FULLERTON COLLEGE ELEVATING. EXCELLENCE.

Instructional Programs

2014-2015 Self-Study

Three-Year Program Review Template

Department of Earth Sciences

Natural Sciences Division

Statement of Collaboration

The program faculty listed below collaborated in an open and forthright dialogue to prepare this Self Study. Statements included herein accurately reflect the conclusions and opinions by consensus of the program faculty involved in the self-study.

Participants in the self-study

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Authorization

After the document is complete, it must be signed by the Principal Author, the Department Coordinator, and the Dean prior to submission to the Program Review Committee.

Printed name of Principal Author	Signature	Title	Date
Printed name of Department Coordinator	Signature	Title	Date
Printed name of Dean	Signature	Title	Date

1.0 Mission and Goals

The College's Mission, Vision, Core Values and Goals drive all college activities. The Program Review committee would like to understand the connection of your program to the College's Mission, Vision, Core Values and Goals. Summarize how your program supports each area.

Mission: The mission of the Earth Sciences Department (ESD) aligns directly with the college mission, that is, "We prepare students to be successful learners in the Earth Sciences."

Vision: As a discipline that embraces scientific inquiry and teaches application of the scientific method to majors and general education students, the Earth Science program vigorously supports the college vision to "create a community that promotes inquiry and intellectual curiosity, personal growth, and a lifelong appreciation for the power of learning."

Core Values: The department greatly values active learning—science by doing—and incorporates activities and pedagogies that promote an understanding of the nature of science, scientific inquiry, and science literacy. Courses within the Earth Sciences department expose students to the scientific method and build student ability to think critically and use information for problem solving. They also measurably improve student awareness of Earth's natural systems and the global environment.

College Goals: The ESD promotes student success and excellence in learning through a mixture of campus and online lecture, laboratory, and field-based course offerings using a variety of pedagogies, including traditional lecture-discussion formats, inquiry-based, active learning pedagogies, experimental approaches, and independent undergraduate research. The college goal to "reduce the existing achievement gap and address the needs of underprepared students" is actively supported by the ESD through incorporation of the division's strategic plan initiative on science literacy, supplemental instruction, tutoring, and the department's support of the Engage in STEM programs. The goal of the college to strengthen its ties to the communities that it serves is integral to the ESD program. The ESD has developed and supported partnerships and programs that bring community events and community members to the campus for educational, cultural, and social activities.

2.0 Program Data & Trends Analysis

2.1 Key Performance Indicators (KPI)

For each KPI listed below, analyze and report your findings and describe what they mean.
(Attach 5-year longitudinal data from Office of Institutional Research and Planning (OIRP) to Appendix.)

KPI	Findings
Enrollment	Enrollments over the 5-year period (Fall 2009-Spring 2014) varied as expected in a time when budget cuts reduced the number of sections. Enrollments were high in 2009-2010 (3,348 students) and fell for two years (2010-2011, 2011-2012) before climbing again, and reaching an all-time high of 3,439 students in 2013-2014. (The previous high was 3,416 in 2008-2009). This number of enrollments is the largest number of enrollments among all departments in the Natural Sciences Division.
Total FTES	FTES varied similarly to enrollments with the first and last year of the 5-year period exhibiting the highest numbers; 343 FTES in 2009-2010 and 339 in 2013-2014. Years between—during which budget cuts reduced the number of sections—saw lower FTES, and reached a minimum of 286 in 2011-2012.
Sections	The number of sections mirrored enrollment and FTES trends. We offered 78 sections in 2009-2010, fewer in the two years that followed, and began to grow again in 2012-2013. The department offered 75 sections in 2013-2014, and that number will grow considerably in the 2014-2015 school year with the addition of several adjuncts.
FTEF	FTEF varied from 12.3 to a high of 16.5 in 2013-2014. Variations in FTEF are largely attributable to growth or reductions in full-time faculty overload, the number of adjuncts, and sabbatical and load bank leaves.
Fill Rate	Fill rates were at or exceeded 100% from 2009-2011, and remain high in 2013-2014. As evidenced in the 2014-2015 school year, fill rates are growing as demand grows. Demographic trends also support higher student enrollment.
WSCH/FTEF	Over the 5-year period, the department's WSCH/FTEF averaged 697, a strong number in terms of productivity. The department balances 25-student lab and field trip sections with 50-student lecture sections, and our WSCH/FTEF demonstrates that this approach works well to maintain a high productivity, well above the 525 "standard."
Retention	Rates of retention remain strong, hovering around 81% over the 5-year period. The strongest retention is achieved during summer semester, reaching 93% in Summer 2009-2010. Among different ethnic groups, rates of retention differ only slightly, except for African American students, whose retention varies consider from semester to semester, ranging from 91% in Summer 2013-2014 to 62% in Spring 2011-2012. We know that some African Americans in our classrooms are athletes, and propose to develop interventions specific to athletes that may improve their success.
Success	Overall rates of success vary from 57% to 81%, and even more widely among different ethnic groups. The highest rates of success are achieved during summer semester, when a high percentage of juniors and seniors in four-year colleges enroll. The highest achieving ethnic groups are Asian Americans (68.8%), Whites (68%), Unknowns (67.6%), and Other-Non-Whites (67%). Filipino students average 62.6%, while other ethnic groups perform several percentage points lower: Native Americans, 57.4%; Hispanic/Latinos, 55.6%; Pacific Islanders, 50%, and African Americans, 46.2%. The science literacy initiative launched as part of the division's strategic plan is an effort aimed at reducing this gap in student success among different ethnic groups.

2.2 Peer Institution Comparison

Complete the table below.

College/Program:	Your Program	Santa Ana	Saddleback	Grossmont	San Diego City
Retention:	80.2%	81.19%	85.93%	76.84%	89.57%
Success:	61.2%	62.02%	72.21%	54.52%	64.54%
Degrees Awarded:	11	N/D	N/D	N/D	N/D
Certificates Awarded:	N/A	N/A	N/A	N/A	N/A
Transfers:	3	N/D	N/D	N/D	N/D

How does your program compare with peer institutions? Provide a narrative of your comparison. (Peer institutions are colleges or programs identified by the Office of Institutional Research and Planning (OIRP)).

We used the National Center for Educational Statistics, and knowledge of similar local (Orange County and San Diego) Earth Science/Geology/Oceanography programs to choose peer institutions for our department. On average, our department is in the middle range of rates of retention and success for local peer institutions. If we compare our department to colleges with strong supplemental instruction programs, such as Bakersfield and Chaffey, we rank poorly. These colleges achieve average rates of retention of 89.79% and 91.99%, and average rates of success of 74% and 81%, respectively, some 10-20% higher than our department. Clearly, we have work to do to boost retention and success with our students.

2.3 Achievement Gap

Indicate achievement gap for each of the groups listed below. (Attach to Appendix the Success and Retention by Ethnicity Data as identified by the Office of Institutional Research and Planning.)

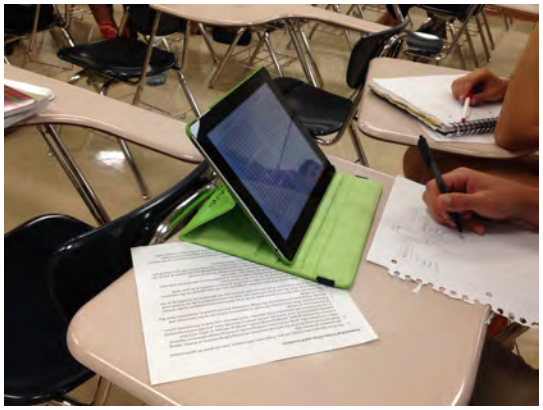
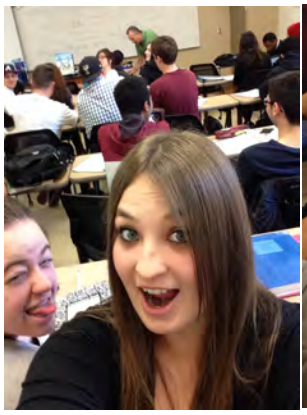
Group	% Retention	% Success
Males	80.8%	62.0%
Females	79.8%	60.6%
Asian-American	82.4%	68.8%
African-American	73.8%	46.2%
Filipino	83.4%	62.6%
Hispanic	78.2%	55.6%
Native American	79.8%	57.4%
Other Non-White	81.2%	67.0%
Pacific Islander	81.8%	50.0%
White	82.8%	68.0%
Unknown	83.8%	67.6%
Range (Max-Min)	10.0%	22.6%
Previous (2011) Range (Max-Min)	28.85%	27.6%

2.4 Program Effectiveness

Since your previous Program Review Self-Study, what significant changes have occurred that impact the effectiveness of your program?

Collegewide cuts in 2010-2012 necessitated reductions in our course offerings. At the same time, one of our long-time oceanography adjuncts was hired to teach full-time at another community college. The combination of these effects reduced our ability to sustain course offerings in the face of skyrocketing demand. To compensate, full-time faculty took on overload, but that approach is not sustainable in view of faculty's desire to pursue grant opportunities, incorporate undergraduate research, transform pedagogical approaches to increase success in lecture sections, manage supplemental instruction, and update textbooks and teaching materials. Though we continue to advertise to fill adjunct positions in geology and oceanography, and have done so for the past three years, a lack of applicants and a lack of qualified candidates has made it difficult to replace previous adjuncts and limited our capacity to grow and add sections. We are slowly growing our adjunct pool, and making efforts to help our new adjuncts develop as teachers. The addition of a new Oceanography/Earth Science full-time faculty member, approved by the college in October 2014, will balance teaching loads, and permit faculty to focus additional efforts on student success and reduction of the achievement gap.

Despite these challenges, the addition of 25 iPads, acquired through funding from our last program review budget request, and an additional dozen iPad minis acquired through strategic plan funds, is beginning to have positive impacts in the affective domain on a few sections of oceanography. Students near-unanimously favor in-class activities on iPads. (The only nay votes come from older students not accustomed to the technology.) Students can watch videos interactively and complete video-related worksheets at their own pace (versus the entire class watching a video once through); complete surveys and quizzes; perform Google searches and apply information to answer short questions; read ebooks and practice science literacy tools (e.g., talk to the text, think alouds, prefix/suffix recognition, reading for understanding, etc.); use maps and learn geographic and geologic features; use apps to access real-time information on weather, waves, tides, and positions of the moon and planets; and email completed work to the instructor from their desktop. If funding permits, we anticipate expanding our use of iPads and the number of sections in which they are used, and plan to develop tools to measure their effectiveness in the cognitive domain for increasing students' knowledge and understanding.


2.5 Describe any laws, regulations, trends, policies, procedures or other influences that have an impact on the effectiveness of your program. Please include any other data (internal or external) that may be relevant to student achievement, learning, and trends within your Basic Skills, CTE, or Transfer Education programs.

The 2011 Fullerton College Environmental Scan underscores the "tremendous growth" in Orange County and Fullerton College over the past 20 years. The report cites a projected growth rate of 33% in the county over 2000 levels. Already, the college is experiencing unprecedented rates of expansion of course offerings. Fortunately, the Earth Sciences Department is one of the few science departments that is prepared to grow rapidly. The department has been a leader in online education since 1998, currently offers online general education courses in oceanography, meteorology, and earth science. Because much of the department's "laboratory" curriculum is field based, we are positioned to expand field classes, limited only by the availability of equipment, vehicles, and instructors. The addition of a new full-time faculty member, and acquisition of equipment through college funding (though infrequent) and external grants (increasingly sought) should permit the department to keep pace with the projected growth in student populations.

Nevertheless, as reported in the 2012-2013 Fullerton College Institutional Effectiveness Report, the college will continue to be challenged by a high percentage of students who place in below college level Math (~70%), and Reading (~50%). What's more, because the college cannot offer enough sections of Basic Skills Math and Reading to accommodate such large numbers, as the report states, these students choose to enroll in college-level general education courses for which they are underprepared. Because the Earth Sciences department offers mostly 100-level, general education courses, it follows that many of our students lack adequate preparation in Math, English, and Reading to perform satisfactorily or succeed in our courses. Data provided by the Basic Skills Office clearly illustrate the lack of success of underprepared students in Earth Science lecture classes. Students enrolled in English 39, three levels below college English, have success rates from 7-40% in our lecture courses. Students two levels below show little improvement with rates ranging from 11-44% in lecture courses. English 60 students, one level below college English, perform better, with rates from 29-60% in our lecture courses. This outcome is well-documented (e.g., Bailey et al, 2009) and appears to hold true for below-college-level students enrolled in any course, including Physical Education (e.g., Student Success Conference, 2010). Thus, we have begun discussions to require an appropriate pre-requisite for our courses, such as Math 20, to ensure that students are better prepared to succeed in our courses.

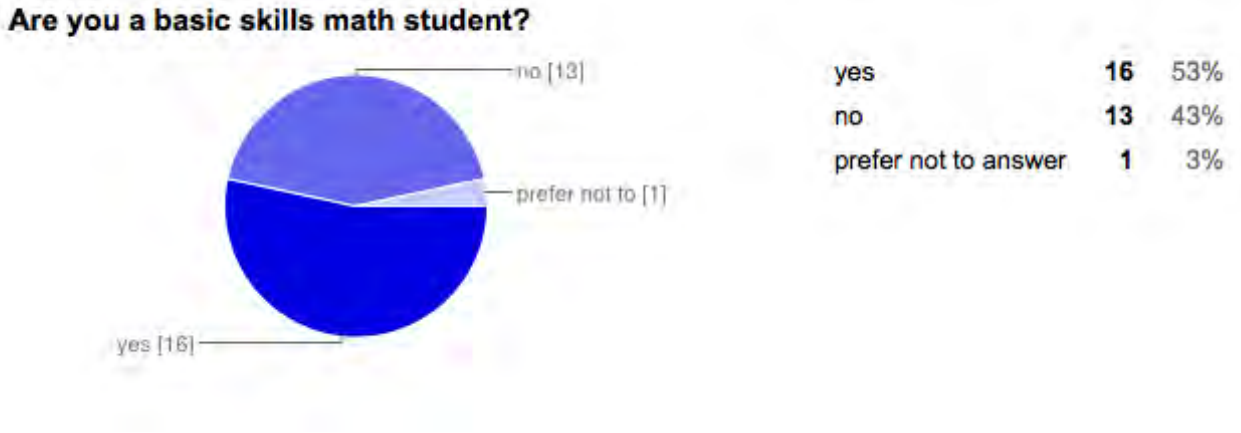
Success Rates for Student Concurrently Enrolled in Developmental English Courses, 2001-2009

	English 39 Students		English 59 Students		English 60 Students		All Students	
Course	Enrollment	Success Rate	Enrollment	Success Rate	Enrollment	Success Rate	Enrollment	Success Rate
ESC100 F	30	7%	66	17%	166	29%	3,787	44%
ESC100LF			11	45%	42	50%	1,115	62%
ESC101 F	5	40%	9	11%	57	53%	1,088	59%
ESC101LF					16	88%	299	80%
ESC116 F	20	30%	65	42%	210	60%	4,399	64%
ESC116LF			15	73%	67	78%	1,406	80%
ESC130 F	36	22%	117	44%	328	55%	7,791	56%
ESC130LF			13	38%	57	72%	1,887	78%

Data provided by the Basic Skills Office Director.

Like most departments, the Earth Sciences department will continue to be challenged by underprepared students, and even more so as we expand the number of sections we offer. The department has implemented supplemental instruction in a few oceanography sections in Fall 2014, and is expanding supplemental to all sections of oceanography and a few geology sections in Spring 2015. We have also increased the availability of learning tools available to students (e.g., instructor-written textbooks, image libraries, glossaries, lecture notes, lecture slides, and videos available through Blackboard, My Gateway, and personal websites) and continue to explore different pedagogies, including flipped classroom instruction, hands-on activities, problem-based learning, research mini-projects, and critical thinking activities to increase student success.

Despite our efforts, we still lack of critical information on our students before the semester begins. We know that different sections of students in the same course taught in the same manner by the same instructor perform better or worse than average within and between semesters. We attribute at least some (if not most) of this variability to differences in the percentages of underprepared students in different sections. A survey of an underperforming afternoon section of oceanography this semester revealed that more than 50% of the students were simultaneously enrolled in one or more basic skills courses, and most of them were first-time students. In contrast, a morning section of the same course with students performing significantly better was composed of more than 90% second-year students. Knowledge about our student population prior to the start of the semester is critical for designing instructional approaches, interventions, and support services to the needs of a particular section. Through a recently funded Faculty Inquiry Group, we are working on a start-of-semester survey that will provide some of this information, and allow us to tailor our courses and recommend services to our students that are most appropriate for their level of college readiness. At the same time, we support a college-wide effort to provide demographic and academic information about students before the semester begins, similar to the data provided to instructors at the beginning of the semester at Irvine Valley College.

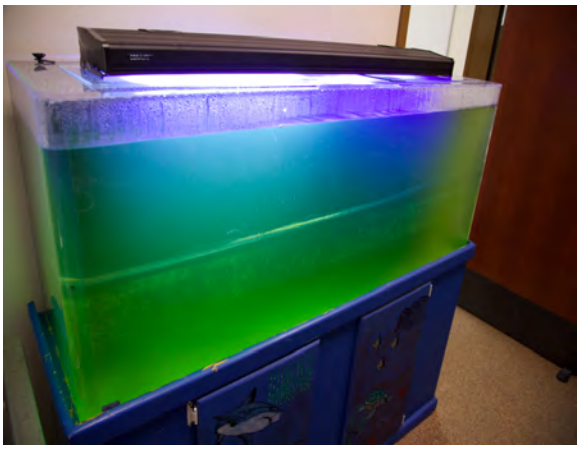


Demographic information would also provide faculty with better opportunities to address the achievement gap. The Institutional Effectiveness Report and Environmental Scan make clear that our students are increasingly ethnically diverse with Hispanic/Latino students making up 48% of the student population. The 2011 Environmental Scan projects that Hispanics will reach a majority in Orange County by 2040, and that the Asian population will equal the percentage of white residents. Thus, we can expect that the ethnic makeup of students at Fullerton College will continue to change. As emphasized in this report, authored by the late FC Director of Institutional Research, Ken Meehan, "…growth of groups that have been traditionally

underrepresented in higher education is important to understand…[because] support services…may be different for… [these] student groups… [and] have important planning implications for the college." The Earth Sciences department remains committed to respecting and celebrating the diversity of our students by including geographically diverse examples of Earth Science features and processes in lectures and course content, by acknowledging the contributions of scientists in different cultures, and by participating in the college's Worldfest event. We have also begun and plan to expand supplemental instruction that provides multiple ways of learning for students. We will continue to explore ways to address the increasing diversity of our students.

The 2013 Orange County Workforce Indicators Report (OCWIR) offers insights academic performance trends of incoming freshman from feeder schools. As pointed out in the report, schools in Orange County have continued to improve in state measures of academic performance, e.g., the Academic Performance Index (API) and High School Exit Exam. While 23 of 28 school districts exceeded statewide API scores, including the Fullerton Joint Union High School District, the report notes that the Anaheim Union High School District, where most Fullerton College students attend high school, has not yet met the state API standard (though they are expected to do so in the coming years.) The Anaheim School District also falls below state standards in the high school exit exam for English Language Arts. Thus, we will need to continue to focus on underprepared students, and acknowledge the diverse academic background of learners in our classrooms.

The 2013 OCWIR offers one more piece of data worth considering. The report emphasizes the critical importance of STEM disciplines to the growth of "Orange County's rapidly growing high-tech industry cluster." The report cites four emerging industries, International Trade, Information Technology, Creativity, and Green Technology, as important drivers of near-future workforce expansion in OC. While the Earth Sciences department does not directly serve these industries, we do serve students who will find careers within these industries, and we can leverage this knowledge by emphasizing the science within these industries in our classrooms. Within Green Technology, there is a growing need for workers trained in water and wastewater industries, and energy infrastructure, which potentially includes biofuels, an area of undergraduate research in the department. These are also topics often covered in our Earth Science courses. While the Earth Sciences Department currently offers no certificate programs of any kind, we are continuing to watch developments that may be favorable for departmental offering of certificates to serve green industries in Orange County and elsewhere.



2.6 Provide any other data that is relevant to your self-study.

Anonymous surveys of students in a couple sections confirm the above college-wide trends, including that more than half of our students are basic skills students. While efforts are made to spend some class time teaching study skills, reading comprehension skills, writing skills, and math skills, these mini-lessons are insufficient to compensate for the lack of skills in these students. Students are encouraged at the start of the semester to obtain these skills before attempting our courses, but the effectiveness of that approach is limited. We have offered tutoring in oceanography, but the number of students attending has been disappointing. As pointed out in our previous program review, we believe that supplemental instruction is the best approach to give these students the skills and confidence they need to be successful in our courses. Through a grant, we have been able to offer supplemental instruction to one section this fall, and the initial results are encouraging. In mid-semester Fall 2014, we became part of the college's supplemental instruction program, and hope to secure additional funds through this program review to offer supplemental instruction to all of our sections in oceanography, geology, earth science, and meteorology. We have included this proposal in our Strategic Action Plan. (SAP; See below.)

In our previous program review, we included data provided by Ken Meehan on success and retention rates in our laboratory/field classes versus lecture classes. As the table below shows (reproduced from our previous program review), rates of retention and success in laboratory/field classes exceed those rates in lecture sections. Retention rates in lab/field classes were 9% higher, while success rates were 19% higher over the 10-year period. The dramatically higher rates of retention and success imply that hands-on teaching and experiences with lab and field methods improve student learning. To that end, we began to introduce hands-on experiences with simple instruments (tape measures, thermometers, salinometers, and other instrumentation) in lecture sections as a means for engaging students and improving learning. While carrying out hands-on activities in large lecture halls with fixed seating presents its own set of challenges (e.g., Room 410), the results have been encouraging so far, especially as such tools help students understand the scientific method. However, continuation and expansion of hands-on, instrument-based activities is jeopardized by the degradation of existing equipment, and the challenge of maintaining and managing new equipment.

10-year comparison of Earth Science Program Lecture and Lab courses, Fall 2001-Spring 2011

Course Type	Enrolled	Retained	Succeeded	Retention Rate	Success Rate
Lecture (50)	26,534	20,358	15,390	77%	58%
Lab/Field (25)	6,502	5,617	5,002	86%	77%
Total	33,036	25,975	20,392	79%	62%

(size of sections in # of students)

In every program reviews since the 1990s, including the previous one, and in a recent request to the college administration, we have asked for an Earth Science Lab Clerk position to maintain and manage the growing inventory of equipment and supplies. Unlike other large departments in the division (namely, Biology, Chemistry, and Physics), the Earth Sciences Department has no staff to assist with the organization and maintenance of classroom, field, and laboratory equipment and materials, including hundreds of rock specimens, dozens of geologic and bathymetric maps, a variety of field instruments (an inflatable Zodiac and outboard motor, several YSI water quality meters @$2000/meter, dozens of temperature and salinity sensors, Secchi disks, measuring tapes, sounding lines, sediment sieves, clinometers, globes, compasses, stopwatches, graduated cylinders), camping equipment, dissecting microscopes, dozens of field guides, a stream table, a classroom set of more than 40 iPads, two dozen still/video cameras (GoPros and Flip cameras), a 120-gallon algae biofuels demonstration aquarium, a water filtration unit, and dozens of carboys, among other

equipment. For the past five years, we have relied on student volunteers and student hourlies working 10-15 hours per week (hired through external funding) to assist in the organization and maintenance of equipment and supplies. However, many badly needed duties have not been performed, including maintenance, calibration, and minor repair of existing equipment, and ordering and cataloguing of new equipment. In addition, instructors have no assistance preparing, setting up, deploying, and restoring equipment and materials in the classroom or laboratory, as is provided in three other major departments in the division. The rapid expansion of equipment and supplies in our department has been necessitated because of changes in classroom pedagogies (flipped classrooms, project-based learning, etc.), increases in the number of lab and field sections, and increases in the number of adjuncts, who often require their own set of equipment to take into the field. Fortunately, we have been able to accomplish growth in equipment and materials because of funding provided as a result of our previous program review, an innovation grant from the district, and external funding. However, the amount of equipment and supplies, their organization and maintenance, their calibration and repair, their deployment and storage, a recordkeeping of their service and repair, and an ability to share their use among instructors and class sections has become unmanageable without assistance from an Earth Science Lab Clerk. We have included this request in our SAP.

Finally, in anticipation of state approval of the Earth Science AS, we wish to note data obtained from the Department of Geology at CSUF regarding the number of majors in Earth Science. After only two years offering their BA in Earth Science, they report approximately 40 majors currently seeking BAs in Earth Science at their college. Because this degree path is especially appealing to K-12 teachers, and because of the current demand and national calls for more STEM teachers, we anticipate that the Earth Science AS offering at Fullerton College will attract more majors to our department. We propose an aggressive marketing campaign in collaboration with the Engage in STEM program and the Fullerton Union High School District's Science Advocacy Council to attract students, and especially future teachers, to the program. This offering coincides with introduction of the Next Generation Science Standards (NGSS) in K-12, scheduled for full implementation by 2016. In anticipation of offering of the Earth Science AS, and in response to the offering of an Earth Science BA at CSUF as well as implementation of the NGSS, we propose a continuing focus on hands-on, instrument-based, teaching and learning methods, and an expansion of the tools used in these methods. We have begun to develop a program called the College Watershed Project that focuses on processes and impacts within OC watersheds and the coastal ocean, and unites many aspects of the curriculum taught in our courses. To accomplish this, we will require additional equipment. We have included this request in our SAP.

3.0 Strengths, Weaknesses, Opportunities, Challenges (SWOC)

Based on your analysis in 2.1 through 2.6, answer the following questions:

3.1 What are the strengths of your program?

The department…

- serves a high number of students (>3000 annually).
- maintains high fill rates, near 100% over the 5-year period.
- maintains a high WSCH/FTEF (near 700 over the 5-year period).
- increased success by 1% since the last program review.
- increased retention by about 0.5% since the last program review.
- narrowed the achievement gap rate of retention by 20% and rate of success by 5% since the last program review.
- received funding from the Metropolitan Water District of Southern California in 2012-2014.
- was awarded a District Innovation Grant in 2014-2015.
- was awarded funding from Basic Skills to create a Faculty Inquiry Group in 2014-2015
- authors textbooks and learning materials for students.
- completed sabbaticals that have enriched student learning in the classrooms.
- is charismatic, passionate about teaching, and a blast to hang out with!

3.2. What are the weaknesses of your program?

The department…

- exhibits retention and success rates lower than some peer institution averages.
- maintains very few majors and awards very few degrees.
- continues to struggle with retention and success among African-Americans and Hispanics.
- has difficulty finding adjuncts to teach additional sections.
- desperately needs assistance managing and maintaining an enormous inventory of equipment

3.3 What opportunities exist for your program?

Opportunities for the department include

- the potential for significant increases in the number of majors and degrees awarded with state-approval of the Earth Science AS degree.
- the potential to expand rapidly and increase enrollments
- the potential to increase rates of success and retention, and narrow the achievement gap through implementation of supplemental instruction and other innovative pedagogies
- to support undergraduate research

3.4 What challenges exist for your program?

- meeting the needs of underprepared students.
- improving the success and retention of African-Americans and Hispanics
- expanding hands-on activities to more sections and continuing to manage and coordinate undergraduate research without staff assistance to maintain an ever-expanding inventory of instructional equipment
- tracking, mentoring, and helping majors without a division-wide STEM Coordinator

4.0 Student Learning Outcomes (SLO) Assessment

4.1 List your program level SLOs and complete the expandable table below.

	Program Student Learning Outcomes (PSLOs)	Date Assessment Completed	Date(s) Data Analyzed	Date(s) Data Used For Improvement	Number of Cycles Completed
1.	Upon successful completion of courses leading to the Geology AS-T, the student will be able to demonstrate an understanding of how the scientific method is used to explore topics in geology.	June 6, 2014	June 6 of every school year.	Fall 2014 and subsequent fall semesters.	4
2.	Upon successful completion of courses leading to the Geology AS-T, the student will be able to apply geology concepts to better understand current issues of environmental and/or geologic concern.	June 6, 2014	June 6 of every school year.	Fall 2014 and subsequent fall semesters.	4

4.2 Assessment: Complete the expandable table below.

Program Student Learning Outcomes **Assessment for Instructional Programs at Fullerton College**			
Intended Outcomes	**Means of Assessment & Criteria for Success**	**Summary of Data Collected**	**Use of Results**
1. Upon successful completion of courses leading to the Geology AS-T, the student will be able to demonstrate an understanding of how the scientific method is used to explore topics in geology.	Common questions, problems, or projects assessed at the course level.	2010 69% 2011 71% 2012 72% 2013 71% 2014 72%	Revision of assessments; refinements of projects; modification of department-authored textbook.
2. Upon successful completion of courses leading to the Geology AS-T, the student will be able to apply geology concepts to better understand current issues of environmental and/or geologic concern.	Common questions, problems, or projects assessed at the course level.	2010 69% 2011 70% 2012 72% 2013 71% 2014 72%	Revision of assessments; refinements of projects; modification of department-authored textbook.

4.3 What percentage of your program level SLOs have ongoing assessment? Comment on progress/lack of progress.

100% of program level SLOs have ongoing assessment.

4.4 How has assessment of program level SLOs led to improvements in student learning and achievement?

Students demonstrate a heightened level of interest in geology and earth science because we have focused on local examples of geologic features and processes.

4.5 How has assessment of program-level SLOs led to improvements in transfer or certificate/degree awards?

We have seen no change in transfers or certificate/degree awards. These numbers continue to remain very small.

4.6 What challenges remain to make your program level SLOAs more effective?

We are satisfied with the effectiveness of our SLOA process. Much more work remains to increase success in students taking our courses.

5.0 Evaluation of Progress Toward Previous Goals/SAP's (Future program review templates for this section will identify "previous goals" as "previous *strategic action plans*"-- SAP's.)

5.1 List the goals from your last self-study/program review.

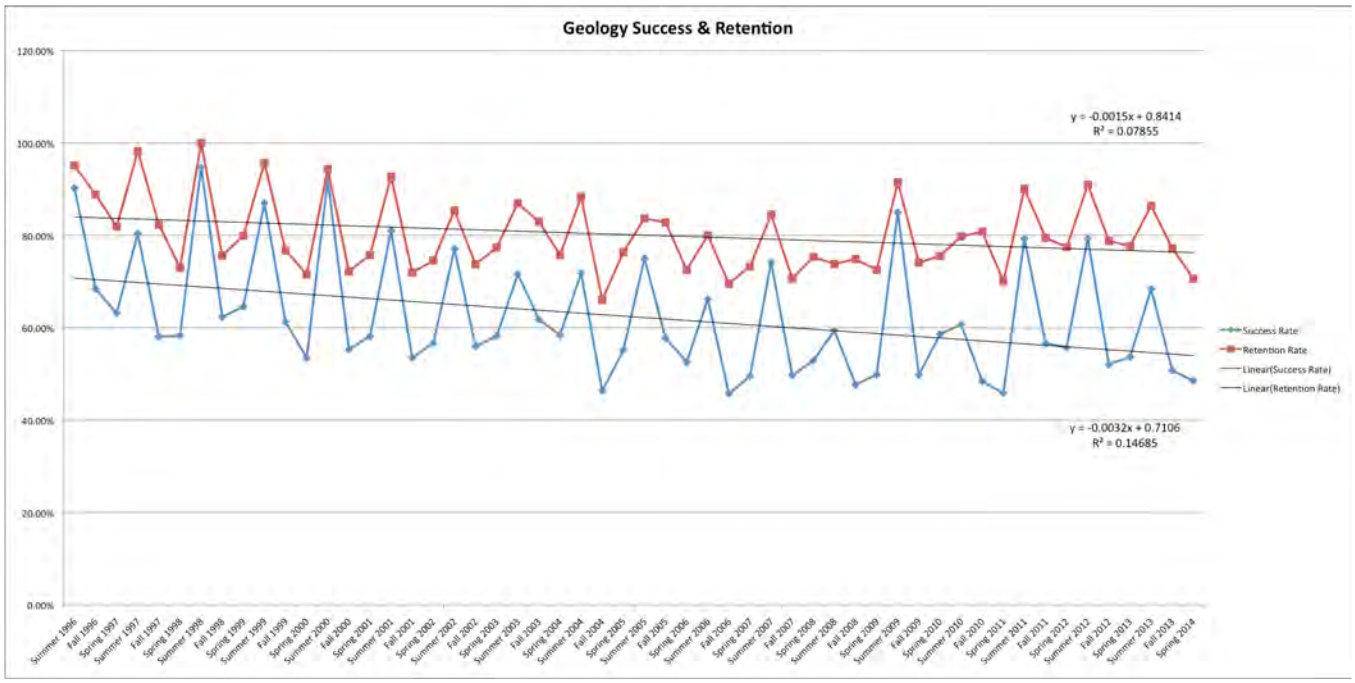
Short-Term Goal 1: Improve retention and success by 2%; and reduce the achievement gap by 5%.
Short-Term Goal 2: Increase the number of Earth Science/Geology majors to an average of 15 students annually.
Long-Term Goal 1: Expand the Earth Science "museum" to attract majors, provide informal education to community members, and create a resource for campus events, such as Kindercaminata, Smart Start Saturday, Career Day, and other events where K-12 students, FC students, and community members might be present.
Long-Term Goal 2: Establish undergraduate research as part of the department curriculum as a means to exceed the peer average in retention and success and substantially reduce the achievement gap.

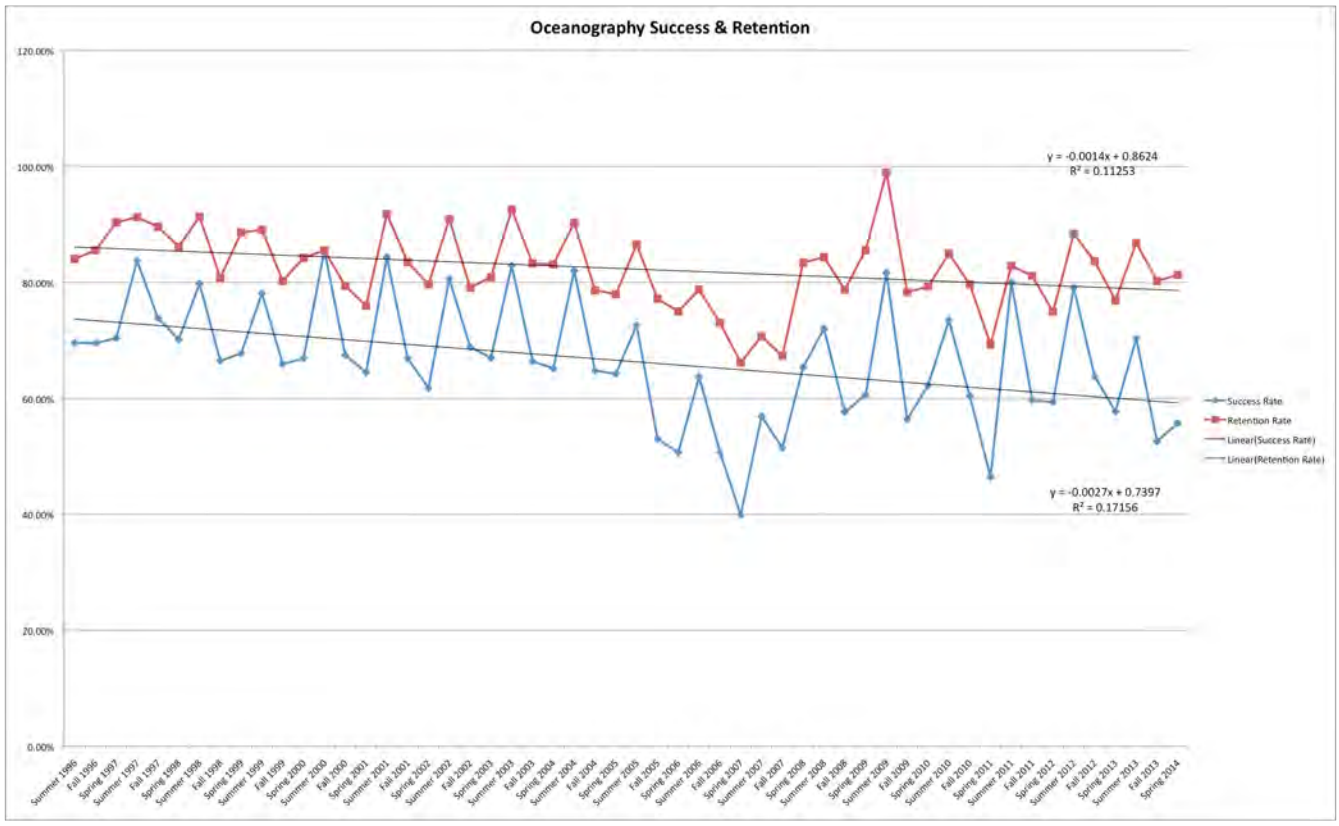
5.2 Describe the level of success and/or progress achieved in the goals listed above.

Short-Term Goal 1: *Improve retention and success by 2%; and reduce the achievement gap by 5%.*

We did not meet our target of 2%, but we appear to have made progress. As noted above, rates of success improved by 1% and rates of retention improved by about 0.5% since our last program review (2006-2011). We caution, however, that interpretation of these data depends on the averaging methods used to calculate rates of success and retention. Neither the previous KPI data (2006-2011) nor the current KPI data (2009-2014) provide data on numbers of retained students or numbers of successful students; only percentages are provided. So average rates of success and retention calculated using the more complete data from the Data Mart, which includes success and retention counts for each semester, provide a different view of our "progress." Indeed, these data indicate a decline in rates of success and retention since the last program review. If we extend our analysis to 1996, we observe an overall decline in rates of success and retention in both geology and oceanography with a slight upward trend since 2007 in oceanography. By comparison, an 18-year analysis of rates of success and retention in Biology and Chemistry, comparably sized departments within our division, show steady and slightly increasing rates, respectively.

Discussions of these trends with faculty in these departments suggest that different types of students enroll in Earth Science versus Biology/Chemistry courses, and that this self-selection of students may explain the 18-year trend. We hypothesize that a greater number of underprepared students enroll in Earth Science courses because they are perceived as easier courses (and, indeed, we have heard from students that counselors often recommend Earth Science courses for this reason). We are currently working with the OIRP and Basic Skills office to determine the percentage of underprepared students in our courses. A preliminary survey of students in one oceanography section, conducted as part of the innovation grant study, indicates that as many as 60% of the students are also enrolled in basic skills classes. We know from the literature on student success, and from data provided by the previous Director of Institutional Research, that success and retention of students enrolled in basic skills courses is dramatically lower than college-ready students. Nonetheless, it is incumbent upon us to recognize this challenge and take steps to address it.





On the achievement gap, we appear to have progress, especially with retention of African-American students in oceanography. Retention rose from 61% in our last program review to 70% in the current one. The success of African Americans in both oceanography and geology fell considerably, from approximately 46% in 2011 to 35% in 2014. Rates of success of Hispanics also fell from nearly 62% in 2011 to 45% in 2014. Success of a traditionally high-performing group, Asian Americans, fell from about 70% in 2011 to 57% in 2014. We note

that declining success of Asian American students accounts for some of the "narrowing" of the achievement gap in our department, but this is decidedly not the way we wish to narrow the gap. We have been in conversations with the college football coach to address the low rates of success among the African-American athletes in our classes, but these students are only one part of a larger problem, that is, declines in success in all ethnic groups.

The department has taken great strides to diversify teaching methods, and, especially, to place a greater emphasis on active learning in the classroom. Faculty have attended and participated in professional development workshops, including Reading Apprenticeship training and workshops, science literacy efforts, and Habits of Mind workshops. Improvements in Blackboard and MyGateway have enabled improvements in our ability to provide formative assessments (quizzes and assignments), track student engagement outside the classroom (such as whether students log in regularly and complete work), provide opportunities for student-student and student-teacher interactions (e.g., discussion boards, email, early alert), provide faster feedback on assessments (e.g., automatically graded multiple choice assessments and the MyGrades feature of Blackboard), availability of lecture slides, lecture notes, instructor-created glossaries, worksheets, study guides, and instructor-created YouTube lectures. Faculty are also engaging students in research mini-projects, such as tracking the growth of marine microalgae in 8-oz water bottles that students can take home, where they are able to observe and photodocument changes in the growth of the algae. Faculty continue to use the campus as a "field site," where students may take a rock tour, conduct quantitative surveys of debris, gather temperature data, or make sky observations. In lab classes, students may "hike" to nearby Fullerton Creek where they can perform measurements of stream size and flow, and estimate urban runoff. In field labs, students are taken on whalewatching trips, and tours of local aquariums (Aquarium of the Pacific and Cabrillo Aquarium); they conduct plankton tows and measure temperature and salinity profiles at local piers and docks; they perform debris surveys, determine sand grain size, and measure beach slopes and longshore current speeds at local beaches; they follow geologic road logs to observe representative geologic features in Orange County; and they take field trips to local geologic wonderlands, including Anza-Borrego, Death Valley, Owens Valley, the Mojave Desert, and the Channel Islands.

Despite these efforts, we have much more work to do. We are taking steps to expand supplemental instruction to all of our oceanography sections, and, hopefully, in the near future, to provide supplemental instruction to our geology and earth science sections as well. We have developed directed learning activities to improve student comprehension and understanding of maps and graphs (especially the location of Antarctica, which seems to baffle some students), simple calculations (e.g., slope, pressure, wave speed), and earth system concepts (e.g., concept maps of the water cycle, carbon cycle, eutrophication). We have introduced science literacy techniques into some of our sections (e.g., Talk to the Text, Think Alouds, prefix/suffix identification). Through the District Innovation Grant and other small, we are exploring incorporation of research mini-projects into our general education curriculum as a means of engaging students. We also continue to develop iPad activities to help students to actively engage in learning during class time. We welcome suggestions for improvement and for interventions that have been shown to help students succeed in Earth Science.

Short-Term Goal 2: *Increase the number of Earth Science/Geology majors to an average of 15 students annually.*

Achievement of this goal has not been realized, but we have made progress, notably, in the creation of an Earth Science Associates of Science (AS) degree aimed at future teachers. The degree has been approved at all levels of the college and district, and awaits state-approval. Paperwork for state approval was submitted in September 2014.

The Earth Science AS at Fullerton College introduces students to the multidisciplinary field of Earth Science. It aims to prepare students for a broad range of Earth Science-related careers, including K-12 science education, environmental monitoring, environmental policy making, environmental law, natural resources management, sustainable business, and science journalism, among others. The Earth Science AS degree provides a balanced and flexible offering of topics within the Earth Sciences that allows students to tailor the degree to their specific academic goals and interests, and exposes students to a number of critical science-related problems with social and personal dimensions, including natural disasters, climate change, resource limitation, and pollution.

The Earth Science A.S. was developed in collaboration with Cal State University, Fullerton (CSUF), who began to offer an Earth Science B.A. in 2012. Students who complete the Earth Science A.S. at Fullerton College will be have completed some of the lower-division degree requirements at baccalaureate institutions, and be prepared for studies in majors such as Earth Science, Earth Systems Science, Environmental Science and Policy, Geology, Geophysics, Geoscience Education, and Geoscience, among others. The Earth Science A.S. also satisfies many academic and career choices for students not transferring to a baccalaureate institution.

We expect that demand for the Earth Science A.S. will mirror demand at CSUF, where approximately 40 students have declared Earth Science as their major in the two years since the degree was first offered. We also expect that the number of majors in Earth Science will continue to increase in the coming decades. Demand for STEM teachers continues to grow, especially in view of national initiatives to increase the number of STEM teachers (e.g., Educate to Innovate, 100Kin10, Change the Equation, US2020). These efforts have set a target of 1 million additional STEM teachers by 2022. In addition, according to the Bureau of Labor Statistics (2012), job growth in the geosciences is expected to average 16% from 2012-2022, higher than the national average for all job occupations (11%), and higher than the growth expected in the life, physical, and social sciences (10%). Thus, while we have not yet met our goal of 15 majors annually, we have made substantial progress.

Long-Term Goal #1: *Expand the Earth Science "museum" to attract majors, provide informal education to community members, and create a resource for campus events, such as Kindercaminata, Smart Start Saturday, Career Day, and other events where K-12 students, FC students, and community members might be present.*

We continue to work towards a more visible and engaging display of Earth Science materials. Thanks to a student volunteer, we have been able to update the Geology display cases on the second floor of the 600 building. Student volunteers have also established a 120-gallon algae "bioreactor" for exploration and research of the potential use of marine algae for biofuels. The bioreactor is on display in the science display room on the first floor of the 400 building. This bioreactor serves both as an incubator for our nascent undergraduate research efforts, and for materials used in our lecture courses. Within the science display case, we have placed a television monitor that displays a continuously running powerpoint slide show on undergraduate research efforts within the department. This display has attracted more than dozen students to our program, and several of them have participated in some aspect of our research efforts. Because of a grant from the Metropolitan Water District of Southern California, we were able to employ several students over a two-year period to investigate the use of water for landscape maintenance by hundreds of households, and explore the reasons that homeowners are resistant to replacement of their lawns with drought-tolerant plants. Students assisted in creating a booklet, *The Simple Way to Replace All or Part of Your Lawn with California-Friendly Plants*, which has been distributed by students to hundreds of homeowners. Students also helped produce a 10-minute video on lawn replacement, *No Water, No Lawn*, which can be viewed on YouTube (https://www.youtube.com/watch?v=8l-KiL3smz4&list=UUCCHehc5VdSGrTAVHOG3R4w). We also note and greatly appreciate the efforts of the college administration, the Fullerton College Centennial Committee, the Art Department faculty and students, and the Natural Sciences faculty in supporting and creating the first installment of the geologic history of the world mural, representing Earth's history from Earth's formation to a period prior to the Cambrian explosion.

Our department continues to support the Engage in STEM project, acting as mentors for students, and hosting events, such as geology hikes, biofuels and plankton workshops, and whalewatching trips. The department continues to support collegewide events, and, in doing so, to educate students, staff, faculty, administrators, and the community in various Earth Science topics. Department faculty members have played a central role in the college's Great Shakeout, held every year. Faculty handed out water conservation literature and native plant seeds during Worldfest. The department continues to collaborate with CSUF through mutual grant proposal opportunities, by teaching on their campus, giving seminars, or participating in the Geology Undergraduate Research Day. Faculty in our department also lecture in assisted living facilities,

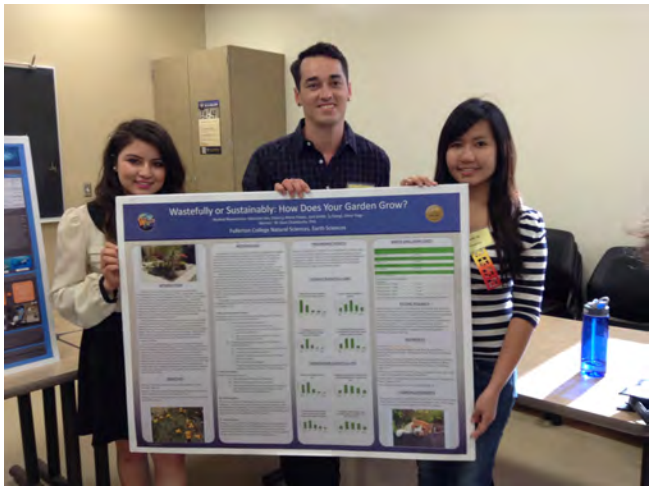
and on cruise ships, promoting Earth Science, and representing Fullerton College. The department has increased its efforts to obtain external funds, and will; continue these efforts to increase opportunities for students to engage in research.

Nevertheless, some aspects of our long-term goals remain unfulfilled. Due to a lack of funding, we have been unable to increase the number of display cases in the 600 building. Due to the lack of a classified staff position (the Earth Sciences Lab Clerk), the Geology storage room (600 building) and the Oceanography storage room (400 building) remain disorganized and ill-maintained, making it difficult to find materials for use in campus events, such as the Natural Sciences Open House, and to rotate displays to generate interest. We also note that the Natural Sciences 400-building mural is incomplete, representing only one part of what was envisioned to be a three-part mural. We propose a college-wide effort to fund completion of the mural, in collaboration with the Art Department.

Long-Term Goal #2: *Establish undergraduate research as part of the department curriculum as a means to exceed the peer average in retention and success and substantially reduce the achievement gap.*

Since 2005, the department has offered research experienced to interested undergraduate students. Since that times, students have participated in a number of projects, including maintenance and monitoring of a reef tank, and weekend watershed science experiences. As a result of our ongoing commitment to undergraduate research, we're happy to report that we have made significant progress towards incorporating research practices into departmental curriculum. This effort has taken place on two fronts: 1) establishment of independent undergraduate research project opportunities for science majors and science-interested students; and 2) introduction of research mini-projects for students (mostly non-science majors) into the curriculum of general education courses.

Independent research projects undertaken by students within the department include water conservation studies, algae biofuels research, and marine debris studies. The first project, nicknamed The Water Project, received $10,000 funding from the Metropolitan Water District of Southern California (MWD) as part of a World Water Forum Grant, an effort to improve water conservation worldwide through engagement of colleges, including community colleges. Over a period from 2012-2014, at least 10 students participated in some aspect of a project to develop scientific and resource tools to help homeowners replace their lawns with drought-tolerant plants. Students conducted and summarized surveys on student and homeowner attitudes towards water conservation, and assisted in the production of a 23-page booklet and 10-minute video on lawn replacement. As part of a grant to Dr. Jo Wu, Professor, Biological, student research on algae biofuels was established in Fall 2012 under the moniker, The Algae Project. Since that time, six students have participated in efforts to establish and monitor a large-volume algae bioreactor, and to conduct small-scale experiments on conditions that promote the production of lipids in algae. The Marine Debris Project, an effort to quantify the types and amounts of debris on the foreshore and backshore of local beaches, has attracted a few interested students, but only one student has participated to date.



As a result of these independent undergraduate research efforts, and the external funding that supported them, tools and resources have become available to incorporate mini-projects into the curriculum of some of our courses. Students in oceanography lecture courses work in teams to perform debris surveys using transect methods in the Quad, and report on the results in class. Students are introduced to seawater chemistry by mixing salts with 8-0z bottles of distilled water, and testing the salinity using salinometers. These miniature oceans-in-a-bottle are then enriched with "fertilizer" and inoculated with microalgae so that students may observe over the course of a couple weeks the growth of algae at home in a location that receives sunlight. Students record their observations and take pictures, and send them to the instructor via

email for discussion in class. During summer classes, students in our Geology of the OC Area course take a short hike to nearby Fullerton Creek where they measure and record stream dimensions and flow. These and other mini-projects, including weather monitoring, on-campus urban heat island studies, plankton identification and counting, marine mammal and bird surveys, introduce students to the scientific method, and allow them to experience scientific inquiry firsthand. While it remains to be seen if these mini-projects translate into increased rates of retention or success, their incorporation into the general education curriculum is a step we believe is important to helping students develop critical thinking skills, and to developing an understanding of the nature of science. It is our hope to obtain institutional resources to continue and expand these efforts, especially as some of these projects require consumable supplies (salts, water bottles, filters), and a lack of sufficient tools (e.g., flow meters, plankton nets, salinometers) limits expansion to additional sections. We have included this request in our SAP.

One major limitation to undergraduate research efforts and incorporation of research into the curriculum is a lack of classroom space dedicated to undergraduate research. Prior to construction of the new 400-bulding, the Native Plant Garden Annex served as a place for students (and classes) to carry out simple experiments, and to engage in research. The greenhouse served for studies of acid rain, and the aquaculture lab housed a 100-gallon coral reef tank. This area became a temporary storage area during construction of the new building, and because of modifications required for construction, this area no longer has running water. In addition, termite damage has weakened the structure of the aquaculture lab, and broken glass panels and an inoperable heating/cooling system in the greenhouse renders this area unusable. We have begun conversations with the College's Construction Department to repair the greenhouse and reconstruct the aquaculture lab, and we have prepared a separate document (available on request) with a more detailed explanation of the use of this area. We include an estimate of the cost of renovation here as a means for stimulating a division- and college-wide conversation on this space.

5.3 How did you measure the level of success and/or progress achieved in the goals listed above?

Progress or lack of progress towards Goal 1 depends directly on the bottom line, that is, the rates of success and retention of students in our classrooms. However, until we can get a better description of the kinds of students enrolled in our courses (i.e., their college readiness), we will likely never know if we are making true progress. The metric of success and retention depends on the preparedness of the populations entering our classrooms, and our efforts to recognize and adapt to the degree of preparedness.

The establishment of a new Earth Science AS and its approval at the college and district level demonstrates progress towards Goal 2. Once state approval is granted, we can begin to market this degree and attract students.

5.4 Provide examples of how the goals in the last cycle contributed to the continuous quality improvement of your program.

Awareness of low rates of success, particularly among African Americans and Hispanics, brought a greater focus on the needs of these students, and how we may help them. This awareness resulted in diversification of teaching methods, and greater attention to culturally relevant examples of Earth Science processes, such as volcanoes in Mexico and Japan, earthquakes in South America, great white sharks in South Africa, or fossil finds in China. Oceanography faculty frequently invited student athletes to visit during office hours, and these discussions yielded helpful insights into the challenges of succeeding in academics and in sports.

Implementation of active learning activities using iPads resulted from a desire to shift from a largely lecture-based curriculum in oceanography to a student-centered one. Previous efforts involving out-of-class homework assignments frequently resulted in students copying from each other (facilitated by texting, as one instructor observed on the quad), or simply non-completion of the assignment. In-class activities using iPads permit student pairs to work together, to teach each other, and to email their completed assignments to the instructor from their desktop. In this way, we ensure time on task, allow for immediate feedback (end-of-activity review and discussion), and help students build confidence in their ability to complete work.

5.5 In cases where resources were allocated toward goals in the last cycle, how did the resources contribute to the improvement of the program?

The previous program review cycle allowed us to purchase 25 iPads that are finally, as of Fall 2014, being introduced in a few sections of oceanography classes. At the time of our previous program review, the iPad mini had not been invented. Subsequent to awarding of funds in Spring 2012, we requested purchase of the new iPad minis (introduced January 2012), but were denied because we did not request them in our program review. Thus, though we might have been able to purchase 35 iPad minis (for use in our sections of 100 students), we could not. The 25 iPads were delivered in October 2013 so we were not able to use them in Fall Semester, and spent Spring 2014 developing curriculum using iPads and testing them in a few classes. Through various grants, we have now been able to cobble together 45 iPads for student use (25 regular iPads, 20 iPad minis).

Deployment of iPads in the classroom has been met with complete satisfaction among nearly all students. Two adult learners struggled to use them at first, but since have become adept at the technology. Among 18-20 year olds, there have been no technical problems using the iPads. Indeed, they use technology as naturally as fish swim in water. iPads have been used to complete short surveys and quizzes in Google Forms and Blackboard; to calculate household water use using online water use calculators; to practice Talk to the Text and Think Alouds using iBooks, to email science literacy assignments to the instructor; to watch short instructional videos on YouTube; and to research the effects of the drought on California.

This resource energizes the classroom and appears to increase student engagement with the course materials. We lack sufficient data to determine whether this engagement yields increases in exam scores and SLO achievement, but we will continue to monitor these metrics and will conduct end-of-semester surveys to determine the degree to which this resource contributes positively to student learning.

5.6 If funds were not allocated in the last review cycle, how did it impact your program?

Though requested, supplemental instruction was not allocated in the last program review cycle. The ongoing poor performance of students in Earth Science classes, despite diversification of teaching methods, suggests that other interventions are needed. The success of supplemental instruction in other departments, such as chemistry and nutrition, serve as good examples of the value of supplemental instruction in science. Through the Innovation Grant, we have been able to implement an ad-hoc supplemental instruction effort in one oceanography section, but we clearly need training in supplemental instruction and we need additional supplemental instruction leaders. Recently, we were recently granted two supplemental instruction leaders for oceanography and one for geology in Spring 2015. Our goal, however, is to connect a supplemental instruction leader to each full-time instructor in our department, so that we can provide supplemental instruction to students in oceanography, geology, earth science, and meteorology courses.

6.0 Strategic Action Plans (SAP) [formerly called Goals (6) and Requests for Resources (7)]

Using the tables below, list the strategic action plans (SAPs) for your program. These plans should follow logically from the information provided in the self-study. Use a separate table for each SAP.

SAPs for this three-year cycle:

STRATEGIC ACTION PLAN # 1	
Describe Strategic Action Plan: (formerly called short-term goal)	Using Supplemental Instruction, the Earth Sciences department will address the needs of underprepared students in an effort to increase rates of course retention and success.
List College goal/objective the plan meets:	College Goal #1: Fullerton College will promote student success. Objective #1: Address the needs of underprepared students. Objective #2: Increase course retention and success.
Describe the SAP: (Include persons responsible and timeframe.)	This SAP targets underprepared students. Chamberlin has prepared an online survey in Google Docs that permits students to anonymously provide demographic information and basic skills status. Using iPads, we will implement this survey at the beginning of the semester in Spring 2015 (and thereafter) in all of our general education sections (oceanography, physical geology, earth science) to gain insights into the percentage of underprepared students enrolled in our classes. In classes with a high percentage of underprepared students (the exact percentage TBD), we will implement directed learning activities (DLAs) aimed at improving skills in science reading, simple math, map and graph interpretation, science writing, critical thinking, and habits of mind (Chamberlin, Heath, Lozinsky, and Willis). These DLAs will be the focus of SI sessions, and students will be strongly encouraged to attend SI sessions to get help completing the DLAs. We will start with a few activities in Spring 2015, and work towards a set of a dozen activities by Spring 2016. This effort will require four SI leaders, and sufficient iPads to complete a classroom set (50 iPads), including iPads for instructor use. By focusing on sections with underprepared students, we can more easily monitor the effectiveness of the DLAs, and make changes, as necessary. We will pool our data on assignment completion rates, and assignment grades, and compare them to sections where DLAs were not implemented (if applicable). This SAP relies on the assumption that most college-ready students have the skills (and motivation) to be successful, and that DLAs are not necessary to their success (an assumption we can test). A focus on sections with large percentages of underprepared students will lead to a more efficient and effective use of instructor time and resources designed to improve success in

	underprepared students. If a large percentage of underprepared students exists in all sections, then we may need to modify this SAP All full-time faculty will participate in this SAP with the Department Coordinator acting as the lead. We propose incorporating SI into at least two sections in Spring 2015, and hope to sustain a 3-year effort with four SI leaders thereafter.
What *Measurable Outcome* is anticipated for this SAP?	An increase in the rates of success and retention in Earth Science courses over a three-year period.
What specific aspects of this SAP can be accomplished without additional financial resources?	We can implement the demographics/preparedness survey, and we can create DLAs for students, but without support for SI, we believe this effort will not yield the results we desire.

If additional financial resources would be required to accomplish this SAP, please complete the section below. Keep in mind that requests for resources must follow logically from the information provided in this self-study.

Type of Resource	Requested Dollar Amount	Potential Funding Source
Personnel 4 student SI leaders @$11/hr (including benefits) for 6 hrs/week for 14 weeks/semester x 2 semesters/yr x 3 years	**$22,200**	Si Initiative, Basic Skills, College Planning & Budget Steering Committee
Facilities		
Equipment 4 instructor iPads 5 student iPads (to bring our total to 50)	**$5300**	College Planning & Budget Steering Committee
Supplies		
Computer Hardware		
Computer Software		
Training		
Other		
Total Requested Amount	**$29,200**	

STRATEGIC ACTION PLAN # 2	
Describe Strategic Action Plan: (formerly called short-term goal)	The Earth Sciences Department will establish an Earth Science Lab Clerk position to organize, maintain, repair, and distribute the equipment and supplies necessary for instruction.
List College goal/objective the plan meets:	College Goal #1: Fullerton College will promote student success. Objective #1: Address the needs of underprepared students. Objective #2: Increase course retention and success. Objective #3: Increase the number of degrees. Objective #4: increase the number of transfers College Goal #2: Fullerton College will strengthen connections with the community. Objective #2: Strengthen partnerships with local feeder schools and universities. Objective #3: Increase funding capabilities of the college. Objective #5: Increase engagement of the college with the community through college events, community service, and other partnerships.
Describe the SAP: (Include persons responsible and timeframe.)	The Earth Sciences Department provides instruction to more students than any other department in the Natural Sciences Division with 3439 students enrolled in 2013-2014. Unlike other large departments in the division (namely, Biology, Chemistry, and Physics), the Earth Sciences Department has no staff to assist with the organization and maintenance of the hundreds of pieces of classroom, field, and laboratory equipment and materials, listed in Section 2.6 . The department has requested a staff position in every program review since the 1990s, yet our request has gone unanswered. For the past five years, we have relied on student volunteers and student hourlies (hired through external funding) working 10-15 hours per week to assist in the organization and maintenance of equipment and supplies. However, many badly needed duties have not been performed, including maintenance, calibrations, minor repairs, and cataloguing of new equipment. In addition, instructors have no assistance preparing, setting up, deploying, and restoring equipment and materials in the classroom or laboratory, as is provided in three other major departments in the division. The rapid expansion of equipment and supplies in our department has been necessitated because of changes in classroom pedagogies (flipped classrooms, active learning, inquiry-based learning, etc.), increases in the number of lab and field sections, and increases in the number of adjuncts, who often require their own set of equipment to take into the field. Fortunately, we have been able to accomplish growth in equipment and materials because of funding provided as a result of our previous program review, an innovation grant from the district, and external funding. However, the amount of

	equipment and supplies, their organization and maintenance, their calibration and repair, their deployment and storage, a recordkeeping of their service and repair, and an ability to share their use among instructors and class sections has become unmanageable. If a request can be turned into a plea, then after more than 15 years of asking, this request is a plea. All four full-time faculty in the department will participate in the hiring of the Earth Sciences Lab Clerk, once permission for the position has been granted. We see this need as immediate, and propose hiring a person with a July 1, 2015, start date.
What *Measurable Outcome* is anticipated for this SAP?	1. Addition of a classified staff person to the Earth Sciences Department. 2. Organization and cataloguing of all equipment and supplies used by Earth Science faculty, including adjuncts. 3. Deployment of a checkout system for equipment used by faculty, including adjuncts. 4. Expansion of instrument-based activities to more sections of Earth Science courses. 5. An increase in the rates of success and retention in Earth Science courses over a three-year period.
What specific aspects of this SAP can be accomplished without additional financial resources?	Without funding, this SAP will not happen.

If additional financial resources would be required to accomplish this SAP, please complete the section below. Keep in mind that requests for resources must follow logically from the information provided in this self-study.

Type of Resource	Requested Dollar Amount	Potential Funding Source
Personnel 50% time Earth Science Lab Clerk, 9 months	**$1507-$1842** per month (50%, 9 months)	College Administration, District
Facilities		
Equipment		
Supplies		
Computer Hardware		
Computer Software		
Training		
Other		
Total Requested Amount	**$13,563-$16,578 annually**	

STRATEGIC ACTION PLAN # 3	
Describe Strategic Action Plan: (formerly called short-term goal)	Using instrument-based activities, and incorporating research mini-projects into the GE curriculum, the Earth Sciences Department will increase rates of course retention and success.
List College goal/objective the plan meets:	College Goal #1: Fullerton College will promote student success. Objective #1: Address the needs of underprepared students. Objective #2: Increase course retention and success.
Describe the SAP: (Include persons responsible and timeframe.)	The Earth Sciences Department will expand instrument-based activities and research mini-projects into more sections of its courses. The curriculum already exists for these activities, but the tools and resources for expanding into other sections (including those taught by adjuncts) and additional sections (due to expansion of course offerings) are not available. We propose expanding the "algae-in-a-bottle" project to six oceanography sections (versus 1 currently), necessitating resources to regularly purchase salts and 300, 8-oz bottles of distilled water, additional salinometers (15), additional thermometers (40), and equipment for measuring algae biomass (i.e., fluorometers) so that pairs or teams of four students can prepare seawater. We propose improving high-performing ocean field labs with the purchase of new plankton nets (to replace aging and defunct ones), the purchase of additional microscopes (similar to an existing 6 dissecting microscopes so that each student in a field lab has access to a microscope), the purchase of Vernier LabQuest instruments that inferface with iPads, and the purchase of field profiling temperature/salinity/dissolved oxygen meters (so that these instruments are available to adjunct sections). We propose improving high-performing geology labs with the addition of more sand sieves (to replace defunct ones), and additional Fullerton quadrangle topo maps (to permit more students to work with maps). We propose expanding watershed activities to more geology sections, necessitating the purchase of two additional flow meters. Until we are able to hire an Earth Science Lab Clerk, we request the hiring of two student hourlies to distribute tools and supplies at the beginning of class, and collect it at the end of class. Hourlies will also maintain the algae bioreactor. Chamberlin and Heath will be responsible for coordinating oceanography courses, Lozinsky will be responsible for coordinating Physical Geology courses, and Willis will be responsible for coordinating Earth Science Courses. The Department Coordinator will provide overall leadership on the SAP.

What *Measurable Outcome* is anticipated for this SAP?	An increase in the rates of success and retention in Earth Science courses over a three-year period.
What specific aspects of this SAP can be accomplished without additional financial resources?	Without additional funds, the incorporation of instrument-based activities and mini-projects will be limited to three oceanography sections, and 1 summer geology section. While rates of success and retention may be improved in these sections, it will not be sufficient to overcome the steady decline observed over the past 18 years.

If additional financial resources would be required to accomplish this SAP, please complete the section below. Keep in mind that requests for resources must follow logically from the information provided in this self-study.

Type of Resource	Requested Dollar Amount	Potential Funding Source
Personnel 2 student hourlies @$11/hr (including benefits) for 6 hrs/week for 14 weeks/semester x 2 semesters/yr x 3 years	**$11,088**	College Planning and Budget Steering Committee
Facilities		
Equipment 1. 2 x handheld fluorometers, $3270 ea 2. 3 x field temp/sal/ox meters, $2000 ea 3. 2 x flow meters, $1200 ea 4. 2 x plankton nets w flow meters, $1100 ea 5. Weather station, $1500	**Total: $18,640** Subtotals 1. $6540 2. $6000 3. $2400 4. $2200 5. $1500	College Planning and Budget Steering Committee
Supplies 1. 12 x LabQuest sensor interface $365 each with 12 wireless temp probes ($85 ea), 12 salinity probes ($110 ea), 12 wireless pH sensors ($115 ea), 2 PAR light sensors ($220 ea), 2 colorimeters ($135 ea), 2 oxygen probes ($430) 2. 18 x dissecting scopes, $200 ea	**Total: $19,975** Subtotals 1. $9230 2. $3600 3. $2250 4. $1200 5. $1050 6. $800 7. $720 8. $525 9. $160	College Planning and Budget Steering Committee

3. 15 x handheld salinity monitors, $150 ea 4. 24 x field binoculars, $50 ea 5. 6 x stainless steel sieves for sand grain analysis, $175 ea 6. 40 x digital pocket test thermometers, $20 ea 7. 36 x 48-bottle cartons of 8-oz distilled water @$20/carton 8. 15 x 7.5-minute (1:124,000), Fullerton Quadrangle maps, $35 ea (mytopo.com) 9. 4 x Instant Ocean Sea Salt, 160, gallon, $40		
Computer Hardware		
Computer Software		
Training		
Other		
Total Requested Amount	**$49,703**	

STRATEGIC ACTION PLAN # 4	
Describe Strategic Action Plan: (formerly called short-term goal)	By offering undergraduate research opportunities, the Earth Sciences department will increase the number of majors, transfers, and certificates in Earth Science, and other STEM disciplines.
List College goal/objective the plan meets:	College Goal #1: Fullerton College will promote student success. Objective #3: Increase the number of degrees. Objective #4: increase the number of transfers College Goal #2: Fullerton College will strengthen connections with the community. Objective #2: Strengthen partnerships with local feeder schools and universities. Objective #3: Increase funding capabilities of the college. Objective #5: Increase engagement of the college with the community through college events, community service, and other partnerships.
Describe the SAP: (Include persons responsible and timeframe.)	This SAP targets Geology, and Earth Science majors, STEM majors in other departments and divisions, and science-interested students. By offering research opportunities in oceanography, geology, and earth science, we train the future STEM workforce, and provide students with a unique opportunity to engage in research at a community college. Our goal is to expand our capability to mentor students, and obtain greater support for research activities, so that more students may take

	advantage of research opportunities. As a capstone to their research, students will participate in the Natural Sciences Undergraduate Research Symposium, and may submit posters for presentation at scientific conferences in Southern California, including the Southern California Conference for Undergraduate Research, and the Southern California Academy of Sciences annual meeting. By offering students an opportunity to jump start their scientific careers, we hope to attract a greater number of majors, increase the number of Geology and Earth Science degrees attained, and increase the number of transfers from our department to four-year institutions. The Earth Sciences Coordinator will spearhead the effort until a STEM Coordinator can be hired. Our Vision: The Earth Sciences department proposes to institutionalize and strengthen existing undergraduate research programs and opportunities through the Natural Sciences Division, and to create new programs to expand undergraduate research experiences and opportunities for our students. We also propose to integrate our undergraduate research efforts under the broad umbrella of sustainability, the practice of maintaining a harmonious coexistence with our natural environment in a manner that ensures the survival and well-being of future generations. Sustainability incorporates ecological, economic, and social principles that act to permit the sustainable functioning of the natural systems on which humans depend. Our efforts mirror similar efforts underway at California State University, Fullerton (CSUF), under their Center for Sustainability (sustainability.fullerton.edu). We propose creation of a similar center at Fullerton College, and call this effort the Fullerton College Sustainability Research Center. As a foundation for these efforts, we envision the following: 1. We envision an undergraduate research program that provides world-class science education opportunities to a diverse community of students, that inspires lifelong learning in science and technology, and that prepares students for careers and workforce opportunities in science and technology in the 21st century. We are committed to accessibility, academic excellence, and success for all students. 2. We envision an alliance of our diverse scientific research interests to provide opportunities for all students to take part in or experience undergraduate research. We are committed to providing sustainability-related research opportunities to majors and non-majors in all of our disciplines, including Anatomy, Physiology, and Microbiology, Astronomy, Biology, Chemistry, Earth Sciences, Environmental Sciences, Health Sciences, Horticulture, Nutrition and Foods, and Physics.

	3. We envision an expansion of degrees and certificates, and an increase in transfers in the sciences as a result of our commitment to providing undergraduate research opportunities. We are committed to continuous quality improvement in undergraduate research opportunities. Our Goals and Benchmarks: A strengthened and expanded undergraduate research focus in the Earth Sciences Department and Natural Sciences Division at Fullerton College will: 1. Meet a growing need for a general public capable of understanding the science behind global environmental challenges, as evidenced in improvements in science literacy and student success in general education science courses incorporating research; 2. Reduce the achievement gap in general education science courses, as evidenced by a narrowing of rates of success among different ethnic groups; 3. Boost achievement among science majors, as evidenced by increases in the number of science majors, increases in their rates of success, and increases in their rate of transfer to colleges and universities. 4. Meet a growing demand for students trained in green industries, as evidenced by an increase in existing certifications, such as those offered in horticulture and biotechnology, and future certifications, including algal biotechnology, aquaponics, and marine technology. 5. Attract greater recognition and greater community involvement for the Natural Sciences Division, as evidenced by increases in external funding, and increases in positive news and media items about the division. Our Proposal 1. Renovate the Nature Garden and Annex area to modern building code standards, and use this area to carry out curricular and extracurricular undergraduate research projects that are not possible within the confines of the 400 building (due to limited space). 2. Create an Undergraduate STEM Research Coordinator, to establish, organize, and manage a Fullerton College Sustainability Research Center under which undergraduate research activities can be coordinated, assessed, and continuously improved; through which external funding efforts that support undergraduate research can be spearheaded and coordinated; and to coordinate and host the long-standing Natural Sciences Seminar Series. 3. Continue to collaborate with CSUF's Center for Sustainability to develop and coordinate curriculum, certificates, degrees, internships, and external funding; to support outreach activities with local high

	schools, and K-12 organizations (e.g., Fullerton School District Science Advocacy Council), and seek new partnerships with industry and professional organizations. 4. Create new vocational certificate programs to train future science technicians and sustainability workers; create new courses focused on undergraduate research in a variety of disciplines, including seminars; and explore associate degree options for sustainability, in coordination with similar efforts at CSUF. The Undergraduate STEM Research Coordinator will carry out the following duties: 1. Identify Geology/Earth Science majors and develop a database for tracking them. 2. Develop contact folders and meet with majors once a semester. 3. Assist majors with educational plan, resume, and statement of purpose. 4. Match majors with faculty mentors for increasing connectivity to college. 5. Identify scholarship, internship, and employment opportunities in Earth Science. 6. Develop an "environmental scan" (job market) for LA/OC. 7. Identify, promote, and assist undergraduate research opportunities. 8. Assist with applications for scholarships and internships. 9. Act as a liaison between the Earth Sciences and Engage in STEM offices. 10. Act as liaison with CSU/UC science departments 11. Develop funding opportunities for Earth Sciences 12. Communicate and market the Earth Sciences program to the campus and community
What *Measurable Outcome* is anticipated for this SAP?	1. An increase in the number of majors. 2. An increase in the number of Earth Science AS and Geology AS-T degrees awarded. 3. An increase in the number of majors transferring from our department to a four-year institution.
What specific aspects of this SAP can be accomplished without additional financial resources?	None, unless we can obtain external funds.
If additional financial resources would be required to accomplish this SAP, please complete the section below. Keep in mind that requests for resources must follow logically from the information provided in this self-study.	

Type of Resource	Requested Dollar Amount	Potential Funding Source
Personnel STEM Coordinator @45/hour for 6 hrs/week for 16 weeks/semester for 2 semesters/year for 3 years	**$25,920**	College Planning & Budget Steering Committee
Facilities Renovation of the greenhouse, demolition and reconstruction of the Annex building, and repair of electrical and plumbing to the native plant garden.	**$120,000** (estimate provided by Pat McGrew, Professor, Construction Technology)	District
Equipment		
Supplies		
Computer Hardware		
Computer Software		
Training		
Other		
Total Requested Amount	**$145,920**	

STRATEGIC ACTION PLAN # 5	
Describe Strategic Action Plan: (formerly called short-term goal)	The Earth Sciences department will expand outreach efforts to attract more students to our programs, to educate students and the public about natural disasters and human impacts on our planet, to build relationships with local K-12 institutions, and to strengthen ties with local community and business partners, including potential sources of funding.
List College goal/objective the plan meets:	College Goal #2: Fullerton College will strengthen connections with the community. Objective #2: Strengthen partnerships with local feeder schools and universities. Objective #3: Increase funding capabilities of the college. Objective #5: Increase engagement of the college with the community through college events, community service, and other partnerships.
Describe the SAP: (Include persons responsible and timeframe.)	This SAP targets incoming and existing students, the greater college community, local K-12 institutions, local community and business partners, and the public. We propose to strengthen our ability to provide outreach by purchasing a departmental laptop computer, an HD-LCD projector, and a portable screen that will be available to all departments in the division. We propose to coordinate completion of

	the Natural Sciences Building mural. And we propose to develop a brochure and video on the Earth Sciences department, its courses and degrees, and its educational and career offerings. All faculty will participate in this effort. We propose to continue ongoing outreach efforts, such as the Great California Shakeout and Worldfest, and to maintain collaborations with nearby community colleges (especially Santa Ana College and Orange Coast College), higher education institutions (i.e., CSUF and UCI), the Fullerton School District Science Advocacy Council, the Fullerton College Foundation, and professional organizations, such as the Southern California Geological Society and the National Association of Geoscience Teachers, and other partners. We also propose to work with the Art Department to plan and complete the remaining two sections of the 400 building mural. The Earth Sciences Coordinator will take the lead on this project, in collaboration with science faculty involved in the first mural.
What *Measurable Outcome* is anticipated for this SAP?	1. An increase in the number of majors. 2. An increase in the number of Earth Science AS and Geology AS-T degrees awarded. 3. An increase in the number of majors transferring from our department to a four-year institution.
What specific aspects of this SAP can be accomplished without additional financial resources?	The department will continue to collaborate with local institutions and partners, and will continue to seek external funding. Without additional resources, the Geologic Timeline mural will remain incomplete, and efforts to provide community outreach external to the college will be limited.

If additional financial resources would be required to accomplish this SAP, please complete the section below. Keep in mind that requests for resources must follow logically from the information provided in this self-study.

Type of Resource	Requested Dollar Amount	Potential Funding Source
Personnel		
Facilities		
Equipment Portable LCD HD Projector	**$1000**	College Planning & Budget Steering Committee
Supplies Portable Projection Screen ($200) Mural Supplies ($4000)	**$4200**	College Planning & Budget Steering Committee

Computer Hardware Apple Macbook Pro	**$3000**	College Planning & Budget Steering Committee
Computer Software Microsoft Office ($100) Apple Keynote ($20)	**$120**	College Planning & Budget Steering Committee
Training		
Other		
Total Requested Amount	**$8320**	

STRATEGIC ACTION PLAN # 6	
Describe Strategic Action Plan: (formerly called short-term goal)	The Earth Sciences department will maintain or expand the number of sections of field courses to meet growing demand of majors and non-majors for field-experience classes. No Student Left Inside!
List College goal/objective the plan meets:	College Goal #1: Fullerton College will promote student success. Objective #1: Address the needs of underprepared students. Objective #2: Increase course retention and success. Objective #3: Increase the number of degrees. Objective #4: increase the number of transfers.
Describe the SAP: (Include persons responsible and timeframe.)	This SAP addresses a long-standing need in the Earth Sciences department for 1-2 twelve-passenger vans to transport students to field sites. The current vans that are available are aging and need replacement. Currently, students must provide their own transportation to oceanography lab field sites (local beaches), and geology field course sites in a variety of distant locations. Ideally, we would have two vans available with video capability so that students could learn “on the road” as a group. With two vans, an entire section of 24 students could be accommodated.
What *Measurable Outcome* is anticipated for this SAP?	1. An increase in the number of majors. 2. An increase in the number of Earth Science AS and Geology AS-T degrees awarded. 3. An increase in the number of majors transferring from our department to a four-year institution.
What specific aspects of this SAP can be accomplished without additional financial resources?	We have reduced the number of field outings due to an inability to provide transportation. Without new vans, we will not be able to maintain or expand field-course offerings.

If additional financial resources would be required to accomplish this SAP, please complete the section below. Keep in mind that requests for resources must follow logically from the information provided in this self-study.

Type of Resource	Requested Dollar Amount	Potential Funding Source
Personnel		
Facilities		
Equipment		
Supplies		
Computer Hardware		
Computer Software		
Training		
Other Two 12-passenger vans with video capability @$35,000 ea	$70,000	College Planning & Budget Steering Committee
Total Requested Amount	**$70,000**	

STRATEGIC ACTION PLAN # 7	
Describe Strategic Action Plan: (formerly called short-term goal)	The Earth Sciences department supports creation of a Campus STEM Resource Center.
List College goal/objective the plan meets:	College Goals: Goal #1: Fullerton College will promote student success. Goal #3: Fullerton College will strengthen connections with the community. Objectives: 1.1: Address the needs of under-prepared students. 1.2: Increase course retention and success. 1.3: Increase the number of degrees and certificates awarded. 1.4. Increase the number of transfers. 1.5: Increase the persistence rate of students. 3.1: Strengthen our contacts with Alumni. 3.2: Strengthen partnerships with local feeder high schools and universities. 3.3: Strengthen partnerships with local business and industry. 3.4: Increase funding capabilities of the college. 3.5. Increase engagement of the college with the community through college events, community service, and other partnerships.

Describe the SAP: (Include persons responsible and timeframe.)	The proposed Campus STEM Resource Center will need a suitable facility to house it. There are several possible locations for the Center, which include the land adjacent to the native plant garden and the former Math Lab in the 600 building. Additionally, the STEM Center will require the services of a full-time dedicated counselor and a full-time classified staff member to run the Center. The Center's staff would have the following duties: • Identify STEM majors and develop database for tracking • Develop contact folder and meet with STEM majors once a semester. • Identify potential majors and recruit them • Counsel STEM majors • Assist STEM majors with educational plan, resume, and statement of purpose. • Coordinate with Institutional Research and Basic Skills offices to identify trends and opportunities • Match STEM majors with faculty mentors for increasing connectivity to college. • Identify scholarship, internship, and employment opportunities in STEM fields • Develop "environmental scan" (job market) in LA/OC • Identify, promote, and assist undergraduate research opportunities. • Assist STEM majors with applications for scholarships and internships. • Update STEM calendar of events • Develop/Maintain/Update STEM website • Manage STEM tutors hiring/scheduling • Assist with tutoring and supplemental instruction • Develop and assist with STEM-experience activities • Act as liaison between STEM programs • Act as liaison with CSU/UC STEM departments • Coordinate STEM seminar series • Develop funding opportunities for STEM • Communicate/market STEM programs to campus and community
What *Measurable Outcome* is anticipated for this SAP?	• Increased number of STEM degrees/certificates • Increased number of STEM majors transferring • Increased recruitment of underrepresented groups to STEM majors • Increased success rate of STEM students • Increased persistence and retention of STEM students • Increased number of students attending tutoring and SI sessions • Creation of a STEM Alumni Network • Increased placement of students in research and internship

	programs • Increased opportunities for students to participate in community service • Increase the amount of grant money to support student/faculty research opportunities • Greater connectivity and partnerships with area STEM industries • More interdisciplinary coordination among STEM departments
What specific aspects of this SAP can be accomplished without additional financial resources?	This plan is highly dependent on funding and facilities.

If additional financial resources would be required to accomplish this SAP, please complete the section below. Keep in mind that requests for resources must follow logically from the information provided in this self-study.

Type of Resource	Requested Dollar Amount	Potential Funding Source
Personnel	$200,000/yr. ongoing	General Fund
Facilities	$150,000	Measure J Bond or Carryover
Equipment	$10,000	Instructional Equipment Funds
Supplies		
Computer Hardware		
Computer Software		
Training		
Other		
Total Requested Amount		

7.0 Long Term Plans

Describe the long term plans (four-six years) for your program. Please consider future trends in your narrative. (Identifying financial resources needed for these plans is optional.)

Our short-term plans drive our long-term plans, and, in fact, are one and the same. Over the short- and long-term, the Earth Science department strives: 1) to continue to address the needs of underprepared students and increase their retention and success; 2) to continue to attract more majors, award more degrees, and transfer more students; 3) to continue to incorporate diverse methods of teaching that help diverse learners succeed; 5) to continue to offer research opportunities for students; and 6) to continue to strengthen ties with the community.

Given the Environmental Scan and Workforce Board data, we expect demand for Earth Science classes to remain high. We expect to be teaching a more diverse population of students, and we expect to continue to bring more high impact teaching practices into our classrooms. We hope that new California Standards, and especially the Next Generation Science Standards, will bring better prepared students to our courses, ones who are college-ready. We expect that national demand for teachers and scientists, and increased concerns for human impacts on the planet, will generate continued interest in Earth Science and its methods. We expect that national efforts to improve preparation of next-generation scientists will provide funding

opportunities to incorporate undergraduate research at the community college level, and we will continue to seek those opportunities. We expect that heightened awareness of natural disasters and human impacts will increase the need for professionals to communicate and educate the campus and public, and we will continue to promote scientific understanding of our planet through our participation in campus and public outreach.

8.0 Self-Study Summary

This section provides the reader with an overview of the highlights, themes, and key elements of this self-study. It should not include new information that is not mentioned in other sections of this document.

The Earth Sciences department in the Natural Sciences Division at Fullerton College serves more than 3400 students annually, more than any other department in the division. The department offers an AS-T in Geology, and will soon gain state approval to offer an Earth Sciences AS degree. The department maintains an 80% retention rate, and 60% success rate, on-par with peer institutions, but these rates have declined over the past two decades. Retention and success in lab and field sections, however, remain 9% and 19% higher, respectively than lecture sections. In view of this finding, and in response to the long-term decline in retention and success, the department has aggressively diversified teaching methods, and has begun to incorporate hands-on and instrument-based activities in lecture classes. The department has also begun to offer supplemental instruction with grant funding. These efforts are severely limited, however, by a lack of funding for equipment, supplies, and personnel to maintain and expand these efforts. Since the 1990s, the department has sought a lab clerk similar to other large departments in the division. The lab clerk is needed to organize and maintain an extensive inventory of equipment and supplies. Incorporation of instrument-based activities, and expansion of undergraduate research efforts make this position even more urgent. So, too, the department needs to expand SI to address the needs of the large number of underprepared students that enroll in our courses. This two-pronged effort, diversifying teaching methods and providing supplemental instruction, requires resources for equipment and supplies, and for personnel, including the lab clerk and student hourlies. We have outlined a strategic action plan and requested funds to support these efforts. The department also maintains high visibility across campus and within the local community through participation in Engage in STEM and campus events, collaborations with K-12 and college/university partners, and work funded by external agencies. Over the long term, the department desires to increase and expand undergraduate research as a means to attract science majors, and supports efforts to renovate facilities to support such efforts.

Division Deans' or appropriate Immediate Management Supervisor (IMS)
Response Page

☐ *I concur with the findings contained in this Program Review.*

☐ *I concur with the findings contained in this Program Review with the following exceptions (include a narrative explaining the basis for each exception):*

Area of exception:

_____

_____

_____

_____

☐ *I do not concur with the findings contained in this Program Review (include a narrative exception):*

_____

_____

_____

_____