Instructional Program Review
2019/20 UPDATE

Physical Sciences

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General Information (Instructional Program Review 2019/20 UPDATE)

2019/20 Instructional Program Review

SUBMISSION INFORMATION AND UPDATES (REQUIRED)

Lead Writer: Irena Stojimirovic
Liaison: Jonathan McLeod
Department Chair: Donald Barrie
Manager/Service Area Supervisor: Dean Susan Topham

OUTCOMES AND ASSESSMENT (REQUIRED)

Form: 2019/20 Program Review Outcomes and Assessment Section (See appendix)

PROGRAM ANALYSIS FOR EQUITY AND EXCELLENCE (REQUIRED)

Form: 2019/20 Program Review Instructional Program Analysis Section (See appendix)

PROGRAM GOALS (REQUIRED)

2018/19 Goals for Physical Sciences

Develop new astronomy course- Solar System Astronomy

A new course, Solar System Astronomy, will be developed and added to the list of course offerings in the physical sciences program.

Mapping

CA- Mesa College Strategic Directions and Goals: Strategic Goal 1.1, Strategic Goal 1.2, Strategic Goal 1.4, Strategic Goal 4.1,

Institutional Learning Outcomes 2016/17: Critical Thinking

Improve student success rates in Astronomy 101

Data show relatively low rates of student success in Astronomy 101. As a way to address low success rates, astronomy faculty will engage in a dialogue specifically focused on strategies to improve success rates.

Mapping

CA- Mesa College Strategic Directions and Goals: Strategic Goal 1.1, Strategic Goal 1.2, Strategic Goal 1.4, Strategic Goal 1.5, Strategic Goal 2.1, Strategic Goal 5.1,

Institutional Learning Outcomes 2016/17: Communication, Critical Thinking

Equity

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

Mapping

CA- Mesa College Strategic Directions and Goals: Strategic Goal 1.1, Strategic Goal 1.2, Strategic Goal 1.3, Strategic Goal 1.4, Strategic Goal 1.5, Strategic Goal 1.6, Strategic Goal 2.1, Strategic Goal 2.3, Strategic Goal 2.4, Strategic Goal 3.1, Strategic Goal 3.2, Strategic Goal 3.3, Strategic Goal 4.1, Strategic Goal 4.2, Strategic Goal 5.1, Strategic Goal 5.2, Strategic Goal 6.2

Program success

Increase long-term program (astronomy) success rate.

Mapping

CA- Mesa College Strategic Directions and Goals: Strategic Goal 1.1, Strategic Goal 1.2, Strategic Goal 1.3, Strategic Goal 1.4, Strategic Goal 1.5, Strategic Goal 1.6, Strategic Goal 2.1, Strategic Goal 2.2, Strategic Goal 2.3, Strategic Goal 3.1, Strategic Goal 4.1, Strategic Goal 4.2, Strategic Goal 5.1, Strategic Goal 5.2, Strategic Goal 6.2

ACTION PLANS FOR GOALS (REQUIRED)

Actions

2018/19 Goals for Physical Sciences

Goal

Goal: Develop new astronomy course- Solar System Astronomy

A new course, Solar System Astronomy, will be developed and added to the list of course offerings in the physical sciences program.

Action: Course has been approved

Describe the actions needed to achieve this objective:	We are offering it in the Spring of 2020.
Who will be responsible for overseeing the completion of this objective:	
Provide a timeline for the actions:	
Describe the assessment plan you will use to know if the objective was achieved and effective:	
List resources needed to achieve this objective and associated costs (Supplies, Equipment, Computer Equipment, Travel &	

Conference, Software, Facilities, Classified Staff, Faculty, Other):	

Goal: Improve student success rates in Astronomy 101

Data show relatively low rates of student success in Astronomy 101. As a way to address low success rates, astronomy faculty will engage in a dialogue specifically focused on strategies to improve success rates.

No actions specified

Goal: Equity

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

Action: Equity Action Plan

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

Goal: Program success

Increase long-term program (astronomy) success rate.

Action: Provide Oversight Over PHYN 100 Success Rates

Describe the actions needed to achieve this objective:	PHYN 100 has vide range in distribution of success rates. In 2016 success rates were around 80% and then 2017 dropped to 63% and then in 2018 to 47%. Make sure we maintain both college standards and expectations in this course. Did the introduction of DE PHYN 100 drive the success rates down? Do we need to provide more resources for students to succeed.
Who will be responsible for overseeing the completion of this objective:	We just hired two new faculty Jen Snyder and Stephanie Colby. I hope to work with them so that we can evaluate the challenges in the course.
Provide a timeline for the actions:	Starting now. Monitor data trends and practices.
Describe the assessment plan you will use to know if the objective was achieved and effective:	Data trends will be studies. Also it would be good to have a TT faculty consistently teach this course for few semesters so that we can all work on standards that should be met in this course.
List resources needed to achieve this objective and associated costs (Supplies, Equipment, Computer Equipment, Travel & Conference, Software, Facilities, Classified Staff, Faculty, Other):	We just hired two faculty so that was our major request last year.

GOAL STATUS REPORT (REQUIRED)

Action Statuses

2018/19 Goals for Physical Sciences

Goal

Goal: Develop new astronomy course- Solar System Astronomy

A new course, Solar System Astronomy, will be developed and added to the list of course offerings in the physical sciences program.

Action: Course has been approved

Describe the actions needed to achieve this objective:	We are offering it in the Spring of 2020.
Who will be responsible for overseeing the completion of this objective:	
Provide a timeline for the actions:	
Describe the assessment	

plan you will use to know if the objective was achieved and effective:	
List resources needed to achieve this objective and associated costs (Supplies, Equipment, Computer Equipment, Travel & Conference, Software, Facilities, Classified Staff, Faculty, Other):	

Status for Course has been approved

No Status Added

Goal: Improve student success rates in Astronomy 101

Data show relatively low rates of student success in Astronomy 101. As a way to address low success rates, astronomy faculty will engage in a dialogue specifically focused on strategies to improve success rates.

No actions specified

Goal: Equity

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

Action: Equity Action Plan

Describe the actions needed to achieve this objective:	Seek to create a culture of equity by keeping program faculty informed of equity-related campus training, conferences, and funding sources.
Who will be responsible for overseeing the completion of this objective:	Irena Stojimirovic
Provide a timeline for the actions:	3-5 years
Describe the assessment plan you will use to know if the objective was achieved and effective:	Objective will have been achieved and will be considered effective when program success rates for various under-represented groups show long-term (3-5 year) improvement.
List resources needed to achieve this objective and	Conference funding, supplies, equipment.

associated costs (Supplies, Equipment, Computer Equipment, Travel & Conference, Software, Facilities, Classified Staff, Faculty, Other):	

Status for Equity Action Plan

Current Status:	In Progress
If the Current Status was marked Completed, what was the impact of the completed objective on your program:	
If the Current Status was not marked Completed, what are the implications and next steps:	This has been discussed in the PR Analysis for Equity and Excellence. We are focusing our effort on student centered culturally relevant pedagogy. We find it hard to attend conferences outside of Mesa, as the funding for faculty's professional development is not available. Through various offices (department/LOFt etc) we can get $200-$300 in funding which often cannot add up to the cost of conference registration let alone travel or lodging costs.

Goal: Program success

Increase long-term program (astronomy) success rate.

Action: Provide Oversight Over PHYN 100 Success Rates

Describe the actions needed to achieve this objective:	PHYN 100 has vide range in distribution of success rates. In 2016 success rates were around 80% and then 2017 dropped to 63% and then in 2018 to 47%. Make sure we maintain both college standards and expectations in this course. Did the introduction of DE PHYN 100 drive the success rates down? Do we need to provide more resources for students to succeed.
Who will be responsible for overseeing the completion of this objective:	We just hired two new faculty Jen Snyder and Stephanie Colby. I hope to work with them so that we can evaluate the challenges in the course.
Provide a timeline for the actions:	Starting now. Monitor data trends and practices.
Describe the assessment plan you will use to know if the objective was achieved and effective:	Data trends will be studies. Also it would be good to have a TT faculty consistently teach this course for few semesters so that we can all work on standards that should be met in this course.
List resources needed to achieve this objective and associated costs (Supplies, Equipment, Computer	We just hired two faculty so that was our major request last year.

Equipment, Travel & Conference, Software, Facilities, Classified Staff, Faculty, Other):	

Status for Provide Oversight Over PHYN 100 Success Rates

Current Status:	Not Implemented
If the Current Status was marked Completed, what was the impact of the completed objective on your program:	
If the Current Status was not marked Completed, what are the implications and next steps:	Our new faculty Stephanie Colby will be taking over PHYN 100 in the future. Currently she dedicates her efforts in creating new Astronomy laboratory curriculum for both ASTR 111 and 109.

Request Forms

CLASSIFIED POSITION, BARC AND FACULTY POSITION REQUEST

Reviewers

LIAISON'S REVIEW

Form: Instructional Program Liaison's Review 2019/20 UPDATE

MANAGER'S REVIEW

Form: Instructional Program Manager's Review 2019/20 UPDATE

Appendix

A. **2019/20 Program Review Outcomes and Assessment Section** (Form)
B. **2019/20 Program Review Instructional Program Analysis Section** (Form)

Form: "2019/20 Program Review Outcomes and Assessment Section"

Created with : Taskstream
Participating Area: Physical Sciences

(REQUIRED) Program name

Physical Sciences

(REQUIRED) Are you on target with your assessment schedule?

Yes. The updated assessment schedule for the physical sciences program involves CLO assessment in all courses being offered, every semester. We've previously assessed two of three CLOs, including Problem Solving and Critical Thinking. This academic year, the third CLO, Communication, is being assessed. This semester (Fall 2019), we assessed the Scientific Literacy PLO. The overall schedule for CLO/PLO assessment is as follows:

- Fall 2016 and Spring 2017: Problem Solving (completed)
- Fall 2017 and Spring 2018: Critical Thinking (completed)
- Fall 2019 and Spring 2020: Communication (in progress)

The overall schedule for PLO assessment is as follows:

- Spring 2018: Transfer (completed)
- Fall 2019: Scientific Literacy (completed)
- Spring 2020: Lifelong Learning (to be completed)

(REQUIRED) What have your assessments revealed about your courses/programs/service area/school/division/office?

In the previous year we assessed problem solving CLO in both Fall 2018 and in the Spring 2019.

40% of students meet competency.

General ed students that take physical sciences courses have very poor mathematical skills.

They can not read numbers, and have huge challenges performing any kind of algebraic operations.

Most students cannot compare two numbers written in scientific notation and/or write million, billion etc in scientific notation.

Desription of the assignment in ASTR 101:

We asked students to apply Stefan-Boltzmann law to compare luminosities (energy output) of 5 stars given their size and temperature.

Effectively this means they would need to identify correct formula to use, raise temperature to the fourth power and multiple it by size.

Then compare numbers and order stars by decreasing luminosity.

Students were given a handout during final exam.

For many the same handout was previously done during semester either assigned as homework or collaborative in-class activity.

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

There are two approaches in teaching science courses to general ed population: expose students to math or completely ignore math in general ed courses.

Given the very low competency of our students in regard to basic math operations we decided not to shy from math in lectures,

but ask students to scale values, square numbers, and do basic K-5 level math to try to improve that basic math proficency.

Always start by reviewing basic math concepts in the first week and assign homework that will ask students to apply this.

We do not need any specific resources in regard to this assessment but we are also changing our labs to modify the way calculations are done.

Again here we tend to include some form of mathematical exercise in every laboratory report.

The level of math that we are trying to inforce here is K-12 level with focus on reading numbers, doing basic operations with numbers in scientific notification and comparing quantities.

Please provide any other comments.

No answer specified

Form: "2019/20 Program Review Instructional Program Analysis Section"

Created with : Taskstream
Participating Area: Physical Sciences

Program Name

(REQUIRED) Type your program name.

Physical Sciences

Part A: In this section, please analyze your program in terms of course success metric. Start by disaggregating the available data by race, gender, and any other parameters of interest to your program and answer the following questions.

(REQUIRED) A1. What patterns do you notice with regard to equity in course success at the program level by race/ethnicity?

You may also conduct analysis by course and/or by modality.

Equity Gap: When a group of students who share a common characteristic (e.g. race/ethnicity) have lower access and/or outcome rates than their peers. The size of the equity gap along with the size of the group determine whether that gap is significant. Larger groups should, statistically, have smaller gaps and therefore when gaps are present (even small ones) they may be significant. Smaller groups will see wider variation in outcomes, therefore gaps should be seen consistently over time and/or reviewed by looking at multiple years in aggregate to determine if they are significant.

I analyzed data separately for ASTR and PHYN courses although both belong to the same program.

The average across PHYN courses is discussed. In addition to the race/ethnicity equity gap I also analyzed gender gap as these are prominent in physics based courses.

PHYN. Total of n-1400 students over a period of 5 years, INT excluded.

Females have greater success rates although both are within 1% of the average 80% success rate,

African Americans have lowest success rate 71% but also lowest number of graded enrollment (n=116 student over 5 year period; small number per semester in multiple courses. These would come down to few students per course per semester).

Latinx students are at 78% (n=475) compared to the 80% average success rate.

ASTR courses - across ASTR courses: 101 (lecture), 109 (lab), 111(lab). First average of all is discussed then just ASTR 101 lecture course alone.

Total of n~4836 students over a period of 5 years. Females have -2% success rates while males are at +2% compared to the average success rate of 60%. African Americans have lowest success rate 47% with total of 218 students in the program in 5 year. Latinx students are at 62% (n=1804). By age the young students 18—24 group are less successful 65% then under 18 (87%) or 30+ (70%+ success rates).

If we restrict analysis to only lecture course, Females have -3% success rates while males are at +2% compared to the average success rate of 60%. African Americans have lowest success rate 47% with total of 218 students in the lecture course in 5 year. Latinx students are at 55% (n=1470). By age the young students 18—29 group are less successful 58% then under 18 (87%) or 30+ (65%+ success rates).

(REQUIRED) A2. Do these patterns persist over time (e.g., look at the last five years)? Describe if equity gaps are increasing, decreasing, or staying the same?

PHYN:

Yes these trends persist and were reported for a five year period.

During this last review period only 120 students took physical sciences courses and no African American students, while Latinx students were in the green domain in the equity gap analysis (+5%).

Therefore small number of students in these courses make five year average data more meaningful.

During five year period by age group our best students are in 40+ category - success rates 92%. Younger students don't show any equity gap (~80% success rates). Most students are in 18—24 age group.

ASTR:

During this last review period n~682 students took ASTR courses.

Male succeed at 66% and female at 63%. Given the enrollment trends I think there is no statistical significance in the difference of their success rates (more mails enrolled than females, larger error to success rates reported by females; within the error margin I think these results are not significant). There were only 32 African American students enrolled in any astronomy class in the last year , while Latinx students were in the green domain in the equity gap analysis (+5%).

It is also interesting to look at the online courses only (for example during summer 2018) where we can see that young students 18-24 do significantly worse (80% sucks rates, n=40) in the online setting than 25+ (100% success rates, n=13).

Playing additionally with the data (per semster, shorter year average etc) it is clear that gender equity gap is not present; However African American and Filipino students constantly show equity gap between 10 and 20% in success rates. However these students come in small numbers in our program. Latinx students during a 5 year period lag in success rates; however during this last review period (F18/SP19) Latinx students didn't show any equity gap; their average success rate in the course was at 59-60% and it has improved in the last five years. This holds both for Astronomy and Physical Sciences courses.

Overall success rates are at 60% which is lower than Mesa College average. At the department we often have discussions to address this issue. We put significant effort in making all of our classes student centered and implementing the learning strategies that promote learning by minority students - however we find that too few students in the

general education classes are motivated to learn. They are often not prepared to transition from the high school to colleege envirnonment. They do not show independence to learn; they tend not to read the textbook, and generally they lack basic math and science knowledge. This aids to the challenges in moving the overall success rates to a greater number. Although again it does seem that we are able to close the equity gap for Latinx population.

(REQUIRED) A3. What factors may have influenced these results? What are your most significant findings?

The big change that happened in our program is hiring of two new faculty: Stephanie Colby (astronomy) and Jennifer Snyder (physical sciences).
Three of us teach most of the courses in astronomy and physical scineces. We spend a lot of time talking and developing pedagogcal approach that is student-centered.
Student centeres activities are designed to eliminate disproportionate impact and promote student success.
In Astronomy we Increase student engagement through many extracurricular activities such as Astronomy night, STEM Lecture Series, Star Partires, Astronomy Club and Astronomy research.
All of us have office hours daily and generally open door policy. We also tend to be encouraging with students: finding summer internship opportunities for students and supporting them through application process.
The research shows that having contract faculty teach college entry level courses is key to students success, because contract faculty have more opportunity to provide help
to students outside of the allotted classroom time and often create additional learning opportunities.
All of these initiatives are showing results through closed equity gap with Latinx students.
African American should benefit as well from these practices (as per my training through Teaching Men of Color in the Community College workshop) so it is suprising that they lack in success.
Thee small number of these students may be a reason why these statistics are not as relible as for Latinx.
We generally have only few African American students in each class.

We will need more time to track changes in the program since both of these faculty are only in their second semester.

(REQUIRED) A4. How have you/might you alter practices to increase student success and reduce equity gaps?

We will continue to foster our student-centered practices that seem to be working towards eliminating equity gaps for Latinx students.
Our BARC requests in physiics and physical sciences will seek to buy equipment that would make learning environment even more inclusive and fitted to different learning styles.
Something that we would like to see is increase in overall student-success rate as those are around 60% in Astronomy courses which is lower than Mesa College average.
We struggle with generally low motivation of our under-prepared students. Students do not take advantage of resources available for them.
Therefore we as faculty are working on developing more material related to the personal growth of students.
Teaching them about what it takes to be a college student, how to study, time manage and self-advocate.
Our course are physics based and yet most of our students had no physics exposure in their K-12 education (or very limited).
The percentages of high school graduates who had taken biology courses is 96%, chemistry 70% and physics 36% (https://nces.ed.gov/fastfacts/display.asp?id=97).
Among those graduating high school, only 26% of African Americans and 26% of Hispanics took any physics classes.
In comparison, 62% of African Americans and 56% of Hispanics took chemistry courses (http://www.nsf.gov/statistics/seind06/append/c1/at01- 18.pdf).
Our CLO analysis in Astronomy show that we work with student population that struggles with basic math skills, such as reading numbers and performing elementary school arithmetics (K5).
We strive to have classroom tutors placed in at least one of the courses taught by each instructor.
For some reason currently we have zero CTs in any of our courses (Fall 2019).
These general ed classes are perfect for CT's placement and in the past students enjoyed working with CTs.
For moree advance courses in our department (PHYS 195, 196, ENGE 200) we prefer to have STEM Peer Meentors working with students.

(REQUIRED) A5. How does your program contribute to the College's identity of being a Hispanic Serving Institution?

Culturally responsive teaching: All of our full time faculty attend workshop on best practices in teaching at HSIs. Whether it is at AAPT meetings, SACNAS meetings, ESCALA College Teaching and Learning in Hispanic Serving Institutions workshops or in Course re-design workshops at Mesa and/or UCSD we are actively focused on understanding our students and how best we can help them learn. These workshops made us more aware of the environment that we were creating in the classroom and the need for community building exercises in particular. " Hispanic students come from communities that support each other. Professors at HSIs should never make students feel like guests in their classrooms but students should be actively involved in learning process". Student evaluations across our program tell that "instructor made learning environment fun place and makes you feel comfortable asking questions."

All of us advise students about their academic choices and support students to apply for internships and research opportunities.

We have many students attend NASA workshops and participate at research at Mesa and elsewhere (Caltceh, CU Boulder, Harvard). Students present their work at Mesaresearch conference and at other national conferences.

The STEM Lecture Series run by our department provides another opportunity for students to discover career paths and learn more about what the day-to-day life of a scientists look like. Only when I was in graduate school I had the opportunity to participate in events like this and I am so proud that Prof. Barrie and I are able to keep STEM Lecture Series talks rolling from semester to semester with such a great success.

The STEM Lecture Series provides opportunities for our students to interact with experts from STEM fields (both from academia and from industry) outside of the classroom. Our evening lectures typically draw crowds of 100 to 150 Mesa students and colleagues from the District and other colleges in San Diego area.

(REQUIRED) A6. Have you identified resource needs? If yes, please list.

We are greatful to Dean Susan Topham and President Pam Luster for supporting hiring of multiple faculty in our program.

Both of these faculty are experts in learning theories. Through collaboration across department we continue to foster our student-centered practices that seem to be working towards eliminating equity gaps for Latinx students.
Our BARC requests in physiics and physical sciences seek to aquire equipment that would make learning environment even more inclusive and fitted to different learning styles.

More CTs placed in the courses in the program would be desired.

(REQUIRED) A7. Do any of your program goals address these implications or needs? If not, please develop a new goal that addresses your findings and subsequent reflection.

Yes, our program goals are direclty related to improving students success rates and equity minded practices.

Part B: In this section, look at the area of focus you identified in last year's program review and answer the following questions.

(REQUIRED) B1. How have you developed this focus? Are you seeing any results? What are your next steps?

The area of focus we identified in the last year was "We focus on education outreach events aimed at creating sense of community across Mesa and inspiring our students to either persue science careers or at least become science literate adults."

We continue providing education outreach opportunity for the Mesa community via Astronomy Night events aimed at whole SDCCD community as well as families and friends of SDCCD students.. During Astronomy Night up on the MS rooftop Observatory we hosted more that 200 visitors in the Fall of 2018 and moree than 100 visitrs in the Spring of 2019. Astronomy Nights build and sustain a sense of community across campus, nurturing collaboration, learning and growth. Astronomy nights provide opportunities for faculty, students and staff to interact outside of the classroom setting.

We also hold monthly *Star Parties* at the Mesa's rooftop observatory. Star Parties at the Mesa rooftop observatory are events open to all students at our department (geology, astronomy, physical sciences). The goal of star parties is to advance delivery of our courses by providing more inclusive hands on experience for students currently enrolled in departmental courses. These activities build a sense of community that nurtures learning and again provide opportunities for faculty and students to interact outside of the formal classroom setting.

Why do these? The allure of the astronomy is a great way to get students who might not like science in the door or to motivate little kids to wonder about universe around them. The interdisciplinary nature of astronomy sparks many discussions during these events such as the geology of the features on the Moon, gravity, the physics of light and matter interaction, spectra. Events like these provide an opportunity to promote interest in science, technology, computer science, engineering.

To make Astronomy Night possible we rely on help from many people here at Mesa. Multiple adjunct faculty across our disciplines (astronomy, physics, geology) are involved in engaging visitors. We also involve ASTR 109 students to showcase knowledge gained in the class. Often former and current ASTR 101 students volunteer. We need folks to be at the door and regulate in and out flow from the roof. Therefore this is truly a joint effort where we come together as a department.

In addition Astronomy Club does Telescope Tuesdays where we take solar telescopes out and look at the Sun while engagging passing students into science discussion.

We contribute to the STEM Lecture Series events.

Yes we think that all of these practices help us build community of faculty and students and are encouraging towards students building STEM/learner identity.