Comprehensive Program Review Report

Program Review - Engineering

Program Summary

2021-2022

Prepared by: Larry Owens

What are the strengths of your area?: .

1. High success rate in engineering courses.

Engineering courses have higher success rates, 90% or higher depending on the year considered, than the college at large. This is especially notable when considering gender and ethnicity. Ninety two percent (92%) of males are successful in engineering courses compared to75% of males in all college courses. Eighty seven percent (87%) of females are successful in engineering courses compared to 78% of females in all college courses. This success rate is clear when ethnicity is also considered. 90% of Hispanic males are successful in engineering courses compared to a success rate of 71% for Hispanic males in all college courses. When looking at multi-year success in engineering courses there is a small difference between Hispanic males and white males, 9-% for Hispanic males and 92% for white males. However when the yearly data is examined for Hispanic and white males it varies, some years Hispanic males have higher success rates, some years white males have higher success rates. (The success rates of females show white females having a higher success rate, 91% than Hispanic females 79%, however there are so few females that most years don't have these groups listed. There are such low numbers of females that general success rates are not very accurate. 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. All data from COS tableau and included in documents section.)

2. 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.

Twelve students earned an Associate's Degree for Transfer in Engineering in 2020-21 - down 1 degree from the previous year. The 2019-20 year had 13 degrees awarded, while the 2018-19 year had 9 degrees awarded. Considering that the 2020-21 academic year was completely online due to COVID a decrease of only one degree awarded is good. Engineering, especially the required labs, is a hands-on major and often attracts students who enjoy and learn best from a hands-on approach. 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.

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 has now returned to a face-to-face format.

•College of the Sequoias Foundation.

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. Continue to decrease student barriers to degree complete with improved student-centered course offerings and scheduling. When courses are offered more than once in the academic year, students can move forward in their progress toward a degree in a smoother fashion, compared to offering courses only once in the academic year. The addition of MATH 81 to the fall 2021 semester now allows all the required math courses to be taken fall or spring.

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
			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

As engineering enrollments continue to increase, the addition of ENGR 1 (Graphics) and ENGR 110 (Intro) to the spring semester should be considered. ENGR 110 would likely be the wisest to add first. It is a short term, 2- unit course that fills easily every fall semester. ENGR 110 serves as an introduction to the field of engineering as well as the course work required. Often students who were unsure about engineering as a major, continue on in engineering after completing ENGR110.

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.

4. Increase the number of females transferring in engineering and/or receiving an AS in engineering.
Describe any external opportunities or challenges.: Teaching in the COVID-19 environment has presented a very large number of challenges.
Overall SLO Achievement: All SLOs are up to date.
Changes Based on SLO Achievement: None
Overall PLO Achievement: PLOs appear to be up to date. The program is due to be assessed this academic year (2021-2022)
Changes Based on PLO Achievement: None
Outcome cycle evaluation: The cycle seems appropriate.

Action: Renew SolidWorks and MATLAB software license agreements

Improve and expand hands-on experiences for engineering, computer science and STEM-major students by using industry-standard equipment, software and supplies. Software license agreements for SolidWorks 3D Modeling and MATLAB Programming software need to be renewed.

Leave Blank:
Implementation Timeline: 2021 - 2022
Leave Blank:
Leave Blank:
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 create2D 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 2.1Increase 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):
Priority: High
Safety Issue: No
External Mandate: No
Safety/Mandate Explanation:

Resources Description

Technology - This request is for the extension of our existing maintenance agreements to maintain currency of our SolidWorks and MATLAB software licenses. This provides us with the current version of the software, updates, and support. For SolidWorks, it also provides our students with a free downloadable student version. It is much cheaper to maintain our agreements than to let them lapse and have to repurchase the software. (Active)

Why is this resource required for this action?: A large part of becoming an engineer is to learn to use the tools that engineers use. Those tools include software packages that are widely used in professional practice. SolidWorks and MATLAB are two of the those packages. SolidWorks is used for 3D modeling and drafting. MATLAB is widely used for engineering programming and computation and is finding use in machine learning and artificial intelligence. MATLAB is routinely required by the university engineering departments to which our students transfer. These software packages are also used on our cloud-based engineering desktop that enables students to access the software from a home computer. This addresses issues of equity since not all of our students have access to a home computer that can support demanding engineering software.

Notes (optional): Quotes attached in documents section

Cost of Request (Nothing will be funded over the amount listed.): 7760

Related Documents:
SolidWorks Quote 329352-22.9 3yr College of the Sequoias.pdf

Action: Expand opportunities and training for students and meet local employment needs by exploring possible surveying course

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

Leave Blank:
Implementation Timeline: 2019 - 2020, 2020 - 2021, 2021 - 2022
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.

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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 2.1Increase 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
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

District Objectives: 2021-2025
District Objective 2.1 - Increase the number of students who earn an associate degree or certificate (CTE and non-CTE) by 5% from 2021-2025.
District Objective 2.2 - Increase the number of students who are transfer-ready by 15% and students who transfer to four-year institutions by 10% from 2021-2025.
District Objective 2.4 - Increase the percentage of CTE students who achieve their employment objectives by five percentage points (job closely related to field of study and attainment of a livable wage) and the number of CTE students who successfully complete 9+ CTE units in a single year by 10% from 2021-2025.

Action: Increase the number of students completing engineering program

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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, 2020 - 2021, 2021 - 2022
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

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.

District Objectives: 2021-2025

District Objective 2.2 - Increase the number of students who are transfer-ready by 15% and students who transfer to four-year institutions by 10% from 2021-2025.

District Objective 3.1 - Reduce equity gaps in course success rates across all departments by 40% from 2021-2025.

Action: Improve on-going fiscal 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, 2020 - 2021, 2021 - 2022
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

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.): 500

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.

District Objectives: 2021-2025
District Objective 2.2 - Increase the number of students who are transfer-ready by 15% and students who transfer to four-year institutions by 10% from 2021-2025.
District Objective 3.1 - Reduce equity gaps in course success rates across all departments by 40% from 2021-2025.