Instructional Program Review

Program Name: **Astronomy**
Program Contact: **Stanford, Darryl**
Academic Year: **2016-2017**
Status: **Submitted for review**
Updated on: **10/28/2016 06:02 PM**

1. Description of Program

Provide a brief description of the program and how it supports the college's College Mission and Diversity Statements, CSM Strategic Goals 2013/14 to 2015/16, and other Institutional Program Planning as appropriate. What is the program's vision for sustaining and improving student learning and success over the next three years?

The Astronomy Department offers the following courses in astronomy:

At the 100 level: ASTR 100 Introductory Astronomy, ASTR 125 Stars, Galaxies and Cosmology, and ASTR 115 Solar System Astronomy,

At the 200 level: ASTR 200 Introduction to Astrophysics, ASTR 203 Astroimaging Techniques, and ASTR 204 Application of Astroimaging Techniques.

The Astronomy Department also offers the following labs in astronomy at the 100 level: ASTR 101 Astronomy Lab and ASTR 103 Observational Astronomy Lab.

Taking the introductory courses and labs allows the student to get a basic understanding of the universe and all that is contained within it, as well as helping to satisfy general education requirements. More advanced students use the observatory to pursue independent research on spectroscopy, photometry, and astroimaging. All of the courses and labs are UC and CSU transferrable.

We have had the first students graduate in our Astroimaging and Observatory Operation certificate program. Three students received their certificates at the conclusion of the Spring 2016 semester. The Introduction to Astrophysics course (ASTR 200) will hopefully run in the Spring 2017 semester, concurrently with Astroimaging Techniques (ASTR 203). We have made the prerequisites corequisites for this course, in order for students to be able to take astrophysics and astroimaging concurrently with their advanced physics courses. The last time ASTR 200 was offered was in Spring 2014. It had been offered in Spring 2015 and 2016, but was cancelled due to low enrollment. We traced the low enrollment to the requirement that students must take certain Physics prerequisites. However, upon further discussion with faculty and prospective students, we have made the Physics prerequisites corequisites. We hope that this change will reflect an increase in enrollment, such that ASTR 200 will run.

The Astronomy Department is closely monitoring SLOs and will start to assess them, at least on yearly basis. This will give us an opportunity to identify and rectify any problems detected in student learning.

2. Student Learning and Program Data

A. Discuss Student Learning Outcomes Assessment

1. Reflect on recent SLO assessment results for courses and degrees and certificates offered by the program.
Specify how SLO assessment informs curriculum development and changes to curriculum.

Assessments are ongoing. Here are some results from ASTR 115 Solar System Astronomy:

SLO 1: Explain the reason for the seasons.

90% of the students got that answer correct.

SLO 2: Analyze the role of tectonics in shaping the surfaces of the terrestrial planets.

78% of the students got that answer correct.

SLO 4: Contrast the similarities and differences of the major solar system moons.

76% of the students got that answer correct.

In each case, the assessment method was a passing grade of 70% on a 50 question multiple choice exam. Apparently SLO 1, was easiest for the students, because it is not difficult for them to relate to the seasons. However, SLO 2 was somewhat more difficult, because students must first understand what the word 'tectonics' means with respect to the Earth and apply it to the other terrestrial planets. SLO 4 was also somewhat difficult, since students had to remember a number of moons as well as their characteristics. I think spending a bit more time on these topics, and discussing them in more detail, may lead to deeper understanding.

2. Comment on the success rates in the program SLOs that are aligned with specific course SLOs. What do the program SLO and course data reveal about students completing the program? Identify trends and discuss areas in need of improvement. Is the alignment between course and program SLOs appropriate and informative? Describe any additional methods used to assess program SLOs and reflect on the results of those assessments. See course-to-program SLO alignment mapping.

The students taking ASTR 203 had done photometry on different types of binary stars and exoplanets and spectroscopy on Be and carbon stars. In doing so, they had to use and control the observatory telescopes, which are a mixture of refractors and Schmidt-Cassegrain telescopes, as well as the SGS spectrograph and the SA100 diffraction grating spectroscope. They also had to understand the following image processing and spectroscopy programs: CCDSoft, CCDStack, Maxim DL, RSpec and VSpec.

These students had shown, by their reports and by my observing their progress, that they definitely mastered the necessary techniques. Due to their great success, I see no need for improvement. The alignment between course and program SLOs is definitely appropriate. We have had the first recipients of the Astroimaging and Observatory Operation certificate (AOOC) in Spring 2016.

3. For any courses in the program that satisfy a GE requirement, which GE SLOs are supported or reinforced by the course SLOs? What do assessment results for the course SLOs (and for the GE SLOs, if available) reveal about student attainment of the GE SLOs? See GE SLO Alignment Summary Report or All Courses GE SLO Alignment Data.

All of the courses that satisfy a GE requirement have SLOs that are aligned with the "Effective Communication", "Quantitative Skills", and "Critical Thinking" GE SLOs. Since success rates of students attaining the course SLOs has been high in assessments, we can conclude that these courses are indeed supporting students in attaining these three GE SLOs.

B. Student Success Indicators

1. Review Student Success and Core Program Indicators and discuss any differences in student success indicators across demographic variables. Also refer to the College Index and other relevant sections of the Educational Master Plan: Update, 2012, e.g., Student Outcomes and Student Outcomes: Transfer. Basic Skills programs should also refer to ARCC data.

Student Success Indicators

Astronomy	Success (%)	Retention (%)	Withdraw(%)
2013-14	71.6	88.6	11.4
2014-15	73.5	88.1	11.9
2015-16	76.5	90.4	9.6

College	Success (%)	Retention (%)	Withdraw (%)
2013-14	70.3	84.1	15.9
2014-15	71.1	84.8	15.2
2015-16	72.0	85.3	14.7

Math/Science	Success (%)	Retention (%)	Withdraw (%))
2013-14	65.5	80.8	19.2
2014-15	65.8	81.1	18.9
2015-16	65.4	80.8	19.2

As can be seen from the data above, Astronomy has exceeded both the retention and success figures for the Math/Science division and college for the years 2013-16. In addition, the withdrawal rate is far lower than both college and the Math/Science division.

The following are the Successful Course Completion Rates for the 2015-2016 year.

The success rate for Hispanic students taking Astronomy courses was 71.1%, while it was 54.5% for the Math/Science Division and and 63.7% for the College. The rate for White students was 79.3%, 68.6% and 75.6% respectively. Black students accounted for only 2.7% of Astronomy's total enrollment, but had a success rate of 56.7%, compared to 50.0% for Math/Science Division and 64.1% for the college. The number of Black students is unfortunately very low, as is the case all across the board for Math/Science Division and the college. However, Black students are sorely underrepresented in Astronomy. This is partly due to lack of role models as well as insufficient exposure to the science. I do, however, see many Black families coming to our planetarium shows, Project Star Gaze, and Jazz Under the Stars events. Hopefully, this exposure will help to increase the numbers. Female students account for 46.3% of the total students in Astronomy, with a success rate of 78.3%. This compares to a success rate of 68.2% for the Math/Science Division and 73.9% for the College. Overall, students are succeeding at a higher rate taking the courses the Astronomy Department offers, compared to the corresponding rates for the Math/Science Department.

Why is this so? Perhaps, students really enjoy taking these courses and as a result respond favorably. Many of them participate in our community outreach activities and also like to let their instructors know of the latest news in astronomy. This means that these students are really interested and as a result have a good success rate. They also bring their families and return again and again to our planetarium shows, our Jazz Under the Stars, and the first Friday speaker events.

2. Discuss any differences in student success indicators across modes of delivery (on-campus versus distance education). Refer to Delivery Mode Course Comparison.

The ASTR 100 online course has been successful. Over the Fall 2013, 14, and 15 semesters, the success rates are comparable: 72.8%

for the online course compared to 71.6% during AY 13-14, 73.5% during AY 14-15, and 76.5% for the traditional course during AY 15-16.

C. Program Efficiency Indicators. Do we deliver programs efficiently given our resources?

Summarize trends in program efficiency as indicated in the Student Success and Core Program Indicators (LOAD, Full-time and Part-time FTEF, etc.)

Program Efficiency Indicators

For Astronomy:

LOAD for the 2015-2016 academic year was 749.3. The success rate for the same time period was 76.5%, the retention rate was 90.4% and the withdrawal rate was 9.6%.

For the College:

The LOAD figures for the college as a whole were 498.7, for the same time period. The success rate for the College for the same time period was 72.0%, the retention rate was 85.3% and the withdrawal rate was 14.7%.

For the Math/Science Division:

LOAD for the same time period was 486.1. The success rate for the College for the same time period was 65.4%, the retention rate was 80.8% and the withdrawal rate was 19.2%.

The Astronomy Department's LOAD figures are much higher than both the College's and Math/Science departments, The success figures are higher than both the College's and Math/Science departments and the withdrawal figures are lower than both the College's and Math/Science departments. Overall, the Astronomy Department is doing very well in retaining and enabling students to succeed.

3. Additional Factors

Discuss additional factors as applicable that impact the program, including changes in student populations, state-wide initiatives, transfer requirements, advisory committee recommendations, legal mandates, workforce development and employment opportunities, community needs. See Institutional Research as needed.

We have updated our hybrid planetarium at the beginning of the Spring 2016 semester. Digital capabilities have now been upgraded to 4K resolution by RSA Cosmos. Advantages over our previous system include high resolution graphics, the ability to fly through the universe, and realistic sunrise/sunset atmospheric graphics. Our early model CHRONOS star projector has been upgraded to a CHRONOS II. Advantages are brighter sun, moon, and stars, since they are produced by LEDs rather than by bulbs. This will result in lower costs in not having to replace bulbs anymore. There have been some issues in system reliability, however the RSA Cosmos technicians have been very proactive in addressing them. Reliability has increased and we are happy with the current progress.

The enrollments for our ASTR 203 and 204 advanced astroimaging classes has been low. We are working out a plan to possibly have ASTR 203 and 204 run concurrently.`

An issue has arisen with the recent installation of bright LEDS along the CSM spine leading from the observatory. These lights protrude below the bottom of their enclosures presenting observers with a series of bright lights. The impact to the ASTR 103 observational lab is that students are having a more difficult time pointing out celestial objects in the southern part of the sky, where these lights are located. These bright lights also increase light pollution for our advanced astroimaging classes, ASTR 203 and 204. In addition, the increased light pollution is noticed by the public, when we have our Jazz Under the Stars open observatory event. We have been

working with Facilities Planning and Operations to find a solution.

4. Planning

A. Results of Program Plans and Actions

Describe results, including measurable outcomes, from plans and actions in recent program reviews.

Our FLIR camera is used in a number of demonstrations and experiments in the classroom and the lab. For instance, the camera allowed students to see themselves in the infrared portion of the electromagnetic spectrum. They were able to see the different temperatures of their hair, skin, clothes, etc. This showed them how different parts of their bodies can be at different temperatures.

We are using a new spectroscopy tool for our introductory labs. This tool includes a diffraction grating mated to a camera, with included software. This device is manufactured by RSpec and allows students to view spectra in a fun and exciting way. Students really like this visualization of emission spectra because it enables them to see that every gas has a unique spectrum, due to their unique electron configuration.

We have yet another spectroscopy tool, the LHires Lite. This spectrograph allows students to view the the sun's spectrum in high resolution. Students are able to view the sodium D lines as well as the mercury triplet lines on the sun's photosphere.

Clickers are now being used in all of our lectures, as a result of a rental agreement between the bookstore and the clicker company. Clickers are allowing us to increase student to student and faculty to student interaction. Students love using them, since it allows them to compete with their friends, as to who knows the correct answer. Faculty love using clickers because they allow them to really see if the students understand the material. It also allows faculty to hear from students, who are normally reticent to express their opinion.

B. Future Program Plans and Actions

Prioritize the plans to be carried out to sustain and improve student success. Briefly describe each plan and how it supports the CSM Strategic Goals 2013/14 to 2015/16. For each plan, list actions and measurable outcomes. Plans may extend beyond a single year. Describe the professional activities and institutional collaborations that would be most effective in carrying out the program's vision to improve student learning and success.

We are requesting one astronomy faculty member to teach introductory courses and labs and with expertise in observatory and planetarium operation. This includes, but is not limited to: Introductory astronomy lecture and laboratory; observational astronomy; study of our solar system; studies of stars and galaxies; introduction to astrophysics; astroimaging techniques and applications of astroimaging techniques. We have only one full-time faculty member and two adjuncts and we have had 1117 students during the 2015-2016 academic year. If the one full-time faculty member falls ill or is otherwise unable to fulfill instructional duties, the Astronomy program would be in peril.

The current astronomy faculty member was hired in Fall 1998 and so there has not been a new hire since then. The demand for astronomy courses continues to increase. The success rate for astronomy courses is 76.5% compared to 65.4% for the entire science division. The retention rate is 90.4% for astronomy compared to 80.8% for the division. Therefore, the addition of a faculty member to the astronomy department will positively impact the number of successful students.

In addition to the data on student success, the technology in the planetarium and in the observatory needs more oversight, service and expertise. It requires a partnership between the faculty and the technical support to keep all of the equipment at performance level all the time. This is currently proving a strain on both faculty and staff. We need additional faculty and staff to maintain the equipment the department has been entrusted with by the District and the College.

In addition, we are also requesting an additional part-time astronomy technician. The present technician has numerous duties:

attending to and the repair of the observatory telescopes and other equipment as well as troubleshooting planetarium problems and configuring new shows. The present technician also has to be available during class time to assist instructors. An additional technician would help the present one in these duties.

The Astronomy Department now has an Astroimaging and Observatory Operation Certificate (AOOC), recently approved by the California state review board. The AOOC program is designed such that, upon completion, students are qualified to operate any observatory, and apply various imaging techniques to gather and analyze astrophysical data. With minimal modification, students can apply their course load for this program toward a BS degree in astronomy or astrophysics upon transfer to any four-year institution that offers such a degree. Bay Area colleges and universities, as well as professional observatories, are in need of qualified technicians that can operate telescopes and various imaging devices to collect astrophysical data and advance the field of astronomy. For instance, a graduate of this program is well equipped to operate the telescopes at Stanford University or San Francisco State University. There is a high demand for such technicians and there are very few institutions that can train the students in this field. The College of San Mateo Astronomy Department, with its roll off roof observatory and trained staff and faculty, is in a unique position to fulfill that need.

We are removing two of our bolted planetarium seats, near the right center of the planetarium, to allow space to accommodate a wheelchair student. This will allow a wheelchair student to be able to see the front of the dome, where lectures are projected and to see the sky, when the star projector is used. Presently, a a wheelchair student sits right at the front of the class, with a table provided by DRC. This presents a problem for the student when viewing the sky, since she/he has to crane her/his neck. DRC is purchasing a table that can be hooked to a a wheelchair student's chair. This will enable that person to be able to sit in the newly allotted space. We will also need to purchase two seats to replace the bolted seats, when we do not have a a wheelchair student in class.

In addition, preliminary talks are underway in considering the feasibility of also offering an AS in Astronomy.

5. Program Maintenance

A. Course Outline Updates

Review the course outline update record. List the courses that will be updated in the next academic year. For each course that will be updated, provide a faculty contact and the planned submission month. See the Committee on Instruction website for course submission instructions. Contact your division's COI representatives if you have questions about submission deadlines. **Career and Technical Education courses must be updated every two years.**

Courses to be updated	Faculty contact	Submission month
ASTR 100	Darryl Stanford	February 6, 2017
ASTR 101	Darryl Stanford	February 6, 2017
ASTR 103	Darryl Stanford	February 6, 2017
ASTR 115	Darryl Stanford	February 6, 2017
ASTR 125	Darryl Stanford	February 6, 2017
ASTR 204	Darryl Stanford	December 2016

B. Website Review

Review the program's website(s) annually and update as needed.

Faculty contact(s) (our Astronomy tech maintains our website)	Date of next review / update
Justin Stevick	ongoing

C. SLO Assessment Contacts

Faculty contact(s)	Date of next review / update
Darryl Stanford	Fall 2016

6. Dominant Themes Summary for IPC

Briefly summarize the dominant, most important themes or trends contained in this program review, for division deans to collect and forward to the Institutional Planning Committee. What are the key program issues that matter most? (Brief paragraph or bullet points acceptable).

The dominant theme in this program review, is the hiring of another full-time faculty member and another part-time astronomy technician. We also want to expand our program and the additional staff will make this possible.