Instructional Program Review 2018/19 (Comprehensive)

Geology

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General Information (Instructional Program Review 2018/19 (Comprehensive))

2018/19 Instructional Program Review

Program Review Data and Resources

Submission Information (REQUIRED)

- Name of Lead Writer: Don Barrie
- Name of Liaison: Valerie Abe
- Department Chair: Don Barrie
- Name of Manager/Service Area Supervisor: Susan Topham
- Is this a CTE program? (State **Yes** or **No**): No

Faculty/staff (REQUIRED)

- Number of T/TT Faculty: 1
- Number of Adjunct Faculty: 5
- Number of sections taught by T/TT Faculty: 1
- Percent of FTEF taught by T/TT Faculty: 22%
- Number of Pro-Rata Faculty: 0

Program Mission (REQUIRED)

The primary mission of the geology program is to prepare both majors and non-majors for transfer to higher-level institutions, enabling them to achieve their academic goals. Program course offerings lead students to a basic understanding of important geoscientific concepts and principles that will help them make informed decisions as responsible citizens and prepare them for more advanced study.

The program mission supports the broader mission of San Diego Mesa College through its committment to access, success, and equity. By offering courses throughout the day and evening, in both on-campus and online modalities, geology program courses remain accessible to Mesa's diverse student body. Program success rates have increased over the last five years and currently stand at 81% for the 2017/2018 academic year. These latest results are well above Mesa's Institutional Effectiveness Partnership Initiative (IEPI) goal of 74%. Overall, these data indicate that geology students are succeeding in program courses. Program success rates for Asian students are consistently high over the past five years. Success rates for other groups (including African Americans, Philipino, LatinX, and White students) are generally lower but have increased. These data suggest that that the institutional priority placed on student equity--helping all groups succeed--is contributing to positive outcomes at the program level.

Program Overview (REQUIRED)

Form: 2018/19 Comprehensive Program Review Instructional Program Overview Section (See appendix)

Curriculum (REQUIRED)

Form: 2018/19 Comprehensive Program Review Instructional Curriculum Section (See appendix)

Form: "2018/19 Comprehensive Program Review Instructional Program Overview Section"

Created with : Taskstream
Participating Area: Geology

(REQUIRED) Program name

Geology

(REQUIRED) Program strengths

Discuss strengths of the program.

Program strengths include: (1) high program success rates and improving program GPAs, (2) opportunities for learning and enrichment beyond the classroom, (3) excellent adjunct faculty, (4) recent equipment acquisitions, and (5) a strong relationship with local university partners. Each of these strengths is detailed below.

High program success rates & improving program GPAs

For the past five years, overall program success rates (all genders, ages, ethnicities, courses) show a strong upward trend, from a low of 68% during the 2013/14 academic year to a high of 81% for the 2017/2018 academic year. The overall 5-year success rate is 73%, just below the College's IEPI goal of 74%. In addition, program GPAs (for all courses, combined) likewise show a strong upward trend, from a low of 2.45 for the 2013/14 academic year to a high of 2.83 for the 2017/2018 academic year. These results suggest that our institution's commitment to helping all students succeed is paying off at the program level.

Opportunities for learning and enrichment beyond the classroom

The geology program continues to engage students beyond the classroom. Geology remains a field-based science, and to this end, it's critical to enhance student learning by inviting students into the field to observe geologic features and processes firsthand. Currently, the program employs one full-time, tenured faculty and five adjunct faculty. All six faculty regularly provide field trip opportunities for their students. Each semester, our faculty co-lead an overnight field trip to someplace of geologic interest. This semester, our group took 30 students to the Anza-Borrego Desert to study world-class examples of geologic features including faults, folds, debris flow and alluvial fan deposits, igneous, sedimentary, and metamorphic rock, and mountain-building processes. Not only do students have the opportunity to see these various features in three dimensions on trips like this, they're also exposed to the natural world in an "up-close and personal" way. This has important, lasting effects. For example, many students return to field trip locations with their friends and family and pass along the knowledge they've gained. In addition, field trip experiences are what typically lead some students to major in geoscience. As a student commented many years ago after one of our overnight trips, "Geology is more of a lifestyle than just a science." In essence, geology becomes real for field trip participants, enriching the educational experience immensely. Our commitment as geology faculty is to continue to offer our students high-quality field experiences similar to what they'd have access to in a university geology program.

Mesa's STEM Lecture Series is another way our program offers enrichment opportunities beyond the classroom. Geoscience-related events over the past year have included public talks on climate science, mass extinctions, geologic history, the San Andreas Fault, paleogeographic mapping, soil science, ocean science, and planetary science. These events offer students the opportunity to learn first-hand about all the exciting research opportunities in geoscience as well as about the many career paths that are available to geoscientists. In this regard, the STEM Lecture Series benefits geology students across the entire District.

Student research is a growth area for our program. For the past three semesters, our program has been involved in a research partnership with a branch office of the U.S. Forest Service (USFS). During the fall 2017 and spring 2018 semesters, four students worked closely with a USFS soil scientist to investigate soil recovery patterns atop Mt. Palomar, in an area recently subjected to controlled burning, as part of an ongoing forest fuels management effort. In addition, the students worked with geology faculty and also with Dr. Anar Brahmbhatt in the biology department to characterize the physical, chemical, and microbial characteristics of the samples they collected, and presented their research at Mesa's 2018 Spring Research Conference. Another student worked with Mesa geology faculty and a local consulting geologist to investigate natural and human-related coastal processes along the Point Loma

coastline. This student also presented his research at Mesa's research conference, and went on to participate in an international scientific poster competition sponsored by the American Geophysical Union (AGU).

Excellent Adjunct Faculty

Although our adjunct to full-time/tenure-track faculty ratio is low (20%), our program maintains high standards thanks to the tireless efforts of all program faculty, full-time and adjunct faculty alike. As discussed above, all five adjunct faculty regularly lead field trips for their students. In addition, our adjunct faculty are very involved in the physical sciences department, volunteering regularly at department-sponsored events like star parties, eclipses, and Math/Science open house gatherings. Adjunct faculty regularly attend STEM Lecture Series events and have been STEM Lecture Series speakers themselves. The willingness of adjunct faculty to become so involved at the program and department levels contributes to the high academic standards our program aspires to.

Recent Equipment Acquisitions

Over the past three years, the geology program has acquired important equipment that has contributed to overall program improvement. Key equipment acquisitions include a seismograph, polarizing microscope, microscope camera, sand collection, student fossil sets, digital balances, periodic table charts, rock/mineral sets, and field compasses. This equipment has greatly expanded possibilities for high-impact lecture, lab, and research opportunities and also facilitated additional curriculum development. For example, the seismograph allows program faculty to illustrate key aspects of earthquake seismology in near real-time. Rather than just discussing a recent large earthquake somewhere in the world, faculty can show their students the local seismic record of the earthquake generated from our seismograph. This helps reinforce key learning objectives. In addition, we're accumulating an extensive record of digital seismic recordings that can be used as the basis for future student research projects. In another example, thanks to a generous donor, our program recently received an extensive sand collection from beaches all over the world. We've already made use of this collection to develop learning activities in several geology courses, including GEOL 111 (The Earth Through Time), GEOL 101 (Physical Geology Lab), and GEOL 120 (Earth Science Lab). Using this collection, students can investigate first-hand how the geologic setting of a region (i.e., the spatial distribution of rock types) influences the mineralogy of sand grains that end up on the beach. This is so much more interesting and rewarding that simply looking at photographs of sand grains online or in a book!

Strong Relationships with Local University Partners

For the past several years, program faculty have made more of an effort to reach out to their counterparts at two local universities, including SDSU and UCSD. We now have a strong relationship with SDSU in particular. SDSU faculty regularly come to Mesa College to give STEM Lecture Series lectures, and geology majors at Mesa regularly transfer to SDSU. Dr. David Kimbrough, the former chair of the SDSU Geological Sciences Department, has on more than one occasion remarked that SDSU regularly receives more geology majors from Mesa College than other community colleges throughout California. Mesa geology students also occasionally take geology courses at SDSU through the Mesa-SDSU duel enrollment program. Moreover, program faculty regularly collaborate with SDSU faculty in regard to articulation agreements, to ensure that our courses transfer.

Historically, far fewer Mesa geology students transfer to UCSD, but we're working to change this. Recently, program faculty collaborated with UCSD faculty on a grant proposal designed to attract more community college students to UCSD to major in geoscience. If funded, this grant will offer Mesa geology students opportunities for paid summer internships with UCSD geoscientists. Moreover, UCSD geoscience faculty have agreed to be part of Mesa's Spring 2019 STEM Lecture Series in an effort to expand the partnership between the Mesa and UCSD geoscience disciplines.

(REQUIRED) Program challenges

Discuss challenges to the program.

Program challenges include: (1) quantitative thinking skills among some students in some courses, (2) the need to recruit and mentor more geoscience students, and (3) the need to improve tutoring services for geology students.

Quantitative Thinking Skills

The ability of students to use mathematical tools to solve quantitative problems is formally assessed through the problem solving course learning outcome (CLO) in all geology courses. This CLO was last assessed in fall 2016 and spring 2017; it is also being assessed this semester (fall 2018); however, assessment results for the current semester are not yet available. The fall 2016 and spring 2017 assessment results for the problem solving CLO indicate that less than the 75% target percentage of Geology 100 students successfully solved the assigned problem for both semesters. The problem, given below, requires only a basic knowledge of proportional reasoning and unit conversion typical of middle school math:

Global Positioning System (GPS) data indicate that the Pacific Plate is moving northwestward with respect to the North American plate at approximately. 5 centimeters per year. Given this rate of relative motion, how many kilometers northwestward will San Diego (on the Pacific plate) move in 100,000 years? Note: 1 meter = 100 centimeters, 1 kilometer = 1,000 meters.

These results highlight the need to provide more opportunities for Geology 100 students to engage in quantitative thinking.

Geoscience student recruitment and mentoring

Our geology courses mostly appeal to non-STEM majors. According to recent research (Barrie 2016), non-STEM students account for 86% of all students in our GEOL 100 (physical geology) course. However, career opportunities for geoscientists abound. According to the Bureau of Labor Statistics, geoscience jobs are expected to grow by 14% (faster than average) over the next 8 years, with excellent salary prospects. The 2017 median annual income for geoscientists was $89,850 per year. Moreover, geoscientists express high levels of career satisfaction relative to many other careers. Given these opportunities, our program needs to recruit and mentor more geoscience majors. Although no students have yet earned Mesa's Associate Degree for Transfer (ADT) in geology, this is not because our students aren't transferring to higher institutions to major in geoscience. As discussed above, SDSU geology faculty regularly tell us that Mesa sends them more geology majors than most other schools. Although this is a positive trend, our program can do more to attract and recruit potential geoscience majors.

Tutoring services for geology students

Although Mesa's tutoring services have grown, tutoring in geology remains inconsistent, for several reasons. One difficulty is that prospective tutors--very often, those planning to major in geoscience at a university--are so busy taking challenging courses (e.g., calculus-

based physics, majors chemistry, etc.) that they have little time to devote to tutoring. Another difficulty is that geology tutors don't tend to stay at Mesa very long, because they move on to university within a year or so. One way to address this particular difficulty is for our program to do a better job at recruiting geology tutors on a regular basis, particularly among STEM students who can tutor other subjects in addition to geology.

(REQUIRED) External influences

Discuss external influences (Collegewide and beyond).

External influences include a strong economy, promising employment trends for teachers, and an increase in online course offerings at Miramar College. With regard to the economy, it's long been recognized that among many programs (ours included) a strong economy correlates with declining enrollment. During the spring 2018 semester, enrollment as of census was 347 students. In addition, our program was showing signs of growth, up from 308 students in the spring 2017 semester. However, this semester (fall 2018), enrollment unexpectedly declined to 286 students (down from 347 the previous semester), a 19% difference. A portion of this decline was the result of offering GEOL 111 (The Earth Through Time), a lecture-lab combo. course with a cap of 24 students (vs. 48 students for other lecture courses). However, the fall 2018 enrollment decline is still significant even accounting for this.

Although it's difficult to know what drove the fall 2018 enrollment decline in our program, two possibilities include a strong economy and an increase in online geology course offerings at Miramar College. In a strong economy, more people tend to seek gainful employment rather than pursue and education. In addition, Miramar College has been expanding its geology offerings lately, particularly its online offerings. Although online geology courses can be taught effectively, among students there may still be a perception that they're easier than on-campus courses, the result being that with more online course offerings available, more students can be served. Our program typically offers one or two online geology sections each semester; however, program faculty feel that because geology is, at heart, a field-based science, it's important to offer our students on-campus geology courses with lots of field trips. As discussed elsewhere in this program review, success rates are typically much lower for online sections than for on-campus sections of the same course. Therefore, offering more online sections doesn't necessarily better serve students.

A more promising external influence affecting our program is that the teaching profession is showing signs of growth again. Discussions with teacher education faculty at Mesa College and SDSU indicate that more students are seeking to become teachers. This is a promising trend for our program because we offer two courses specifically geared toward elementary, middle-school, and high school teachers, including GEOL 104 (Earth Science) and GEOL 120 (Earth Science Lab).

(REQUIRED) Areas of Focus

Describe one or more areas that your department is focusing on. You will refer to this response in the Program Analysis Section.

A main area of focus for our program concerns the recruitment and mentoring of geoscience students. As discussed above, our program primarily serves non-STEM students by offering

geology courses that satisfy general education requirements; however, given the excellent career prospects of geoscientists, we need to make more students aware of this option. In this regard, field trips continue to be an important recruitment tool. Many geoscientists (including this writer) first became enamored with geology after going on extended field trips with professors and classmates. Out in the field, a sense of community develops that many students are drawn to. Also, geoscience, more so than many other STEM disciplines, remains a field-based science in many respects. Learning geoscience involves work both inside and outside of the classroom. As countless students have told this writer over many years, it's one thing to see a photograph or a diagram of a geologic feature; however, the feature doesn't become truly real until it's observed in the field, rather like an ornithology student who sees a bird in its natural habitat after having learned about it in class. To summarize, most students don't become geosciene majors only by taking a class. Rather, they go on a field trip, which motivates them to take more classes, with more field trips, with each learning modality reinforcing the other.

Although our program already offers numerous field trip opportunities for our students, we need to recruit more majors. One way to do this might be to offer informational lunches (with free pizza!) about careers in geoscience. Additionally, our program will begin offering a new course within a year or so: GEOL 130 (Field Geology of San Diego County). This course will articulate with lower division field geology at SDSU--a majors course--and as such, will enable geology students to complete more of their program while at Mesa, at significantly less cost, before transferring to SDSU. In addition, this course will hopefully serve as a recruitment tool for prospective geology majors. It will be a way to get more students out into the field early in their academic career, while they still have time to switch majors.

The Following Questions are for CTE Programs ONLY.

Enter "not applicable" if your program is not CTE.

(REQUIRED) Describe how the program's industry partners (including advisory committee) assist with program improvement including curriculum advice, obtaining equipment, providing internships and finding or providing other funding (limit 500 characters) (P.N. 1.b.). Please upload Advisory Committee minutes from the last year here.

Enter "not applicable" if your program is not CTE.

No answer specified

(REQUIRED) Describe how your program connects to High Schools, Universities and Continuing Education, creating career pathways in your field. Include articulation, specific projects, collaboration with teachers/professors, etc. (limit 500 characters) (P.N. 3)

Enter "not applicable" if your program is not CTE.

No answer specified

Form: "2018/19 Comprehensive Program Review Instructional Curriculum Section"

Created with : Taskstream
Participating Area: Geology

(REQUIRED) Program Name

Geology

(REQUIRED) What degrees and certificates are offered?

Associate Degree for Transfer (ADT).

(REQUIRED) How many of each degree and certificate have been earned in the past 4 years?

0

(REQUIRED) If you have no (or very few) degrees/certificates, what other paths do you offer? (for example, GE, transfer)

As discussed elsewhere, our program overwhelmingly serves general education students. It's also important to point out that a number of our students each year transfer to universities to major in geoscience; they simply do so without earning a Geology ADT. SDSU geology faculty report that they often receive more Mesa College students into their department as geology majors than most other schools in California. This is important because it highlights the need for caution when using number of degrees awarded as a proxy for program success.

In addition to the Geology ADT, we've recently launched a liberal arts and sciences degree entitled: Science Studies-Earth Sciences. This degree has been approved by CIC, and is awaiting CRC and State approval. It is expected that this degree will become active within approximately one year.

(REQUIRED) Have you developed any new courses in the past 4 years? Please give details.

Geology 130: Field Geology of San Diego County. This is an introductory field geology course, which will articulate with a lower division majors course at SDSU. In addition, it meets transfer requirements for both CSU and UC. This course has been approved by CRC and is awaiting state approval. We plan to offer this course in fall 2019.

Geology 111: The Earth Through Time. This course articulates with a similar lower division majors course at SDSU. In addition, it meets transfer requirements for both CSU and UC. This course is designed to serve both majors and non-majors seeking to satisfy a physical science requirement.

Geology 120: Earth Science Laboratory. This course is designed to complement our Geology 104 (Earth Science lecture) course. In addition, it meets transfer requirements for both CSU and UC. It's also included in Mesa's Teacher Education ADT.

(REQUIRED) Have you made other curricular changes? (for example, renumbering, sequence change, co-reqs or pre-reqs)

We're in the process of removing basic skills math advisories for all geology courses, per AB 705.

The Following Questions are for CTE Programs ONLY.

Enter "not applicable" if your program is not CTE.

_____

(REQUIRED) List any licensure and/or accreditation associated with your program.

Enter "not applicable" if your program is not CTE.

No answer specified

(REQUIRED) Indicate the program TOP codes for your AA, AS, COA and COPs.

Please find TOP Code Link in the Directions.

Enter "not applicable" if your program is not CTE.

No answer specified

(REQUIRED) Indicate the SOC codes and title associated with your program's AA, AS, COA and COPs.

Please find SOC Code Link in the Directions.

Enter "not applicable" if your program is not CTE

No answer specified

(REQUIRED) Select the sector associated with your program.

Link to sectors list: In process of being developed

- *No answer specified*

Form: "2018/19 Comprehensive Program Review Instructional Outcomes and Assessment Section"

Created with : Taskstream
Participating Area: Geology

(REQUIRED) Program name

Geology

(REQUIRED) We are halfway through our 6-year cycle. Is your department/program on target to complete CLO assessment by Spring 2022? Please attach your schedule for CLO assessment, with explanations as needed.

Refer back to Direction #3 on how to attach documents.

CLO/PLO assessment schedule attached. Our program is on target to complete CLO assessment by spring 2022.

(REQUIRED) Please list your PLOs.

PLO #1 (Transfer): Program courses foster scholarship and facilitate the successful transfer of students from Mesa College to other educational institutions.

PLO #2 (Scientific Literacy): Program courses develop students' understanding of the scientific process and thereby enhance scientific literacy.

PLO #3 (Scholarship and Lifelong Learning): Program courses develop students as scholars and encourage lifelong learning by exposing the students to new concepts and by allowing them to apply those concepts to gain a deeper understanding of the physical world.

(REQUIRED) What progress have you made in your PLO assessment? Please attach your schedule, with explanations as needed.

Refer back to Direction #3 on how to attach documents.

PLO #1 (transfer) has been assessed.

PLO #2 (Scientific Literacy) will be assessed during the spring 2019 semester.

PLO #3 (Scholarship and Lifelong Learning) will be assessed during the spring 2020 semester.

(REQUIRED) What have your completed assessments revealed about your courses or program?

Our completed assessments reveal that our program is healthy, overall, in terms of serving our students. Specifically, the assessment results indicate that our students are able to think critically and can communicate scientific principles and their implications. As discussed below, some of our students struggle with quantitative thinking, however.

(REQUIRED) If issues or problems were identified, what is your plan for implementing change?

Assessment targets have not been met in some courses for CLO #1 (Problem Solving). Although not surprising, these results highlight the need to emphasize quantitative thinking in addition to qualitative/conceptual thinking. Toward this end, program faculty plan to discuss ways to incorporate simple quantitative exercises into program courses in which targets have not been met for CLO #1 (Problem Solving).

(REQUIRED) Based on your assessments, have you identified resource needs?

- Equipment

Please provide any other comments.

Although our CLO assessment results have highlighted the need to place more emphasis on quantitative thinking in some of our courses, we may, in the future, modify our Problem Solving CLO, because it's unclear whether students who cannot solve the assessment problem are struggling with the implicit conceptual knowledge assumed in the problem, or with the mathematical aspects of the problem, which involve proportional reasoning and unit conversions. Based on initial conversations, we suspect that our students struggle with the math more than the concepts. If additional investigation bears this out, we may incorporate some math review into our courses, to help develop the mathematical tools our students need to be more successful problem solvers. In terms of equipment needed to help with this, our program has already received equipment that will be useful in our efforts, including digital balances, a seismograph, and periodic table charts.

Form: "2018/19 Comprehensive Program Review Instructional Program Analysis Section"

Created with : Taskstream
Participating Area: Geology

(REQUIRED) Program name

Geology

(REQUIRED) Using the data dashboards, discuss how students are doing in your program. Please refer to indicators of success, retention, persistence, etc.

As discussed below, program census enrollment increased from fall 2017 to spring 2018, but decreased substantially this semester (fall 2018). Program enrollment nonetheless shows an overall increase for the current academic year in comparison with last year.

Several measures of program success show positive trends with regard to:

- fill rate
- gender balance
- program GPA
- program success rates and success rate trends
- curricular offerings and updates
- opportunities for enrichment outside the classroom

Program courses continue to exhibit high fill rates. For the current, fall 2018 semester, the program fill rate (total census enrollment/total capacity) was 88%, and has been at 85% or above for the past seven semesters. These data indicate that we're offering an optimal number of program sections given current student demand.

Regarding gender balance, females account for 50% or more of all students for each of the past seven semesters (including summers). This is particularly gratifying because geoscience has historically been a male-dominated field. In terms of program success rate, females and males show equivalent performance, with both groups exhibiting a long-term program success rate of 73%.

Program GPA shows long-term improvement over the past past five years, based on a linear regression of online data from the course outcomes dashboard. Program GPA ranged from 2.45 for the 2013/14 academic year to 2.8 for the current 2017/18 year.

Program success rate shows consistent improvement over the past five years, based on a linear regression of the online data from the course outcomes dashboard. During the 2013/14 academic year, the program success rate was 68%; this year (2017/18) it was 81%. Overall, the 5-year long-term program success rate currently stands at 73%--very close to the College's Institutional Effectiveness Partnership Initiative (IEPI) goal of 74%.

Program success rates for various groups generally show long-term increases over the past five years, based on linear regressions of the the online data from the course outcomes dashboard. A summary of these data for various ethnicities follows:

- Asian: long-term success rate, 85%; no long-term trend in success rates
- Black/African American: long-term success rate, 61%; long-term trend of increasing success rates
- Filipino: long-term success rate, 72%; long-term trend of increasing success rates
- LatinX: long-term success rate, 68%; long-term trend of increasing success rates

- Native American: insufficient data
- Pacific Islander: insufficient data
- White: long-term success rate, 78%; long-term trend of increasing success rates
- Unreported: long-term success rate, 87%; long-term trend of increasing success rates
- Other: long-term success rate, 70%; long-term trend of increasing success rates

Program success rates for first-generation students show a long-term trend of improving success rates, based on a linear regression of the online data from the course outcomes dashboard. For example, the program success rate for first-generation students in the 2013/14 academic year was 68%. Currently, it stands at 81% for the current 2017/2018 academic year. The overall long-term success rate for first-generation students is 72%.

Program success rates for non-first-generation students likewise show a long-term trend of improving success rates. Interestingly, the current program success rate for this group currently stands at 80%--slightly lower than for first-generation students. These data confirm that both first- and non-first-generation students are being served in our program.

Collectively, the above-referenced data paint a picture of a strong program that serves all students. Although success rates are higher in some groups than others, all groups show either consistently high success rates (e.g., Whites, Asians, Unreported) or improving success rate trends (all groups except Asians).

There continues to be a disparity in success rates between students in on-campus and online courses. For on-campus courses, the long-term success rate for all courses is 78%, whereas for the Geology 100 (physical geology) online course, it is substantially lower at 61%. Comparing success rate data for the on-campus and online Geology 100 course (our only online course), the data likewise reveal a disparity. For the on-campus Geology 100 course, the long-term success rate is 73%, whereas for the online/partially online Geology 100 course, it is 61%.

The above data reveal a trend of great significance: students continue to achieve significantly lower success rates in online courses vs on-campus courses, even when online courses are taught by our most experienced instructors. Although online courses serve an important function in terms of providing access for all students (particularly non-traditional students such as stay-at-home parents), they don't serve students better with regard to course success. Although the geology program will continue to offer some sections in an online modality, program faculty aren't comfortable offering more online sections, because student success data don't justify it. Between the two competing priorities of student access and student success, the greater part of this balance lies with student success in our view.

Success rates as a function of course designator (i.e., Honors vs. non-Honors) show an interesting and unexpected trend. In the past, our program has offered Honors courses in Geology 100 (physical geology) and Geology 104 (earth science). Success rate data for these honors courses indicate that students achieve a lower rates of success in Honors courses than in non-Honors courses. For Geology 100 (non-Honors), the long-term success rate is 73%, whereas for Honors Geology 100 sections, it is 68%. Likewise, for Geology 104 (non-Honors), the long-term success rate is 77%, whereas for Honors Geology 104, it is 70%. A possible explanation for these data is that most students don't take Honors geology specifically because it's an Honors course. Instead, it may be that most students take our Honors courses because such courses fit their schedule. In other words, many students in our Honors courses may not be interested in taking such courses, specifically.

In contrast, student success data are more promising for Honors contracts (i.e., honors projects undertaken in a non-honors course). Previous data presented in last year's program review indicate that for the small number of students who undertake honors projects, success rates are quite high (i.e., 100%). These data suggest that Honors contracts among individual students are more conductive to student success than Honors courses. It's difficult to know whether these trends reflect correlation or causality. Are students who undertake Honors contracts more likely to be successful, or are successful students more likely to undertake Honors contracts? In addition, only small numbers of

students typically sign up for Honors contracts, so small sample sizes render any conclusions tentative. In any case, the data seem to demonstrate that students who undertake Honors contracts tend to be more successful than those who don't. Therefore, the data justify encouraging students to pursue Honors contracts. This makes intuitive sense for two reasons. First, Honors contracts provide formal opportunities for student research outside of the classroom, which has been shown to correlate with improved student success (e.g., Lopatto 2010). Second, Honors contracts typically account for a significant percentage of a student's course grade. For students who do well on their Honors contracts, their course grade improves as a result.

In addition to the above measures of program success, the geology program continues to expand its curricular offerings, with a new field geology course (Geology 130, Geology of San Diego County) in the process of receiving state approval, and two recently developed courses (Geology 111, The Earth Through Time; and Geology 120, Earth Science Lab) offered for the second time this semester (fall 2018).

As detailed elsewhere in this program review, students are increasingly offered opportunities for learning and enrichment outside of the classroom, through frequent field trips, geology-related STEM Lecture Series events, student research, and geology tutoring services. This semester, for example (fall 2018), three STEM Lecture Series events focused specifically on geoscientific themes, including geologic history, climate change, and soils. In addition, geology students recently went on an overnight trip to the Anza-Borrego Desert State Park.

All program course curricula are up to date in Curricunet except Geology 100 (physical geology), which is in the process of a six-year review and update.

(REQUIRED) How does your program help to prepare students for success beyond your classrooms?

The geology program prepares students for success beyond the classroom through good pedagogy, a wide range of enrichment activities, and mentoring of potential geoscience majors. With regard to good pedagogy, five of six program faculty (1 full-time/tenured faculty plus 5 adjuncts) are experienced educators, with many years teaching experience. In our view as program faculty, success beyond the classroom begins with good pedagogy. Strong long-term program success rates (73% overall and 81% for the fall 2018 semester) together with a multi year trend of increasing success rates for almost all student groups indicate that our students are succeeding in our courses. This enables them to meet their educational goals beyond the geology classroom.

As discussed elsewhere in this program review document, the geology program continues to engage students beyond the classroom. Geology remains first and foremost a field-based science, and to this end, it's critical to enhance student learning by inviting students into the field to observe geologic features and processes firsthand. Currently, the program employs one fulltime tenured faculty and five adjunct faculty. All six faculty regularly provide field trip opportunities for their students. Each semester, all six faculty co-lead an overnight field trip to someplace of geologic interest. This semester, our group took 30 students to the Anza-Borrego Desert to study world-class examples of geologic features including faults, folds, debris flow and alluvial fan deposits, igneous, sedimentary, and metamorphic rock, and mountain-building processes. Not only do students have the opportunity to see these various features in three dimensions on trips like this, they're also exposed to the natural world in an "up-close and personal" way. This has important, lasting effects. For example, many students return to field trip locations with their friends and family and pass along the knowledge they've gained. In addition, field trip experiences are what typically lead some students to major in geoscience. As a student commented many years ago after one of our overnight trips, "Geology is more of a lifestyle than just a science." In essence, geology becomes real for field trip participants, enriching the educational experience immensely. Our commitment as geology faculty is to continue to offer our students high-quality field experiences along the lines of what they'd have access to in a university geology program.

Mesa's STEM Lecture Series is another way our program offers enrichment opportunities beyond the classroom. Geoscience-related events over the past year have included public talks on climate science, mass extinctions, geologic history, the San Andreas Fault, paleogeographic mapping, soil science, ocean science, and planetary science. These events offer students the opportunity to learn first-hand about all the exciting research

opportunities in geoscience as well as about the many career paths are available to geoscientists. In this regard, the STEM Lecture Series benefits geology students across the entire District.

Mentoring of research students is a growth area for our program. For the past three semesters, our program has been involved in a research partnership with the U.S. Forest Service. During the fall 2017 and spring 2018 semesters, four students worked closely with a Forest Service soil scientist to investigate soil recovery patterns atop Mt. Palomar, in an area recently subjected to controlled burning, as part of an ongoing forest fuels management effort. In addition, the students worked with Dr. Anar Brahmbhatt in the biology department to characterize the microbial ecology of the samples they collected, and presented their research at Mesa's 2018 Spring Research Conference. Another student worked with Mesa geology faculty and City of San Diego personnel to investigate both natural and human-related coastal hazards along the Point Loma coastline. This student also presented his research at Mesa's research conference, and went on to participate in an international scientific poster competition sponsored by the American Geophysical Union (AGU). Research-related activities like these prepare students for success beyond the classroom by enabling them to build an academic resume early on, allowing them to establish a track record of persistence and success that carries over to more advanced study. In addition, early research experiences invariably lead to increased faculty-student contact beyond the classroom, which correlates strongly with future academic and career success (Lopatto 2010).

(REQUIRED) Given your stated area(s) of focus in your program overview section, has your program introduced new or different actions that may have affected changes in these indicators? Please describe.

Moving forward, an important area of focus for our program involves the recruitment and mentoring of geoscience students. As discussed in the program overview section, geology faculty have lately made more of an effort to develop research opportunities for our students. In addition to working directly with outside entities (e.g., the U.S. Forest Service) on collaborative research, program faculty have made new connections with our university partners, including UCSD. This semester, program faculty collaborated with UCSD geoscience faculty on a grant to improve outcomes for community college students. If awarded to UCSD, this grant will open up paid internship and research opportunities for our students. Program faculty are also involved in facilitating student research on their own. For example, one of our faculty (Dr. Sasha Carter) has been working with students to use cellphone-based technology to measure elastic wave propagation characteristics of local structures, including bridges and parking structures, as a way to illustrate the behavior of seismic waves through the Earth following an earthquake.

(REQUIRED) Has your program introduced any new actions specifically focused on issues of equity? Please describe.

Program faculty have been involved in various endeavors supportive of student equity, including student research, participation in the course redesign institute, and the promotion of STEM Lecture Series events. Unlike many student research programs, student research in our program is open to all students. Rather than hand-picking only the strongest students for participation in research projects, our goal is to involve as diverse a pool of students in research as possible. This is because research as demonstrated that historically under represented students benefit from early research experiences (Castillo and Estudillo, 2015). Such experiences present opportunities for increased involvement in college activities as well as the development of personal and professional skills. Under Represented students also benefit from increased opportunity for career exploration and experiential learning.

At least two program faculty have also recently participated in Mesa's course redesign institute (CRI). CRI outcomes for the classroom include improved student learning,

increased course completion rates, improved retention, and decreased equity gaps in student outcomes (http://www.sdmesa.edu/about-mesa/professional-learning/CRI.shtml).

Finally, faculty promotion of STEM Lecture Series events has positive outcomes with regard to student equity, because all students benefit from learning opportunities outside of the classroom. Through listening to and interacting directly with speakers, students are exposed to various career options an mentoring encounters that go beyond their coursework and thus enrich the educational experience for all students.

(REQUIRED) Describe the trends in enrollment for your program. What changes might you foresee in the next 2-3 years?

Although program census enrollment increased from fall 2017 to spring 2018, it decreased this semester (fall 2018). In spring 2018, 347 students were enrolled in program courses as of census; however, this semester, census enrollment decreased to 286 students, an 18% reduction. Although the causes of this recent reduction are not known, we suspect that two factors may partially explain this decrease, including a strong economy (with more students opting for gainful employment vs. education) and an increase in the number of online geology sections being offered by Miramar College.

Program enrollment nonetheless shows an increase for the current academic year. During the 2016/2017 academic year, program headcount was 597. During the 2017/2018 year, it was 654--a 9.5% increase over last year.

Looking ahead, we expect enrollment to remain stable or decrease over the next 2-3 years. As a result, program faculty are working closely with administration to right-size the number of section offerings every semester. In addition, we're continuing to optimize the course schedule. For example, recent enrollment data indicate that geology students prefer morning to afternoon classes, so more of an effort is being made to schedule more sections in the morning. Moreover, we've cut back on the number of evening sections being offered due to low enrollment in these sections.

Increasingly, program faculty are recognizing the need to do more course promotion. As a result, we're making more of an effort to publicize our courses across campus (on VISIX monitors) and via social media, with assistance from the Dean of Mathematics and Natural Sciences and the Office of Communications.

(REQUIRED) Are there any data sets that are not already provided in the dashboards that you could use to inform your program?

Although this would be difficult to obtain, it'd be very helpful to collect finer-grained data on which colleges and universities program students transfer to after they leave Mesa. This data would be helpful to have at the program level. For example, how does the actual number of transfer students change from year to year for students who take program courses?

(REQUIRED) In what ways can the college support your program in our effort to encourage major and career exploration early on in a student's college experience?

First, a word of commendation. Dr. Susan Topham, Dean of Mathematics and Natural Sciences, has been very supportive with regard to all aspects of our program, including

ongoing career exploration opportunities for our students. Dr. Topham is always available, consistently provides helpful input, and most importantly, is open to new ideas. As one example, she sometimes attends evening STEM Lecture Series events in order to become more informed about various career options and research opportunities for our students. Another example: earlier this semester, Dr. Topham attended a pre-event dinner with the head of the SDSU Liberal Studies teacher education program as a way to promote the geology program's commitment to collaborating with SDSU. In summary, program faculty already feel quite supported in our ongoing efforts to improve the quality of our program.

Regarding additional support, we as program faculty would like to suggest that the college be more open to independent study/research courses. Such courses are an excellent way to encourage faculty across campus to undertake collaborative research with their students. Although program faculty understand that well-established transferable courses always have first priority with regard to scheduling, encouraging key faculty to pursue research with their students would help infuse undergraduate research into the culture of our institution. Undergraduate research experiences improve student outcomes with regard to engagement, retention, career exploration, career-skill development, and

The Following Questions are for CTE Programs/Services ONLY.

Enter "not applicable" if your program/service is not CTE.

(REQUIRED) For CTE programs ONLY: Provide specific labor market information showing: 1) Number of jobs available or projected in San Diego County 2) Number of other institutions offering the program 3) How many Mesa students completed the program in the last three years 4) The pay rates for those in the industry (limit 500 characters) (P.N.2.A)

Enter "not applicable" if your program is not CTE.

No answer specified

(REQUIRED) For CTE Services ONLY: How are CTE students identified and tracked for service? (limit 500 characters) (P.N.2.B)

Enter "not applicable" if your service is not CTE.

No answer specified

(REQUIRED) For CTE programs/services ONLY: Upload the report from Launchboard that includes at least three (3) of the following Strong Workforce metrics for your BASELINE year.

Please use the Cal-PASS Plus Launchboard Link available in the Directions.

Refer back to Direction #3 to #6 on how to attach documents.

Strong Workforce Program Metrics
a. Number of Enrollments
b. Number of students Who Got a Degree or Certificate
c. Number of Students Who Transferred
d. Percentage of Students Employed in Two Quarters After Exit
e. Percentage of Students Employed in Four Quarters After Exit

f. Median Earnings in Dollars Two Quarters After Exit
g. Percentage of Students Who Achieved a Job Closely Related to Field of Study
h. Percentage Change in Earrings
i. Percentage Who Attended a Living Wage.

Enter "not applicable" if your program/services is not CTE.

No answer specified

(REQUIRED) For CTE programs/services ONLY Upload the report from the CCCO Perkins site for the College Aggregate Core Indicator Information by 6 digit TOP Code.

Please use the Core Indicator Reports Link available in the Directions.

Refer back to Direction #3 to #6 on how to attach documents.

Enter "not applicable" if your program/service is not CTE.

No answer specified

Outcomes and Assessment (REQUIRED)

Form: 2018/19 Comprehensive Program Review Instructional Outcomes and Assessment Section (See appendix)

File Attachments:

1. **CLO_PLO Assessment Schedule for Fall 2018 Program Review.pdf** (See appendix)

Program Analysis (REQUIRED)

Form: 2018/19 Comprehensive Program Review Instructional Program Analysis Section (See appendix)

Program Goals (REQUIRED)

2018/19

Goal

Goal	Mapping
Equity Strengthen the culture of completion by emphasizing and an equity mindset in support of successful outcomes for all students.	**CA- Mesa College Strategic Directions and Goals:** Strategic Goal 1.1, Strategic Goal 1.2, Strategic Goal 1.3, Strategic Goal 1.4, Strategic Goal 1.5, Strategic Goal 1.6, Strategic Goal 2.1, Strategic Goal 2.3, Strategic Goal 2.4, Strategic Goal 3.1, Strategic Goal 3.2, Strategic Goal 3.3, Strategic Goal 4.1, Strategic Goal 4.2, Strategic Goal 5.1, Strategic Goal 5.2, Strategic Goal 6.2, **Institutional Learning Outcomes 2016/17:** Communication, Critical Thinking, Global Consciousness, Information Literacy
Pathways to student success Provide students with clear pathways for achieving their educational goals.	**CA- Mesa College Strategic Directions and Goals:** Strategic Goal 1.1, Strategic Goal 1.2, Strategic Goal 1.3, Strategic Goal 1.4, Strategic Goal 1.5, Strategic Goal 1.6, Strategic Goal 2.1, Strategic Goal 2.4, Strategic Goal 3.1, Strategic Goal 4.1, Strategic Goal 5.2, Strategic Goal 6.2, **Institutional Learning Outcomes 2016/17:** Communication, Information Literacy
Program success	**CA- Mesa College Strategic Directions**

Increase long-term program success rate to 74% or higher.	**and Goals:** Strategic Goal 1.1, Strategic Goal 1.2, Strategic Goal 1.3, Strategic Goal 1.4, Strategic Goal 1.5, Strategic Goal 1.6, Strategic Goal 2.1, Strategic Goal 2.2, Strategic Goal 2.3, Strategic Goal 3.1, Strategic Goal 4.1, Strategic Goal 4.2, Strategic Goal 5.1, Strategic Goal 5.2, Strategic Goal 6.2, **Institutional Learning Outcomes 2016/17:** Communication, Critical Thinking, Information Literacy
Mentoring Mentor geoscience students more effectively by providing stimulating and enriching research opportunities for such students.	**CA- Mesa College Strategic Directions and Goals:** Strategic Goal 1.1, Strategic Goal 1.2, Strategic Goal 1.3, Strategic Goal 1.4, Strategic Goal 1.5, Strategic Goal 1.6, Strategic Goal 2.1, Strategic Goal 2.2, Strategic Goal 2.4, Strategic Goal 3.1, Strategic Goal 3.2, Strategic Goal 4.1, Strategic Goal 4.2, Strategic Goal 5.1, Strategic Goal 5.2, Strategic Goal 6.2, **Institutional Learning Outcomes 2016/17:** Communication, Critical Thinking, Information Literacy, Professional & Ethical Behavior

Action Plans for Non CTE Programs (REQUIRED)

Actions

2018/19

Goal

Goal: Equity

Strengthen the culture of completion by emphasizing and an equity mindset in support of successful outcomes for all students.

Action: Equity Action Plan

Describe the actions needed to achieve this objective:	Seek to create a culture of equity by keeping program faculty informed of equity-related campus trainings, conferences, and funding

	sources.
Who will be responsible for overseeing the completion of this objective:	Don Barrie
Provide a timeline for the actions:	3-5 years
Describe the assessment plan you will use to know if the objective was achieved and effective:	Objective will have been achieved and will be considered effective when program success rates for various under-represented groups show long-term (3-5 year) improvement.
List resources needed achieve this objective and associated costs (Supplies, Equipment, Computer Equipment, Travel & Conference, Software, Facilities, Classified Staff, Faculty, Other):	Conference funding, supplies, equipment.

Goal: Pathways to student success
Provide students with clear pathways for achieving their educational goals.

▾ **Action:** Pathways Action Plan

Describe the actions needed to achieve this objective:	Develop guided pathways summaries for program degrees offered.
Who will be responsible for overseeing the	Don Barrie

completion of this objective:	
Provide a timeline for the actions:	1-2 years.
Describe the assessment plan you will use to know if the objective was achieved and effective:	Objective will have been achieved and effective when guided pathway summaries have been developed for program degrees.
List resources needed achieve this objective and associated costs (Supplies, Equipment, Computer Equipment, Travel & Conference, Software, Facilities, Classified Staff, Faculty, Other):	Faculty, classified staff time.

Goal: Program success
Increase long-term program success rate to 74% or higher.

▾ **Action:** Program Success Action Plan

Describe the actions needed to achieve this objective:	Program faculty will encourage student success by offering enriching opportunities (e.g., field trips, STEM Lecture Series events, student research opportunities) outside of the classroom. In addition, faculty will seek to identify struggling students as early as possible to educate such students regarding additional resources (e.g., tutoring, DSPS,

	etc.).
Who will be responsible for overseeing the completion of this objective:	All program faculty.
Provide a timeline for the actions:	1-3 years.
Describe the assessment plan you will use to know if the objective was achieved and effective:	Objective will have been effectively achieved when the long-term program success rate equals or exceeds 74%.
List resources needed achieve this objective and associated costs (Supplies, Equipment, Computer Equipment, Travel & Conference, Software, Facilities, Classified Staff, Faculty, Other):	Additional funding for conferences, equipment and supplies, and other resources (e.g., STEM Lecture Series).

Goal: Mentoring
Mentor geoscience students more effectively by providing stimulating and enriching research opportunities for such students.

▾ **Action:** Mentoring action plan

Describe the actions needed to achieve this objective:	Program faculty will increase efforts to recruit and mentor geoscience students, providing them with stimulating and enriching research experiences.

Who will be responsible for overseeing the completion of this objective:	All program faculty.
Provide a timeline for the actions:	2-3 years.
Describe the assessment plan you will use to know if the objective was achieved and effective:	The objective will have been effectively achieved when 5-10 students per year engage in research experiences.
List resources needed achieve this objective and associated costs (Supplies, Equipment, Computer Equipment, Travel & Conference, Software, Facilities, Classified Staff, Faculty, Other):	Equipment and supplies; faculty time.

Project Plan for CTE Programs Only (REQUIRED)

Closing the Loop (REQUIRED)

Form: 2018/19 Comprehensive Program Review Instructional Closing the Loop (See appendix)

Form: "2018/19 Comprehensive Program Review Instructional Closing the Loop"

Created with : Taskstream
Participating Area: Geology

(REQUIRED) Program name

Geology

(REQUIRED) Which one(s) of the following were received in past year?

- BARC

(REQUIRED) How have these resources benefited your program and your students?

Last year, our program was awarded two BARC requests, including a weather station and a group of physical geology reference sets.

Installation of the weather station on the roof of the Math/Science (MS) building is in progress. One installed, this equipment will greatly improve instructional quality in two program courses, including GEOL 104 (earth science) and GEOL 120 (earth science laboratory). Weather-related processes are discussed in both courses, and the ability to collect and analyze meteorological data in real-time will allow instructors to design engaging activities using real data sets. Access to local, real-time weather data will also improve student research capabilities.

Our program was also awarded a group of physical geology reference sets, which include common rocks and minerals. These sets have enabled us to replace aging sets in the geology lab (MS 110) as well as providing us with additional sets to use in our lecture courses, including GEOL 100 (physical geology), GEOL 104 (earth science), GEOL 111 (The Earth Through Time). Our lab students in two courses (GEOL 101, physical geology lab; GEOL 120, earth science lab) now have newer, better examples of common rocks and minerals to examine.

Request Forms

- **BARC & Facilities Requests**
- **Classified Position Request**
- **Faculty Position Request**

Reviewers

Liaison's Review

Form: Instructional Program Liaison's Review 2018/19 (Comprehensive)

Manager's Review

Form: Instructional Program Manager's Review 2018/19 (Comprehensive)

Appendix

A. **2018/19 Comprehensive Program Review Instructional Program Overview Section** (Form)
B. **2018/19 Comprehensive Program Review Instructional Curriculum Section** (Form)
C. **2018/19 Comprehensive Program Review Instructional Outcomes and Assessment Section** (Form)
D. **CLO_PLO Assessment Schedule for Fall 2018 Program Review.pdf** (Adobe Acrobat Document)
E. **2018/19 Comprehensive Program Review Instructional Program Analysis Section** (Form)
F. **2018/19 Comprehensive Program Review Instructional Closing the Loop** (Form)

Course Learning Outcome (CLO)/Program Learning Outcomes (PLO) Assessment Schedule
Geology Program
San Diego Mesa College

CLO / PLO*	Fall 2015	Spring 2016	Fall 2016	Spring 2017	Fall 2017	Spring 2018	Fall 2018	Spring 2019	Fall 2019	Spring 2020
CLO #1: Critical Thinking					X	X				
CLO #2: Problem Solving			X	X			X	X		
CLO #3: Communication	X	X							X	X
PLO #1 (Transfer)						X				
PLO #2 (Scientific Literacy)								X		
PLO #3 (Scholarship, Lifelong Learning)										X

*The same CLOs apply for all geology courses; however, for each course, each CLO may be assessed differently, depending on the course.

CLO Descriptions

CLO #1 (Critical Thinking): Students will display the ability to use proportional reasoning and graphical analysis to establish and analyze relationships between measured quantities.

CLO #2 (Communication): Students will display the ability to clearly communicate scientific principles, experimental results, and their implications.

CLO #3 (Problem Solving): Students will display the ability to apply conceptual and mathematical tools to correctly predict the future state of physical systems.

PLO Descriptions

PLO #1 (Transfer): Program courses foster scholarship and facilitate the successful transfer of students from Mesa College to other educational institutions.

PLO #2 (Scientific Literacy): Program courses develop students' understanding of the scientific process and thereby enhance scientific literacy.

PLO #3 (Scholarship and Lifelong Learning): Program courses develop students as scholars and encourage lifelong learning by exposing the students to new concepts and by allowing them to apply those concepts to gain a deeper understanding of the physical world.