software. The specifications of these computers need exceed current requirements in order to be of use over the next 3 to 5 years.

Leave Blank:

Implementation Timeline: 2019 - 2020

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Identify related course/program outcomes: Engineering students need to use industry-standard software to prepare themselves for transfer to the university level and for professional practice. Engineering software tends to be computationally and graphically intensive. Upgrading computers for the engineering lab support outcomes and objectives at the course, program, and district levels.

Course Level:

The course description for ENGR 1 includes the following statement: "The use of CAD software is an integral part of the course." The following course topics are included in the course outline: CAD - 3D solid modeling, CAD - 2D Construction and Editing Tools. The following course objectives are included in the course outline: Use CAD software to create 3D models and assemblies, Use CAD software to create 2D engineering drawings, including working drawings and assembly drawings.

ENGR 1 includes the following course-level outcome: Computer-aided-drafting (CAD): Given an actual object or a dimensioned drawing, students will be able to use computer-aided-drafting (CAD) software to create 3D models and assemblies, and 2D multiview drawings.

Program-level outcomes:

Engineering Problems: Students will develop the ability to identify, formulate, and solve engineering problems (e.g. circuits, statics, materials, graphics).

Engineering tools and techniques: Students will develop the ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.

Providing appropriate tools for engineering coursework and training creates a learning environment that supports student retention and success, which supports the following District Objectives:

District Objective 1.1 The District will increase FTES by 1.75% over the three years

District Objective 2.1 Increase the percentage of students who earn an associate degree or certificate (CTE and Non-CTE) by 5 percentage points over three years

District Objective 2.2 Increase the number of students who transfer to a four-year institution by 10 percent over three years

Person(s) Responsible (Name and Position): Larry Owens, Engineering Professor

Rationale (With supporting data): The engineering department (and physics department) have a laptop cart with 35 laptop computers. These computers are now several years old and were scheduled to be refreshed in the summer of 2016. Each year, I was promised that they were on the list to be refreshed – only to be told “not this year.” Beginning fall 2018, my students could not use these computers with the SolidWorks 3D modeling software needed for ENGR 1 (Engineering Graphics). The demands of the software are too great for these outdated computers. The laptops lag and lock up when trying to use the software. This fall (2019), I have had to rely on students downloading the student version of the software onto their own laptops and bringing them to class. Students that do not have their own laptops with the minimum specifications to run the software must use the desktop computers in John Muir 211 adjacent to the engineering lab (John Muir 208). There are only 17 computers in JM 211 – not enough for the entire class, so I had to hope that at least a dozen students had usable laptops. As a result, I must go back and forth between two rooms helping students and repeating instructions in one room that I just gave in the other. The students in JM 211 also do not see me demonstrating the software unless they leave their computers and walk back into JM 208.

In addition, we began teaching ENGR 20/CSCI 20 (cross-listed MATLAB Programming) in spring 2019. The laptops are not capable of handling certain functions of this software either, resulting in the computers locking up when those functions are used. As we expand the offerings of this course and the use of the software as a tool in the other engineering courses, this becomes a greater problem.

COS has purchased licenses and maintenance agreements for the SolidWorks and MATLAB software. With the current state of the laptop computers in the engineering lab, we are not able to use this software in an efficient manner to benefit students.

Priority: High

Safety Issue: No

Program Review - Engineering

External Mandate: Yes

Safety/Mandate Explanation: The C-ID for the Engineering Graphics course requires the use of current CAD software. The current laptops in the engineering lab cannot run the required software.

Update on Action

Updates

Update Year: 2020 - 2021

10/15/2020

Status: Action Completed

Purchase was approved for Above-base funding. Working with Computer Services and Academic Services, the installation of new engineering-capable computers were installed in August 2020.

Impact on District Objectives/Unit Outcomes (Not Required):

Resources Description

Technology - 35 laptop computers with specifications exceeding the minimum specifications required to run SolidWorks.

<https://www.solidworks.com/sw/support/SystemRequirements.html>

(Active)

Why is this resource required for this action?: The engineering department (and physics department) have a laptop cart with 35 laptop computers. These computers are now several years old and were scheduled to be refreshed in the summer of 2016. Each year, I was promised that they were on the list to be refreshed – only to be told “not this year.” Beginning fall 2018, my students could not use these computers with the SolidWorks 3D modeling software needed for ENGR 1 (Engineering Graphics). The demands of the software are too great for these outdated computers. The laptops lag and lock up when trying to use the software. This fall (2019), I have had to rely on students downloading the student version of the software onto their own laptops and bringing them to class. Students that do not have their own laptops with the minimum specifications to run the software must use the desktop computers in John Muir 211 adjacent to the engineering lab (John Muir 208). There are only 17 computers in JM 211 – not enough for the entire class, so I had to hope that at least a dozen students had usable laptops. As a result, I must go back and forth between two rooms helping students and repeating instructions in one room that I just gave in the other. The students in JM 211 also do not see me demonstrating the software unless they leave their computers and walk back into JM 208.

In addition, we began teaching ENGR 20/CSCI 20 (cross-listed MATLAB Programming) in spring 2019. The laptops are not capable of handling certain functions of this software either, resulting in the computers locking up when those functions are used. As we expand the offerings of this course and the use of the software as a tool in the other engineering courses, this becomes a greater problem.

COS has purchased licenses and maintenance agreements for the SolidWorks and MATLAB software. With the current state of the laptop computers in the engineering lab, we are not able to use this software in an efficient manner to benefit students.

Notes (optional):

Cost of Request (Nothing will be funded over the amount listed.): 98000

Related Documents:

[KXXN231 - CDWg - 35 Laptops - Larry Owens.pdf](#)

Link Actions to District Objectives

District Objectives: 2018-2021

District Objective 1.1 - The District will increase FTES by 1.75% over the three years

District Objective 2.1 - Increase the percentage of students who earn an associate degree or certificate (CTE and Non-CTE) by 5 percentage points over three years

District Objective 2.2 - Increase the number of students who transfer to a four-year institution by 10 percent over three years

Program Review - Engineering

Action: (Continued 2019-2020) Expand opportunities and training for students and meet local employment needs

Develop a surveying course and investigate the possibility of a surveying certificate program.

Leave Blank:

Implementation Timeline: 2019 - 2020

Leave Blank:

Leave Blank:

Identify related course/program outcomes: Adding a surveying course to the engineering curriculum will allow engineering majors the opportunity to investigate another area of engineering and to prepare themselves more fully for transfer to the university level (surveying is a required course for civil engineering majors). The course would support the following program-level outcomes:

Engineering Problems: Students will develop the ability to identify, formulate, and solve engineering problems (e.g. circuits, statics, materials, graphics).

Experiments and data analysis: Students will develop the ability to design and conduct experiments, as well as to analyze and interpret data.

Engineering tools and techniques: Students will develop the ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.

The course would be designed to apply to majors other than engineering - such as agriculture, architecture, and construction. The local engineering and surveying companies are in need of entry-level surveying technicians. This course and the possible surveying certificate would create a pipeline to support the local economy and the following District Objectives:

District Objective 1.1 The District will increase FTES by 1.75% over the three years

District Objective 2.1 Increase the percentage of students who earn an associate degree or certificate (CTE and Non-CTE) by 5 percentage points over three years

District Objective 2.2 Increase the number of students who transfer to a four-year institution by 10 percent over three years

Person(s) Responsible (Name and Position): Larry Owens, Engineering Professor

Rationale (With supporting data): In meetings with the local chapter of the American Council of Engineering Companies (ACEC), the need for local surveyors, surveying technicians, and civil engineers with surveying experience was clearly expressed. To help meet this need, I am developing a surveying course and looking into the possibility of offering a certificate in surveying. The college has approved an Institutional Improvement Project (IIP) with 3 hours of release time in spring 2020 to research and develop the course and, if deemed feasible, the certificate. In addition to engineering majors, surveying should be useful for agriculture, architecture, and construction majors.

Priority: High

Safety Issue: No

External Mandate: No

Safety/Mandate Explanation:

Update on Action

Updates

Update Year: 2020 - 2021

10/15/2020

Status: Continue Action Next Year

Progress on this action was slowed by the COVID-19 situation in spring 2020. Work will continue on this action in the 2020-2021 academic year.

Impact on District Objectives/Unit Outcomes (Not Required):

Link Actions to District Objectives

District Objectives: 2018-2021

District Objective 1.1 - The District will increase FTES by 1.75% over the three years

Program Review - Engineering

District Objective 2.1 - Increase the percentage of students who earn an associate degree or certificate (CTE and Non-CTE) by 5 percentage points over three years

District Objective 2.2 - Increase the number of students who transfer to a four-year institution by 10 percent over three years

Action: (Continued 2018-19) Increase the number of students completing engineering program

This action will be addressed with several approaches.

1. Investigate the success rates of courses within the engineering program and determine where along the pathway students may have difficulty.
2. Determine which students should actually be considered as engineering majors.
3. Review students support services (MESA/SETA, tutorial, counseling) to see assess the effectiveness for engineering majors.

Leave Blank: Continued Action

Implementation Timeline: 2019 - 2020

Leave Blank: 09/08/2014

Leave Blank: 06/15/2015

Identify related course/program outcomes: All three program outcomes state "Students will develop the ability to..." To adequately assess these outcomes, identifying which students are really in the engineering program is important. Once these students are clearly identified assessing problem areas in the program as well as effectiveness of support services can be done.

Person(s) Responsible (Name and Position): Larry Owens

Rationale (With supporting data): According to EIS, as of August 31, 2014, 138 students declared themselves engineering majors. However, as of August 31, 2014 only 9 student of the 26 students in ENGR 1 declared themselves engineering majors. Obviously there are problems with determining which students are actually engineering majors. Determining who is actually an engineering major would be helpful to develop a process to help all engineering majors. Determining this would also be helpful to follow and evaluate the success of engineering majors at COS.

Investigating the success rates of courses within the engineering program, assuming the student follows a typical course pattern, can help determine where students may have problems and need additional support or alternative opportunities. (A typical course pattern can be found in the documents section.)

A review of support services for engineering students will help determine what services are available as well as how effective those services are for the engineering students.

Priority: High

Safety Issue: No

External Mandate: No

Safety/Mandate Explanation:

Update on Action

Updates

Update Year: 2020 - 2021

10/15/2020

Status: Continue Action Next Year

This is ongoing action. Progress is being made with increases in enrollment in ENGR courses, degrees granted, and transferring students.

Impact on District Objectives/Unit Outcomes (Not Required):

Link Actions to District Objectives

District Objectives: 2018-2021

District Objective 1.1 - The District will increase FTES by 1.75% over the three years

District Objective 2.2 - Increase the number of students who transfer to a four-year institution by 10 percent over three years

Program Review - Engineering

District Objectives: 2013-2015

2013-2015: District Objective #1 - District Objective #1 for 2013-2015: Provide effective academic support services as measured by an increase in the rate at which students successfully complete courses.

District Objectives: 2015-2018

District Objectives - 1.1 - Increase overall enrollment by 1.75% annually

District Objectives - 2.1 - Increase the number of students who are transfer-prepared annually.

District Objectives - 2.2 - Increase the number of students who earn an associate degree or certificate annually.

District Objectives - 3.1 - Reduce the achievement gap of disproportionately impacted student groups annually, as identified in the Student Equity Plan.

Action: (Continued 2018-19) On-going support for engineering laboratory experiences.

Increase the engineering budget by \$400 for consumable supplies used in engineering labs. A significant amount of this is to support the use of the new (over the last two years) 3-D printers. Filament is required to run these printers. 3-D printers are now a common tool in colleges, universities and industry.

Leave Blank: New Action

Implementation Timeline: 2019 - 2020

Leave Blank:

Leave Blank:

Identify related course/program outcomes: Consumable supplies for use in the engineering courses and associated labs supports the following Engineering program-level outcomes.

2. Students will develop the ability to design and conduct experiments, as well as to analyze and interpret data.

3. Students will develop the ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.

Person(s) Responsible (Name and Position): Larry Owens (Engineering/Physics Professor)

Rationale (With supporting data): Although many divisions and departments received a permanent increase in supplies in fall 2018 engineering did not. It was assumed that engineering had other resources. This is not true. Although engineering does sometimes have access to grant money this access is not permanent and should not be considered part of the engineering base budget. Many of the supplies used in the engineering labs are consumables - solder, electronic components, and filament for 3D printers. The engineering budget has actually decreased from levels of several years ago. The supply budget needs to be augmented to make up for those losses and cover the increase in prices for supplies as well as for supplies that are new needs such as 3D printer filament (approximately \$30-\$40/kg).

Priority: High

Safety Issue: No

External Mandate: No

Safety/Mandate Explanation:

Update on Action

Updates

Update Year: 2020 - 2021

10/15/2020

Status: Continue Action Next Year

Now that I know this has to be done through an augmented budget request, the appropriate forms will be filed during the 2020-2021 academic year.

Impact on District Objectives/Unit Outcomes (Not Required):

Program Review - Engineering

Resources Description

Adjustment to Base Budget - Increase the engineering budget by \$500 for consumable supplies used in engineering labs. A significant amount of this is to support the use of the new (over the last two years) 3-D printers. Filament is required to run these printers. 3-D printers are now a common tool in colleges, universities and industry. (Active)

Why is this resource required for this action?: Engineering students need to experience and work with equipment they will see and use when the transfer as well as when they work in industry.

Notes (optional): Although many divisions and departments received a permanent increase in supplies in fall 2018 engineering did not. It was assumed that engineering had other resources. This is not true. Although engineering does sometimes have access to grant money this access is not permanent and should not be considered part of the engineering base budget. Many of the supplies used in the engineering labs are consumables - solder, electronic components, and filament for 3D printers. The engineering budget has actually decreased from levels of several years ago. The supply budget needs to be augmented to make up for those losses and cover the increase in prices for supplies as well as for supplies that are new needs such as 3D printer filament (approximately \$30-\$40/kg).

Cost of Request (Nothing will be funded over the amount listed.):

Link Actions to District Objectives

District Objectives: 2018-2021

District Objective 1.1 - The District will increase FTES by 1.75% over the three years

District Objective 2.2 - Increase the number of students who transfer to a four-year institution by 10 percent over three years

District Objectives: 2015-2018

District Objectives - 2.1 - Increase the number of students who are transfer-prepared annually.

District Objectives - 2.2 - Increase the number of students who earn an associate degree or certificate annually.

District Objectives - 3.1 - Reduce the achievement gap of disproportionately impacted student groups annually, as identified in the Student Equity Plan.