

Instructional Program Review Report

Sierra College, 2019-2020

Department/Program Name: ENGINEERING

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Ideally, the writing of a Program Review Report should be a collaborative process of full-time and part time faculty as well as all other staff and stakeholders invested in the present and future success of the program at all sites throughout the district. The Program Review Committee needs as much information as possible to evaluate the past and current performance, assessment, and planning of your program.

Please attach your Department Statistics Report (DSR) and your planning report with your Program Review.

1) Relevancy: This section assesses the program's significance to students, the college, and the community.

1a) To provide context for the information that follows, describe the basic functions of your program.

The Engineering Program is currently serving student populations in two separate Modes: students for transfer and students that plan to earn a certificate in engineering. First, and by large majority, is the transfer students. The idea for these students is to provide a complete set of engineering classes such that they can transfer seamlessly to any university having all first and second year engineering courses completed. As you will see, this has been a challenge even with Sierra College adopting the new C-ID system and several universities not adhering to the C-ID system for engineering. Second, the program offers a certificate of achievement in engineering. The idea for this group of students is to serve those who want to work in engineering but cannot complete all of the required courses for the four year degree, for example Calculus. These students would get enough education to be capable of getting a job working as an assistant to a professional engineer.

1b) How does your program support the District Mission, Vision Statement, and Core Values, quoted below?

Sierra College Mission

The mission of Sierra College is to provide an inclusive and safe educational environment where learners are supported while challenging themselves and achieving their goals.

Sierra College Vision Statement

Sierra College will be the preferred destination for higher education and training in our region while eliminating achievement gaps among our students.

Sierra College Core Values

The following core values will establish our ethical principles and will guide our institutional decision-making. Sierra College will:

1. Empower students in their education.
2. Strive toward student success and continuous improvement.
3. Be an inclusive and equitable community.
4. Be responsive to the education and workforce needs of our local community and businesses.
5. Demonstrate collaboration with all stakeholders in decision making.
6. Manage all resources in a manner that is sustainable and responsible.
7. Support and model excellence and innovation in teaching, learning, scholarship, and creativity.

The Engineering Program is current on completion and documentation of all PSLOs (Program Student Learning Outcomes) and CSLOs (Course Student Learning Outcomes) that directly align and are linked with the district mission statement and ISOs (Institutional Learning Outcomes). Both transfer and certificate students are represented in the aforementioned documents. In addition, all instructors complete training each year to improve our collective current practices in the classroom. This includes topics such as diversity, student equity, technology implementation, classroom management, new machine operation and maintenance, new software technologies, etc. All of the engineering CSLO and PSLO data can be found in the Microsoft Teams software.

1c) Please describe how your program supports ISLOs (Institutional Student Learning Outcomes): Communication, Technology and Information Competency, Critical and Creative Thinking, and Citizenship?

1d) Program offerings align with which of the following mission categories; check all that apply:

- Transfer Career Technical Education AA/AS/T/Certificates
 Basic Skills Personal Development/Enrichment. Lifelong Learning

Please analyze your department's performance in supporting the mission categories marked in 1c above. Provide evidence in support of this analysis, including data from the dashboard relevant to this evaluation. Relevant data includes the equity and diversity goals of the department and College.

If any of the following apply to your program, please address them in your analysis.

- Degrees, certificates, and/or licenses your department has generated:
 - The alignment of these awards with the district's mission and/or strategic goals. (See the district "Awards Data File, available from Research and Planning, for your numbers).
- Job placement or labor market information for your program's awards and licenses.
- The contribution your program makes to student transfer.
- Participation in basic skills programs.

Please address any developments related to Guided Pathways and Interest Areas that have impacted and/or will impact your program's support for these goals.

The Engineering Department seen an increase in degrees and certificates from 10 in the 2014/15 academic year to 18 in the 2017/18 academic year (Engineering Program DSR). All are Associates Degrees except for two, which are certificates. The engineering program has recently begun to heavily advise students and counselors to not pursue the certificate pathway because we have monitored the career availability for persons with only this award and the outlook is increasing grim (i.e. very few jobs available). Students with only an associate degree or certificate in engineering are simply not sought after in the work force; all employers require a four year degree to become a professional engineer and the engineering assistant job is generally held by student interns, those engineering students currently in college. Most students are aware of this and therefore do not apply for the associate degree or certificate, even after the instructors ask them to. The program expects to see a very large increase in awarded degrees once the 'auto-degree-award' software system takes effect. This is because once students have enough units to transfer to the university, they easily qualify for an associate degree in engineering and multiple other STEM fields. This is due to the nature of the engineering degree being a very high unit four year degree. To assist with job placement, specifically engineering internships, the engineering program holds student development workshops (resume building) and hosts the Engineering Club, where students can get hands-on experience with design build projects. From previous experience we know that these two activities have prepared students well for employment as engineering interns. The engineering internships completed each year are a measure of this success. The dashboard does not include a metric for internships or success and retention rate after transfer. It is suggested by this author that those metrics be incorporated.

1e) Optional Additional Data: Describe any other relevant contributions of your program to the district mission, goals, outcomes, and values not incorporated in the answers above. Examples include but are not limited to contributions to student equity and success, diversity, campus climate, cultural enrichment, community ties, partnerships and service. Please include specific data and examples when these are available and relevant to the analysis.

The Engineering Program hosts several internships each year for students who qualify. These students work in local industrial engineering businesses as part-time employees doing some light engineering work under the purview of a professional engineer. For example, in the 2018/19 academic year, four Sierra College students were working on internships within the field of engineering. Many of these internships are not done for internship credit with the college (for example ENGR95 registration) and so they are not recorded anywhere as a department metric. The reason for this is that it would cost the students additional money to register and additional meetings and documentation to complete the ENGR95 class. Commonly, students simply do not see the point of registering for ENGR95. For this reason, many student internships go completely un-documented and so not visible to the college and community as a marker for success. It would be good to rectify this such that internships that are not done through an ENGR95 course registration were somehow documented and measured.

Second, the engineering program facilitates the Sierra College Physics and Engineering Club (SCPEC). This has allowed students to participate in design and build activities and competitions under the supervision of full-time engineering faculty. Some notable examples of this are the SMUD Solar Regatta and U.C. Davis Rube Goldberg Machine competition. In both of these design and build competitions, Sierra College Engineering Students won first place. This included a sizable monetary reward, a trophy, and well received industry recognition. This was made public and visible to the community through the Sierra College Public Relations Department publications.

2) Currency: This category assesses the currency of program curricula and instruction as dictated by Title 5 and the currency of efforts in meeting accreditation standards as well as improving pedagogy and engaging in professional development.

2a) Curriculum: Describe any developments in your program's curricula since the last Program Review, including discussion of any projected changes. Please describe the process and criteria for curriculum development and review, including state and/or professional mandates, for developing, evaluating and revising curriculum, including the use of SLOs. Please note as part of this analysis if you have completed Curriculum Review.

All curriculum is one hundred percent current and documented. The curriculum is also currently mapped to all ISLOs, PSLOs, and CSLOs. Each also includes a justification. The engineering program is slowly adopting the C-ID system for engineering courses as they become available in northern California Universities. The Department Chair authored, gained committee approval, and has begun offering two new classes, namely ENGR110: Introduction to Engineering Design and ENGR220: Computer Programming and Problem Solving in Engineering. These are two new classes to Sierra College and the first to adopt the C-ID curriculum system. The department plans to continue to review and offer new classes, as well as migrate existing courses over to the newly generated C-ID system.

2b) Student Learning Outcomes Assessment: Analyze your program's assessment of course outcome, analysis of results, and improvements/changes made to the program as a result of this assessment. Please provide specific data and analysis in the space provided.

All SLOs are one hundred percent current (documented) and every engineering course has been assessed for a minimum of at least two CSLOs. For many courses four or more SLOs have been assessed. The SLO map has also been updated so that all assessments have been scheduled out to the 2025 academic year. Please refer to the Microsoft 365 Teams software for the documentation of all CSLOs, DAA, and assessment mapping.

2c) Professional development: Please describe how your department's individual and group activities and professional development efforts, including Flex activities, serve to improve teaching, learning and scholarship.

All engineering instructors participate in FLEX activities for each semester. This includes one full-time instructor and three part-time instructors. The Engineering Department Chair documents 80 hours of FLEX training per academic semester, which is 20 hours higher than the requirement of 60 hours. This is recorded in the ProDev web-based software application. In addition to this, several other activities are performed. This includes reading engineering

periodicals, books, webinars, and videos. As a note, the educational resources available to the instructors must be no-cost. On two separate occasions, instructors requested funding to attend training that was not provided by the college. Both requests were denied with the justification being lack of funding for such activities, even though the professional development department as a funding source. This is a hinderance, and if continued may lead to instructors not current in engineering practices. This should be fixed. The division and the Professional Development department should include funding for program specific training so that instructors can stay current on subject matter. In addition, the engineering program completes several design and build projects outside of the classroom. Many of these are in conjunction with the Engineering Club, for example the robotic arm display for the natural History Museum, but some are not, for example the CLAM BBQ smoker trailer and the Moto Mailbox.

2d) Optional Additional Information: Please describe and explain any additional information that supports your evaluation of your program's success.

The engineering program has contacted the research department and requested the success data of students who have migrated from Sierra College versus the native students at the third-year university level (junior level). To date, this has not been harvested and documented. Once complete, we plan to document that data here. We have anecdotal data that suggests Sierra College Engineering Students are more successful at the third-year university level than the native students (the students whom started at the university as freshman).

3) **Effectiveness: This section assesses the effectiveness of the program in light of traditional measurements.**

3a) Retention and Success: Assess and evaluate the three-year trends in your program's data contained in the DSR and analyze any relevant information found in the data dashboard related to retention and success. Please include the results of any relevant outcomes assessments, as appropriate. Address separately the data for on ground and online courses, as well as the data for the campus or centers at which you operate. Please describe any challenges experienced by your program. If you determine that you need to improve the program's performance, please describe how you plan to achieve this goal.

Please refer to the Engineering Program DSR for all metrics. It is a lengthy document and so I will not copy and paste it in below per Eric Cooper, but will include the data harvest as separate PDF file attachments. I will provide analysis and conclusion based on the data contained within that report so it would benefit one to have that available while reading this. From the DSR, it can be seen that our three-year average course success rate is 73.4% and our course retention rate is 87.7%. The success rate is right at the district average (74.5%) which the engineering program considers a huge success for the following reason. The study of engineering is extremely difficult. The classes typically require over twice the amount of work that the average college course requires due to the vast and technical nature of the subject matter. This is not unique to engineering at Sierra College; it is like this at every college and university across the nation. In fact, at The Ohio State University, Engineering is known as “pre-business” because so many students change their major from engineering to business within the first two years. The typical national attrition rate in the first two years of engineering is about 50% (Pattengale). The fact that the engineering program at Sierra can perform at a success rate of 73.4% is amazing and we believe a testament to our quality of instruction which provides for an excellent student experience. The course retention number of 87.7% is also considered very successful for the same reasons.

Next, we analyze the trends based upon the last three years of data (ENGR DSR p.1). The success rate includes a very positive slope. For the three year trend, it can be seen that the success rate of engineering students has increase about +9-10%. We believe that this is due to all the changes that have occurred within the engineering program over the past three years. These changes are long in both list and scope and so will not be elaborated upon here, but can be seen in multiple other reports written over the past three years; the most comprehensive being the engineering DAA which is written and reported each semester and located within the MS Teams software. The retention rate shows as flat for the past three years, remaining at 88%. It is difficult to postulate a reason for this, since so many factors go into it, but we will try. The average community college student has a difficult time committing to a program that costs time and money, and is such a long commitment period. Life happens. People go bankrupt, get sick, move away, loose their transportation, and more. For these reasons it is unreasonable to expect a 100% retention rate when considering the human condition. Comparatively, 88% looks great. This may be the maximum achievable retention rate based upon life circumstances. The good news is that the trend is not negative, and is just above the district average of 86%. So comparing the retention rate for the Engineering Program to all other Sierra College programs, it seems that we are doing just a bit better, +2% better to be precise. Even with this data, we do have a few plans that target increasing the retention rate. These too are best understood by referring to the Engineering Department DAA because the plans documented there are more comprehensive, but a short list is provided next. We plan to optimize the class schedule, improve course-to-course flow by making the intra-course content more homogeneous, have instructors complete training and implement best practices to increase the retention of historically disadvantaged students, improve the classroom environment to increase the sense of community that all students feel from the first day onward, and more. This abbreviated list will hopefully increase both success and retention for engineering students. Sadly, we need to plan these activities without an increase in funding, which will be a challenge.

- 3b) Enrollment Trends: Assess and evaluate the three-year enrollment trends in your program's DSR data. In addition, analyze any relevant information found in the data dashboard related to these trends. Include an analysis of fill rates, wait lists, course cancellations, program completion, and classroom use. Address separately the data for on ground and online courses, as well as the data for the campus or centers at which you operate. Please describe any challenges experienced by the program. If you determine that you need to improve the program's performance in any way, please describe how you plan to achieve this goal.

If one looks at the enrollments (p. 4 of DSR) it can be seen that the enrollment numbers are at about a +2% increase for the past three years for both entry level engineering courses (ENGR22A and ENGR37) and capstone level courses (ENGR45 and ENGR17). This may normally be cause for concern, but given that the college as a whole has seen a decrease in enrollments of about 1-2% within the same time frame, this makes our flat data appear as good news. It is believed by the author of this report that lower enrollments in Sierra College are due to the completion of expansion projects at the four-year university level. It seems that the universities are simply letting more students in as freshman (both UNR and Sac State just completed a large build-out expansion plan). The fact that the enrollments do not decline in higher level classes AND that the success rate is much higher for capstone classes shows that students are coming in prepared and completing (ENGR45 data). Here again, it can be seen that the success rate for the first engineering class, ENGR22A is pretty low. It is trending between 50% and 75%, with a very high standard deviation. What is noticeable about this is the difference in the Spring and Fall semester data sets. The success rate is higher for the Fall semester. There are likely several variables that contribute to this, such as course schedule differences and instructors. Spring semester includes a late day start, 4PM to be exact, and this course has had a very poor success rate traditionally. We are looking to change the scheduling, but we are having trouble with room availability as it must be taught in V-318 due to specialty software. We are hoping that Ad-Astra software will assist with this. Second, the Spring term course is only taught by adjunct faculty. There is no plan to change this, but the engineering department has been meeting more frequently in an attempt to provide a more homogeneous course experience between adjunct faculty and tenured faculty both in content and delivery.

- 3c) Equity: Analyze and evaluate your program's performance in promoting and/or achieving equity. Based on this analysis, describe any plans you have to sustain or improve the program's contribution to student equity as a central component of student success.

Student equity should identify and hopefully close all equity gaps amongst underserved and/or underrepresented student populations. This is the first attempt to review, analyze, and make conclusions on such data. This data extraction must be done by selecting several different data sets for underrepresented groups within the course success and retention data (Cooper). The first data extraction included success and retention for African Americans, American Indians, and Pacific Islanders all together. This generated no data sets as the numbers are too small to create a usable data set, which is less than four persons (Cooper). Next, the Hispanic/Latino group was compared to the data set as a whole. This shows an average drop in success of -7% and an average drop in retention of -10%, although the data drops do show a very high standard deviation. For example, the Fall 2016 and Fall 2017 data for retention show an increase of +7% and +8% respectively. This is due to the small number of the data set for Hispanic/Latino. The numbers are always less than 10 students. Next, it was found that a lower income level student included a drop in -2% for all semesters for both success and retention and had a very small standard deviation (which means this is really good, conclusive data). After analyzing the data from many extractions, it is clear that some student inequity does exist and this is precise, accurate data.

To help achieve an equitable student experience within the engineering program, the department has planned several things. First, it is planned to have ALL resources available to ALL students throughout the academic work day. This means having a copy of the current textbook available in multiple locations (engineering lab, drafting lab, library, borrow copy from the instructor, etc.). Also, it is planned to have all software resources available to all students throughout the academic day (internet, AutoCAD, Solidworks, MATLAB, MS excel and word, etc.). This resource will be promoted in all engineering classes on the first day and throughout the semester. Next, it will be suggested to all engineering faculty to add to first day of instruction information on all campus resources and programs for underrepresented groups (for example: RISE, Puente, Umoja, TRIO, EOPS, etc.) and include such information within the syllabus (contact information and meeting times). This could prove difficult, due to the large amount of information that must be harvested and documented. Lastly, we plan to monitor the equity data and seek insight and consultation from the campus support programs on how we can better serve these groups of students. We hope that after consultation, we can generate further ideas on actionable processes that can be utilized within the classroom.

3d) Optional information: Please describe and evaluate any additional relevant information supporting the evaluation of your program.

Not Applicable.

3e) Analysis and Planning: Referring to the analysis in 3a-d, your ongoing planning and assessment documents, and any relevant information from section 2 above, please describe your program's plans to maintain or increase its effectiveness and analyze and evaluate your efforts to achieve these goals.

For each of the areas, 3a-d, the action plan is contained within the writing of the particular section. For example, in section 3b it is written that the implementation of Ad-Astra software should help optimize the course scheduling and in Section 3c it is documented that the engineering program will provide additional resources of textbooks and software to all students to help improve success and retention.

Commenting on more actions that have been suggested by instructors, we hope to create a stronger sense of community in each class much earlier in the semester. This will be accomplished by several activities. First, it is planned to have an online and in-class discussion forum throughout the semester that is both academic and personal in nature. This will allow students to get to know each professor both personally and professionally. It is also planned to have a peer-to-peer discussion forum so that the students can get to know, help, and feel responsible to each other. This will foster a sense of community in the classroom and have the students feel responsible for each-other, leading to more It is also planned to have all faculty complete further equity training during the next two semesters. The information and best practices gathered from this training will then be implemented. Finally, the Engineering Department Chair plans to review the department success and retention data regularly and take actions to improve the data.

4) Resources: This category assesses the adequacy of current resources available to the program and describes and justifies the resources required to achieve planning goals by relating program needs to the assessments above.

4a) Please describe the future direction and goals of your program for the next three years in terms of sustaining or improving program effectiveness, relevance, and currency. Please include any relevant analysis of student success, equity goals, and the development of Interest Areas and Guided Pathways. Please incorporate analysis of any relevant outcome or other data in this description, including any data from the dashboard.

For the future direction of the engineering program, several goals have been set for the next three years to improve the program. Those goals, including the scheduled date of completion are listed in the table below. Each of these goals has been elaborated upon within the above sections and other program documentation (ePAR, WebCMS, MS Teams, etc).

No.	<u>Goal (description)</u>	<u>Date</u>
1	Complete the migration to C-ID curriculum for all ENGR classes	6/2022
2	Complete a MAP for counselors to assist students with engineering course navigation. Meet with counselors to help implement this.	6/2020
3	Have all instructors complete equity training and implement equity 'best-practices' into all engineering courses	1/2021
4	Use Ad-Astra software to optimize the engineering course offerings	6/2021
5	Purchase new tools / Equipment / software to maintain relevancy	1/2021
6	Repair and calibrate existing tools and machines	6/2020
7	Assist with the design and layout for the new science building	6/2021
8		
9		
10		

4b) Please describe and justify any projected requests for additional staff, new or augmented technology/equipment, and additional or remodeled facilities necessary to support these goals. Please incorporate any relevant data related to SLOs, student success, and equity.

Equipment/Technology:

The engineering program currently has several new equipment requests within the ePAR software system. In order to keep up with new and changing technology, the program must purchase machines, tools, and software. In addition to the purchase of new equipment, many of the tools in current use are out of calibration and others in need of service. To date, the budget to purchase the items documented within the ePAR (over several years) has not been approved. It is hoped that this report will assist.

Facilities:

The Engineering Lab is inadequate. It is far too small to facilitate all the required equipment, and, over the recent years, other disciplines have been instructing lecture classes in the lab room. These two factors have the effect of reducing the utility of the engineering lab for its intended use, providing an environment with tools and facilities for the engineering students to learn and work. The department working to reverse this trend, but it has been a challenge. It is hoped that the new Science Building will help tremendously with this.

Staff:

The Faculty and Instructional Assistant staffing in the current state is adequate for the program. The engineering program has been adding classes over the past two years, but the addition of new adjunct faculty has kept pace with the increase course offerings. The full-time to part-time ratio does not currently justify the need for an additional full-time faculty member.

4e) Please check the appropriate boxes in the chart below indicating the general reasons for the resource requests described above (please check all that apply):

Function/Role	Maintenance	Development	Growth	Safety	Outcomes	Other success measures	No Requests
	XX	XX	XX	XX	XX		

5) Summary/Closing

5a) Based on the analysis above, briefly summarize your program’s strengths, weaknesses, opportunities/future directions, and challenges.

Strengths:

- Transfer student’s preparedness and success rate at the third-year university level
- Stellar faculty that are motivated, skilled, hard-working, knowledgeable and willing to give instruction at a high level (matching or exceeding that of the University)
- Engineering Labs are comprised of industry standards/procedures and most utilize high-tech equipment

- Curriculum, including the migration to C-ID for engineering and two new course offerings (ENGR220 and ENGR110)
- The Sierra College Physics and Engineering Club is very active
- Engineering has a strong relationship with industry, leading to a healthy internship program

Weaknesses:

- Engineering facilities are inadequate
- Some tools and equipment are old and need to be purchased / updated / serviced / calibrated
- Lack of opportunity for faculty to receive training and/or stay updated within the engineering field and industry
- The 'Engineering Certificate of Achievement' both Civil and General are not pursued

Challenges:

- THE WORKLOAD that is not related to instruction but must be completed to satisfy the academic bureaucracy. This includes the ISLO, PSLO, CSLO, ePAR, specifically the justifications and linking, Program Review, curriculum, faculty reviews, committees (hiring, non-tenure eval, etc..). It is the opinion of this author that the workload for ALL department chairs has become far too great and must be reduced. Over the past ten years, this author has seen the amount of reporting that must be completed increase steadily to the point now where it is unreasonable. This MUST be rectified and should be of the highest priority for management.
- Optimizing facilities (specifically the engineering lab) both usage and equipment
- The on-going Engineering Department Budget is currently inadequate
- Maintaining instructor's motivation with such vast documentation requirements with little to no compensation for such work

Opportunities:

- Integrating engineering into the new Science Building
- Collaborating with other departments, including Physics, Mechatronics, Welding, and Advanced Manufacturing
- Revisions to current labs and the introduction of new labs (for: ENGR45 & ENGR17L)
- The introduction of new software (Solidworks and MATLAB)
- Course offerings and scheduling (one new course and revising the current class schedule)
- The continued migration to C-ID for Engineering

5b) How has this report integrated the views and perspectives of stakeholders in the program?

The analysis and findings of this report have been verbally communicated with the Dean of Math and Science, Randy Lehr. The Associate Dean, whom had been overseeing the engineering program, has been out on medical leave so that person may not be informed of this report and its conclusions. This report was also made available for the Dean and Associate Dean to read if they wanted to do so. This was completed through email in January, 2020. Finally, this report will be a major topic of discussion at the Spring 2020 Engineering Department Meeting (1/22/2020, in S-105). It is planned that all stakeholders will attend this meeting and discuss this report. This includes all full-time faculty, all part-time faculty, and the instructional assistant.