

# Program Review 2021-2022

## Chemistry

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## General Information (Program Review 2021-2022)

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## 2021/22 Program Review

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### 2021/22 PROGRAM REVIEW FORM

**Form:** 2021/2022 Program Review (See appendix)

**File Attachments:**

1. **Program Review Fall 2021 Final with revisions.pdf** (See appendix)  
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2. **Program Review Fall 2021 Final.pdf** (See appendix)  
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3. **Tables and Graphs for Program Review Fall 2021.pdf** (See appendix)  
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## Reference Section

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**MESA2030 COMPREHENSIVE MASTER PLAN**

**ROADMAP TO MESA2030: STRATEGIC PLAN 2021-2026**

**MESA DATA DASHBOARDS**

# Requests Forms

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REQUEST PORTAL

# Appendix

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- A. **2021/2022 Program Review** (Form)
  - B. **Program Review Fall 2021 Final with revisions.pdf** (Adobe Acrobat Document)
  - C. **Program Review Fall 2021 Final.pdf** (Adobe Acrobat Document)
  - D. **Tables and Graphs for Program Review Fall 2021.pdf** (Adobe Acrobat Document)
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# Form: "2021/2022 Program Review"

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## 2021/2022 Program Review

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### (REQUIRED) Name of Lead Writer and Manager/Service Area Supervisor

Paula Hjorth-Gustin, Ed.D. (Lead Writer)

Paloma Vargas, Ph.D. (Dean)

### (REQUIRED) In what ways (if any) did changes to an online/remote modality due to COVID-19 impact student success and equity in your area/program? Please provide evidence.

**Please read Program Review Fall 2021 PDF in attachments.** Chemistry is considered to be the central science because physics, engineering, biology, and allied health majors require courses in chemistry. Because of this, the Chemistry Department offers many courses ranging from preparatory chemistry, general chemistry, organic chemistry, analytical chemistry, allied health prerequisites, and a general education course with an emphasis in environmental issues. The department has 10 full time professors (including tenure track), 20 adjuncts, and 4 Instructional Laboratory Technicians. The Chemistry Department creates a supportive learning environment that spans across our curriculum. We constantly assess our student success across courses that form a sequence such as General Chemistry. Our department works hard to establish a set core of standards so that students can succeed as they move through our courses. Laboratory courses provide an equitable way to present hands-on learning that supports lecture material. Laboratory work also provides a venue for students to work collaboratively and make STEM relationships that can support them through their courses. The Chemistry department prides itself on having student centered teaching and providing high quality equitable instruction grounded in standards for scientific work that will allow students to be successful at four year schools. The hallmark skills that our department fosters are critical thinking and hands-on experiential learning . Our professors use lecture presentations, small group discussions, worksheets, application to the real world, and hands-on laboratory training to help students learn what is considered to be a very difficult and intimidating subject. Critical also is our interaction with students via office hours, review sessions, support courses such as Chem 16 and Chem 20, and Canvas. The enrollments have changed with the pandemic (Table 1). All tables and graphs are in attachment section.

There has been a 27% drop from Fall '20 to Fall '21. (Table 1) There are many factors out of our control affecting enrollment. From record numbers of students accepted to UC and CSU, to enormous financial strain on our students, and direct COVID-19 impact on students and their families, it is most likely a combination of all these factors. The department's lowered enrollment is consistent with national and local trends of decreasing enrollment due to the pandemic.

The philosophy of the department is to be student centered and equitable while upholding standards of excellence in scientific and critical thinking. Standards are important to our department while providing an engaging, supportive, and positive learning environment. This is achieved by communicating clear expectations to students, student centered pedagogy, equitable teaching practices, open door attitude to students, updating and improving laboratory courses, support courses, participation in embedded tutoring programs and Peer Mentoring, close relationship to counseling, and a focus on equity. The Chemistry Department is committed to preparing students for transfer to four year schools and provide a foundation in future work in science or professional schools. There were 8 Associate Degrees in Chemistry and 22 degrees in Liberal Arts and Sciences Science Studies-Chemistry conferred during Fall '19- Sp '21. 67% of the students were 18-24 in age, 63% were female, and 36.7% were Latinx. It should be noted that chemistry supports a wide variety of majors including high transfer majors of Biology and Engineering.

The conversion to online on the part of STEM faculty was very stressful and involved countless hours of work to provide videos for students, adjusted teaching materials, adjusting of laboratory experiments and assignments, and developing equitable assessments that gave meaningful feedback to students. Challenges existed in the Canvas format in grading and exam preparation that cause significant stress for faculty where creating and grading has tripled the time that is usually spent on these tasks. Many of our faculty exceeded expectations for communicating with students and even helped students at unusual hours to support them to be successful in online courses. Many students struggled in this format despite our best efforts. Not having a safe and focused classroom free from household responsibilities is very difficult for students. Technology presented its own challenges with many students not having computer access and reliable Internet connections. The change in modality from face to face to online/remote modality affected the Chemistry Department's success rate for all the courses that are offered. The data was compiled from the Mesa College Course Outcomes Dashboard. Because each semester has variations, Fall '17, Fall '18, and Fall '19 were averaged to provide a reference point of success rates before the COVID-19 pandemic. The average success rate in this time frame was 77% and this was higher than Mesa College's success rate at 72%. Graph 1 shows the decrease in success rates from Spring '20 with a 75% success rate to 70% in Fall '20 to 73% in Spring '21. Despite a lower success rate, the success rate was not significantly lower than the Mesa College overall success rates. Clearly, there has been a lowering of our success rates due to the switch from face to face modality to online. Disaggregation of the data shows that not all students were affected similarly in the switch to online/remote. (Graph 2) Asian students show the least impact with Sp '20 success rate of 88%, F '20 88%, and Sp '21 84% which is similar to the average F'17, '18, '19 of 88%. White students did show a decrease in Sp '20 success rate of 74%, F '20 80%, and Sp '21 78% which is lower than the average F'17, '18, '19 of 85%. Despite the decrease, the success rates are still above the Mesa College averages of Sp '20 success rate of 72%, F '20 73%, and Sp '21 74%.

The equity gap between Latinx and non-Latinx students in Mesa College Chemistry courses was compared from pre-pandemic (comparison to Fall '17, Fall '18 and Fall '19 overall average Latinx 74%) has decreased due to the conversion to online. Latinx success rates were Spring '20 to 68%, Fall '20 to 61% and to 64% in Spring '21. African American students showed the same success rates from pre-pandemic (comparison to Fall '17, Fall '18 and Fall '19 overall average 69%) except for that Fall 2020 showed a decrease. African American success rates were Spring '20 to 68%, Fall '20 to 60% and to 69% in Spring '21.

General Chemistry (Chemistry 152, 200, 201) is a significant portion of our enrollments and one or more of these courses are part of the curriculum for physics, biology, engineering, and variations of these degrees. Spring '20 was the "flip" from face to face to online. Fall '20 and Sp '21, our lecture courses were all online, with only a few partially face to face lab courses. Success rates for Asian, White, Latinx, and African American students in the categories of General Chemistry Lecture courses (Chem 152, 200, 201) and General Chemistry Lab courses (Chem 152L, 200L, 201L) were compared. Data from F'17, F'18, and F'19 semesters were averaged (all face to face sections). That average was compared to Sp'20, F'20 data (all online, except for 201L which was partially face to face), and Sp '21 (all online except for 201L which was partially face to face). There was very little variance between the individual F'17, F'18, and F'19 semesters, so the average is very reliable.

Disaggregation of data for General Chemistry Lectures is shown (Graph 3) and for General Chemistry Laboratory (Graph 4). *In all cases analyzed, Latinx students are the most impacted from the pandemic. The online semesters of F'20 and Sp '21 showed a significantly lower success rate than the face to face semesters for Latinx students.* It should be noted that there was no significant decrease in enrollment for either Latinx or non-Latinx students during Fall '20. For all of Chem, Latinx enrollment increased by 2% in F20 as compared to the average of F '17-F' 19, while non-Latinx showed a 5% decrease. Latinx students represented 37% of enrollment in all chemistry courses as well as Gen Chem in F17-19, and 38% of enrollments in all of chemistry as well as Gen Chem in F20. This percentage is comparable to the percentage of Latinx students at Mesa College. It should also be noted that the negative trends in equity gaps for Latinx students is also apparent in laboratory courses (Graph 4). It should be noted that African American students showed fluctuations in success rates from a low of 56% in F'20 which is similar to average F '17-F' 19 of 58% to highs of 72% in Sp '20 and 71% in Sp '21. It should be noted that the percentage of African Americans in the general chemistry sequence is 4.8% (N=133). This percentage is lower than the percentage of African American students that ranges from 5-6% at the college. The data has a small N value and can fluctuate dramatically with changes in success rates. Therefore, it is difficult to make strong conclusions regarding the data.

The Organic Chemistry courses show a decrease in success rates especially in regards to Latinx students. due to the switch in modality. The data from Organic Chemistry lecture is showing that Latinx students were the most impacted in the pandemic switch in modality where the drop from an average F'17-F'19 went from 68% to Sp'20 62%, F'20 50%, and Sp '21 42%. (N=104). In laboratory work, Latinx students showed a similar trend of lowered success rates. The drops in success rates for Asian students were also present (N=43). African American students are underrepresented in these courses. For example, during F'17-F'19 & Sp'20, F'20, and Sp '21(N=16). This is 3% of the total enrollments during this period (Graphs 5 & 6). Because of this low N value, further statistical analysis will not be valid. Instead we should focus on increasing their representation.

Allied Health track includes the courses Chem 100, 100L, 103, 130L, and 160. The students in this sequence typically include nursing majors and nutrition majors. The trends in success rates show a fluctuation in Spring 2020, but it appears that the success rates are similar to average F'17-F'19 in Spring 2021. Unlike the General Chemistry and Organic Chemistry, the Allied Health track students' success rates appears to be less affected by the switch in modality. (Graph 7)

Analytical Chemistry is a hands-on technical course in learning instrumentation and analytical techniques. It is a required course for transfer for chemistry majors transferring to CSU. It has become a required course for students entering the Clinical Sciences Laboratory Technician Program at SDSU. Course Success Rates from Sp '17-Sp '19 were 83% (N=54). Spring '20 was a 94% success rate (N=17). Because of the nature of this course, it was not offered during Spring '21 and will not be offered in Spring '22. It is the department's goal to bring the course back in Spring '23.

Chemistry 111/111L is a general education course for non-science majors. Its focus is on environmental chemistry and introduction to biochemistry/nutrition. As a department, we always work closely with counseling to encourage underrepresented groups to take the course as a wonderful opportunity to learn more about real world chemistry issues. Typically the course has a wide variety of majors from English to Fashion to Business majors. Our general education courses (Chemistry 111/111L) exhibit success rates for all groups are statistically equivalent and range from 62-86% depending on group and semester. It should be noted that this is a limited course with only one lecture and one lab section per semester. Therefore, it is difficult to interpret success rate trends.

One interesting observation in this course is that the percentage of African Americans in the course is roughly 8% (N=42) which is higher than the college's percentage of African American at the college which is between 5-6% depending on the semester. This reflects our good work in promoting the class to underrepresented groups in science through counseling. It provides an opportunity for us to encourage students to consider further work in the sciences.

Success rates in General Chemistry Lecture courses (Chem 152, 200, 201) were analyzed based on ethnicity and low-income vs non-low income status. All data was obtained from the Mesa HSI STEM Equity Dashboard. Data from F17, F18, and F19 were aggregated. Income data for F20 is not yet available on the dashboard, so these results are all pre-pandemic.

First, success rates in all three courses and all three semesters combined were obtained for various ethnic groups. Graph 8 shows this data for students identified as African American, Latinx, White, and Asian, broken into Low Income and non-Low Income categories. The dashboard uses financial aid status to determine if a student is low income.

As the first graph shows, for the ethnicities included, all but Latinx shows a two percentage point or less difference between students of different income status. Latinx low income students had a success rate nine percentage points lower than their Latinx non-low income counterparts. Note: the n value for each category in Graph 8 is greater than 100, except for African American low income (n=80) and African American non-low income (n=23). To further investigate this data, the courses Chem 152, 200, and 201 were looked at individually during the same three semesters. This time, the non-Latinx ethnic groups were combined into the same columns, while still looking at low income vs. non-low income status. These results, presented in Graph 2, show that there is an obvious equity gap between Latinx and non-Latinx students in Chem 152, with low-income Latinx students showing a 14 percentage point difference from their non-Latinx low-income counterparts. Non-low income Latinx students have a smaller gap of 6 percentage points. Interestingly, the gap between non-low income Latinx students and non-Latinx students is completely erased once students get to Chem 200. However, the gap between low income Latinx students and

other students remains, and they are now 11 percentage points behind their non-low income Latinx counterparts. This gap is widened further in Chem 201. (Note: all n values in Graph 2 are greater than 100, except for non-low income Latinx students in Chem 201, where n=65). This data is limited to general chemistry lectures, for three fall semesters. It does not include any data from pandemic semesters when these courses were taught online. We are looking at general chemistry which represents our largest program, with over 900 students in these classes in F19 alone. Based on the analysis above, all low income Latinx students, and all African American/Black students in Chem 152, 200, and 201, as well as non-low income Latinx students in Chem 152, have success rates below 70%. In F19 these groups totaled 309 students. Efforts should be made to identify and target these students with support to help increase their success rates. Some of these supports are already in place, such as Chem 016, a companion workshop course to Chem 152, Chem 020 a prep course for Chem 200, Peer Mentoring in Chem 200 and 201, and Classroom Tutors for Chem 152. The difficult part is ensuring students in these groups take advantage of these and other supports. Many low income students, for example, need to work more hours or take care of family members making it more difficult for them to increase their time spent on these courses.

**(REQUIRED) What practices has your area/program implemented since the last program review cycle that you would like to improve/continue? Identify impacts on student success and equity.**

The return to on-campus learning was welcomed both by faculty and students. Our department is committed to in person instruction. However, there are pandemic online teaching practices that can help supplement and strengthen in person instruction and attain more equitable outcomes.

- A. Safety First: Chemistry faculty are used to laboratory safety procedures in our discipline. Extending this to mask usage in classrooms has been an extension of existing safety procedures. Our department has been vigilant in asking students to stay home when sick.
- B. Flexible assignments: Because our department is student centered, we are very aware of the difficulties for students during the pandemic. Our department has worked together to allow for flexibility. This is especially true because we are asking students to stay home if sick for any reason. This flexibility includes not only allowing students to drop an exam or laboratory assignment, but having clear policies for making up laboratory assignments or exams. For example, in Chemistry 152L, there are make up weeks for laboratories which is something that did not happen before the pandemic. Previously, if a student missed an experiment, they were allowed to make it up during another section, space allowing. To minimize possible covid exposure, this practice had to be discontinued.
- C. Supplemental Material: Because students may have to miss class, our department is encouraging the use of the supplemental materials so that student absences can be minimized. The videos that our faculty made in the pandemic have been useful for students if they miss class. Some students report using videos to clarify lecture material.
- D. Canvas usage: A greater percentage of faculty are using Canvas in a greater capacity than before the pandemic. Canvas allows for a centralized way to communicate with students, post course materials, and organize in a way that facilitates student engagement. It has become a great tool for communication with students.
- E. HSI Lab Redesign institute was led by Ms. Danica Moore during Summer 21. 10 instructors, 6 faculty and 4 adjuncts, from the department participated in the Lab Redesign. There were 8 different lab courses that were modified: Chem 100L, 103, 130L, 152L, 200L, 201L, 231L, and 233L. In Chem 100L, there were rewrites of lab worksheets that featured an online component to help students demonstrate mastery of the lab component. For Chem 103 there was an online extraction lab that was written to act as a supplemental for students who are unable to attend lab due to hardship or illness. In Chem 130L, there was creation of an online protein synthesis lab serving as a supplemental assignment for students who are unable to attend this lab due to hardship or illness. In Chem 152L, 10 out of 12 labs were shortened to ensure that students have ample time to finish experiments and post-lab questions in the allocated lab period. In Chem 200L, all post-lab questions were moved into Canvas for the purpose of making it easier to cycle through different question sets each semester (ensuring academic honesty). The first two worksheets were also revised and integrated into Canvas with added instructions for students who are unable to attend the first two weeks of class. In addition, the Beer's Law background section is rewritten to include more examples, more depth and be more visually oriented. In Chem 201L, the background sections of all labs were rewritten to

improve language, include more sample calculations, and more visual aids. In addition, the pre-lab quizzes were developed in Canvas to help ensure that students are prepared for lab upon coming to campus. In Chem 231L/233L labs were all reformatted to include online content that was developed in the move to DE. This includes questions embedding in Canvas, updated figures and pre and post lab videos to help students ensure they are safe going into the lab, and understand what they did coming out of the lab.

- F. Scheduling of Chemistry 16 & 20: These are great support courses that had to be suspended from being offered during the pandemic. Chemistry 16 was found through a study (Dr. Fusco-Hernandez) to close equity gaps among Latinx students in Chemistry 152. It is a support course that stresses problem solving skills. They are returning this intercession and in Spring 2021.
- G. Return to Peer Mentoring: During the pandemic, chemistry did participate in Peer Mentoring in Spring '20 and Fall '20. Dr. Fusco-Hernandez and Dr. Sardo were Peer Mentor Leads. Dr. Hjorth-Gustin is active in recruiting students. But, it was difficult to find students who wanted to participate as mentors for Spring '21. This semester, she has recruited two students for Peer Mentor for Spring '22. This is an excellent program for our students to find support for General Chemistry.

### **Future Work & Goals for Chemistry Department**

1. HSI Grant: STEM E3 : Equity, Excellence and Éxito was funded through the Department of Education in Fall 2021 with Dr. Fusco-Hernandez as Principal Investigator. This grant is focused on increasing the number of Hispanic and other low-income students attaining STEM degrees and developing model articulation and transfer agreements in STEM with Four-Year Institutions. This 5 year, \$4.75 million program of integrated interventions and capacity building activities will increase the number of Hispanic and low income students attaining post secondary degrees in STEM and participating in the growing regional STEM economy. The following strategies are at the core of the grant:

1. Development of Free Online Homework System (Lead: Dr. Amanda Fusco Hernandez)
2. STEM Studio Classroom Development Coordinator (Lead: Dr. Budzynski)
3. Interdisciplinary STEM Curriculum Writing (Lead: Dr. Hjorth-Gustin)
4. Continuation and Expansion of Peer Mentoring
5. STEM Professional Learning Opportunities
6. STEM Student Orientation
7. Engineering Workshop Expansion and Biotechnology Workshop Development

This grant will be an incredible opportunity to work collaboratively with all disciplines in STEM to make lasting changes for students that help close equity gaps.

#### 2. General Chemistry

Working through the Interdisciplinary STEM Curriculum Writing Group, focus on pathways for students to accelerate in the General Chemistry path for students with higher math levels and develop Chemistry 152 courses tailored to biology and engineering students to improve success, spark interests, and narrow equity gaps.

#### 3. Goals for Allied Health Track

One of the main goals for the Allied Health track is to work collaboratively with Allied Health Faculty, Nutrition, and Biology Faculty to ensure that our chemistry courses are preparing students for their courses. In addition, the department will be forming an Allied Health Track Workgroup (Lead: Dr. Sardo) to analyze and assess the course outlines of records, modernize the Chemistry 130/130L curriculum keeping in mind equitable assignments. Our goal is to revitalize this track!

#### 4. Goals for Analytical Chemistry

This course is an extension of General Chemistry for chemistry majors and now has a group of students preparing for Clinical Laboratory Sciences. One goal is to partner with transfer institutions for more communication and dialogue.

## 5. Goals for General Education

It is our hope that as the pandemic subsides that we can expand course offerings in this class.

## 6. Goals for Organic Chemistry

Over the last 3 years, there has been an enormous amount of work spent on modernizing the laboratory work. The courses continue to evolve and improve.

7. Increase representation of African American students: The goal of the department will be to seek ways to improve the numbers of African American students in General Chemistry and Organic Chemistry to at least match the 5-6%. One approach is to work more closely with counseling.

8. Obtain a tenure track faculty position: All of our goals will require support from the college by hiring at least one if not two full time tenure track faculty. We recently learned that one of our full time faculty will be retiring in January.

## **(REQUIRED) What practices has your area/program implemented since the last program review cycle that you would like to change/discontinue? Identify impacts on student success and equity.**

Since March 2020, our department has been in constant change and pivoting to the needs of our students during a stressful world-wide pandemic. For lectures, the conversion to online required a massive effort. Different instructors addressed the conversion online in different ways. In March 2020, we all taught remote on Zoom. Many instructors had to invest 1000+ dollars in technology to work from home. Zoom proved to be a tool that was both helpful and difficult. Students would have an opportunity to interact with their instructors on Zoom, but there were technical issues.

Student technological gaps became painfully obvious and the lack of equity for our students became clear to us. Students lacked the necessary technological resources to be able to take courses online. Our department donated 115 lap top computers to help students obtain a computer.

*I am sure this is true of students face-to-face also, however in the case of online, less tech literate students were disproportionately impacted. The instability of many student's internet connections caused much anxiety for myself and students during assessments. In some cases, students would be disconnected 2-15 times throughout the course of assessments. It is only through a concerted effort that I made sure that these students' grades were able to reflect their hard work and commitment to their studies. (D. Moore)*

Zoom fatigue is real and many students would express that they struggled to focus for an hour and half lecture on Zoom. The testing format was problematic as well.

*Each exam I wrote was done with question groups so students were taking different exams than their classmates. Those exams took me about 15-20 hours to write. I was able to reuse exams from the first to next semester. I wrote around 13 quizzes as well. Grading exams took about the same amount of time as writing them, because grading uploaded student work on Canvas is very difficult, and students needed to show their work for many chemistry problems. (D. Budzynski)*

When we went online in March 2020, the conversion of our lecture and laboratory courses was difficult to say the least. *The Chemistry department created a combined total of 800 + videos during the course of the pandemic.* Our laboratory assignments had to be adjusted, which took an enormous amount of work on the part of the full time faculty members. Dr. Toto & Dr. Hjorth-Gustin worked on the laboratory materials for Chemistry 201L. In March 2020, 6 new laboratory assignments were written that focused on data analysis. In Chemistry 200L, Dr. Budzynski wrote 6 new online laboratory assignments that also focused on data analysis. In Chemistry 100L, Ms. Moore creatively adjusted Chem 100L to be self-contained modules with videos, worksheets, and questions. In Chemistry 152L, Dr. Fusco-Hernandez and Mr. Fremland began filming videos where they demonstrated all the laboratory procedures and re-wrote the manual to reflect the changes. Chemistry 231L and 233L were also re-written by Dr. Saidane. Dr. Sardo was actively involved in adjusting the Chemistry 103 laboratory materials. When most of our

courses went fully online in Fall 2020, labs from the first half of the semester had to be adapted as well. In summary, 100+ numbers of experiments were written totaling hundreds of hours of work.

Despite our best efforts, our subject material does not lend itself to an online format for many reasons, and online teaching of chemistry widens equity gaps as shown by the data analysis of question 1 in this document. Unless there is an emergency declaration regarding the pandemic, Mesa College chemistry will be discontinuing online modality as a viable option of instruction. Laboratory courses are by nature hands-on technical learning. Even with the most creative learning materials, online laboratories fall short. It is difficult for students to visualize the experimental procedure (even with videos). More than anything, the students work together in the laboratory to discuss and analyze data. This collaboration provides a foundation of equitable learning and is so essential for our students to learn not only laboratory techniques, but also to reinforce lecture material. It also provides a support and culture of STEM that helps students feel supported.

Because we are constantly analyzing our equity outcomes, as a department we realized that face to face instruction is necessary for our science majors. The Department Chairs in consultation with the full time faculty assessed the feasibility of offering some laboratory courses on campus for Fall 2020-Summer 2021 following safety protocols and COVID-19 mitigation strategies. So, we made a decision to bring back laboratory work in Chemistry 201L, 231L, and 233L. It was not feasible to bring back other laboratory courses. The planning and preparation required to do this was extensive. We were the only community college in San Diego County to bring back chemistry students in person during the pandemic! We followed the safety protocols established by the county and had to social distance the laboratory. On paper, social distancing laboratory work may sound easy. In practice it is not trivial and ***required another rewrite of the manuals for the three laboratory courses and a special schedule*** (written by Dr. Toto and Chairs). This is because the experiments had to be adjusted for the time blocks and students coming from online laboratories needed time to learn the basic skills so we had to make changes. In Chemistry 201L, the course is capped at 24 students. In order to social distance to 6 feet, only 8 students + instructor could be allowed in class. Students were placed in one of three groups. Essentially, they would come to class for an on campus lab once every three weeks. The alternative time was spent on data analysis AND another laboratory virtual assignment. Included here is the schedule. (Table 2)

Organic Chemistry 231L and 233L have a cap of 18 so their social distancing involved splitting the students into two groups. This required another rewrite of the manuals courses and a special schedule not shown in this document.

It should also be noted that socially distanced laboratory courses taught from Fall 2020-Summer 2021 involved support on the part of our Instructional Laboratory Technicians who helped not only to prepare the labs but also to screen students for COVID-19.

In March of 2021, the STEM Department Chairs were proactive in requesting that more courses be allowed back to campus. Fueled by increasing equity gaps and difficult working conditions, we wrote a letter in support of more on-campus courses for Fall 2021. We felt supported by Dean Recalde and Vice President of Instruction Isabel O'Connor. At the same time, the District began negotiating with the AFT Union the vaccination requirements for faculty and students. This allowed for a larger return of 93% of our chemistry courses being offered in a face-to-face format in Fall 2021 and 100% of the laboratory courses being offered face-to-face.

**(REQUIRED) What college-wide practices implemented since the last program review cycle have affected your area/program positively or negatively? Identify impacts on student success and equity.**

One college-wide practice that has positively affected our area are all of the Professional Development opportunities given to faculty to help convert courses to the online format during the change of modality and training for more equitable instructional practices.

The SDCCD Distance Education Certification allowed for all of the chemistry faculty to prepare their online courses for Canvas. All of our faculty participated and we work tirelessly to adapt our course materials to the online format.

There were still issues with the platform for a quantitative field like chemistry in terms of assessment and ease of use in the software (mentioned in previous sections). Canvas was not designed for quantitative fields. However, now that we are back to face to face instruction, the Canvas training allows for faculty to continue effectively using Canvas to supplement face to face learning. The department faculty really supported each other in what felt like 24/7 constant communication (nickname for this group is The Hive). This camaraderie helped carry us through learning all the new technologies. Our faculty attended Zoom training sessions provided by the LOFT and supplemented instruction by learning Canvas Studio, Proctorio, Pronto, Discord, and screencasting.

Our full-time professors work hard to train on equitable teaching practices. Many are involved in attending conferences. For example, Dr. Fusco-Hernandez attended the 2021 AHSIE (Alliance of Hispanic Serving Institution Educators) Best Practices Conference. This conference offered “over 80 concurrent sessions showcasing the creativity, innovation, and commitment of HSI practitioners from dozens of colleges and universities from across the nation. Dr. Hjorth-Gustin attended the Academic Senate Fall 2021 Plenary and attended many equity focused presentations “All Things Ethnic Studies” and “From Equity Theory to Equity Practice: Activating Our Agency as Practitioners”. Ms. Moore attended “Equity in Assignments, African American Male Network (A2MEND)” conferences, and “Culturally Responsive Teaching”. Dr. Sardo was involved in Reading Apprenticeship in STEM-Improving academic literacy in STEM.

In support of all the above, my self-directed study in the appropriate use of technology in the classroom while taking advantage of professional development opportunities, Flex, Mesa LOFT, my participation in Mesa Buddies Program (summer 2020), and my completion of a SWC - Remote Teaching Certificate (Winter 2020), and secondly, sharing these experiences with others by participating in department and school meetings, conferences, etc. have helped me with personal growth. (D. Gergens)

These are a few examples of many Professional Development opportunities that are leading to marked changes within our classrooms where instructors strive to use more inclusive language and assignments. Giving examples to students regarding influential scientists from underrepresented groups in science (Latinx, women), discussing issues of disproportionate impact of climate change, and environmental racism discussions are all part of the ways we bring discussions of equity into our classrooms.

Online Education Resources (OER) in our department had been spearheaded by Mr. Fremland. Building on this, Dr. Fusco-Hernandez as part of the *E3: Equity, Excellence, and Exito* grant will be building a free online homework system for chemistry courses. She has other interested faculty in other disciplines as well. This will be a fantastic addition to our learning materials. Many instructors have experimented with free online laboratory manuals which had pros and cons.

In F'20 - S'21, the college supported the writing and submission of the aforementioned HSI STEM grant that was awarded this semester. To this end, the college hired an outside grant writer. Mesa Chemistry was highly involved in this six month development and writing process. Drs. Fusco-Hernandez and Budzynski were on the grant writing team, along with Dr. Snyder from Physical Sciences. Dr. Budzynski led a STEM Grants Workgroup to involve faculty from other STEM disciplines in the development process. We appreciate the support of President Luster and Vice President O'Connor for these ideas and projects, and are thrilled to begin implementation in S'22.

While the college has done its very best to support students during the pandemic, a digital equity gap persists. As demonstrated in our General Chem data, low income Latinx students have a lower success rate than several other groups. While there are a multitude of reasons for this, as the college continues its return to in person instruction, lack of computer and internet access must continue to be addressed. As mentioned above, we are using Canvas more now, especially for students who need to miss class due to the pandemic. If such a student does not have easy access to the internet and a computer, the accommodations we put in place may not help. Hopefully, some of this will be alleviated with the reopening of the STEM Center for in person access, as well as more access to in person computer labs. Even with that, the digital equity gap is something the college should continually focus on. It impacts students in courses across all disciplines, but is especially prevalent in quantitative, tech heavy areas such as Chemistry. As instructors, we must remain cognizant of this. In Chemistry for example, Professor Moore worked with the bookstore to ensure that printed copies of the OER textbook would be available for students who prefer that. Many students have expressed that while they like the lower cost of OER, it is not always possible for them to access it online when needed, especially in households that are sharing a computer. Dr. Budzynski has been providing printed copies of lecture notes to her General Chemistry students, as well as pdf files on Canvas. This helps students who do

not have easy access to a printer, or tablet to take notes with to have the same access as those who do. The college should encourage these types of practices.

Another college-wide practice that has affected Chemistry positively is the commitment of the college to shared governance. Campus wide engagement and leadership is important to the Chemistry Department. Dr. Budzynski has served as a mentor Department Chair to other new Chairs in STEM. Her leadership has provided a great working relationship with Physical Sciences, Biology, and Mathematics. The culture she has set in the department is one of great respect for our adjunct faculty. She has been sensitive to their employment issues during our downsizing. Because of her expertise, she was a presenter in New Chairs Academy in Fall 2021 for Best Practices in Scheduling. In addition, there is no limit to her advocacy for STEM students and faculty. Problem solving is her forte and if there is a problem, she seeks solutions. Dr. Hjorth-Gustin (Asst. Chair) was elected to Chair of Chairs and has built relationships outside of the MS school that helps our ability to solve problems. Coming back in a hybrid modality and then face to face has taken a vision and organization. Both Chairs have worked relentlessly with Dean(s), Vice President of Instruction Isabel O'Connor, President Luster, Facilities, Student Services, Health Services, and District personnel such as Vice Chancellor Topham to provide clear guidelines and processes for reopening. The reopening efforts have been all consuming for Chairs and included implementation of vaccination requirements and classroom and office readiness. Dr. Hjorth-Gustin has been actively co-chairing the Red Zone group whose main goal was to provide a support system to communicate information regarding reopening issues and information. She hosted the Red Zone Reopening Meeting in August which was very well attended, but too large for Zoom. Currently, she is collaborating with Deans to develop a document with links to all important information regarding the reopening efforts. Reopening is so vital to our equity efforts as the data shows how impacted our Latinx students have been learning a difficult subject online!

We will not be able to completely solve the issues that students are facing in the pandemic. Many are outside of our control. However, the Mesa Chemistry Department is committed to providing high quality instruction with a student centered approach and a commitment to closing equity gaps in particular for Latinx students that make up 38% of Chemistry students. The faculty in this department are extremely hardworking and committed to students and their success. Returning to campus is our major means of providing more equitable instruction during the pandemic. What is important to note is that all of our goals will require support from the college by hiring at least one if not two full time tenure track faculty. This will allow us to continue our HSI grant work, leadership positions in the college, and make effective and institutional changes that close equity gaps.

## **Program Review Fall 2021**

**In what ways (if any) did changes to an online/remote modality due to COVID-19 impact student success and equity in your area/program? Please provide evidence.**

Chemistry is considered to be the central science because physics, engineering, biology, and allied health majors, and many other majors require courses in chemistry. Because of this, the Chemistry Department offers many courses ranging from preparatory chemistry, general chemistry, organic chemistry, analytical chemistry, allied health prerequisites, and a general education course with an emphasis in environmental issues. The department has 10 full time professors (including tenure track), 20 adjuncts, and 4 Instructional Laboratory Technicians. The Chemistry Department creates a supportive learning environment that spans across our curriculum. We constantly assess our student success across courses that form a sequence (e.g. Majors Preparation Track 152->200->201 or Allied Health Track 100->130->160). Our department works hard to establish a set core of standards so that students can succeed as they move through our courses. Laboratory courses provide an equitable way to present hands-on learning that supports lecture material. Laboratory work also provides a venue for students to work collaboratively and make STEM relationships that can support them through their courses. The Chemistry department prides itself on having student centered teaching and providing high quality equitable instruction grounded in standards for scientific work that will allow students to be successful at four year schools. The hallmark skills that our department fosters are critical thinking and hands-on experiential learning . Our professors use lecture presentations, small group discussions, worksheets, application to the real world, and hands-on laboratory training to help students understand and learn what is considered to be a very difficult and intimidating subject. Critical also is our interaction with students via office hours, review sessions, support courses such as Chem 16 and Chem 20, and Canvas.

The enrollments have changed with the pandemic (Table 1). There has been a 27% drop from Fall '20 to Fall '21. (Table 1) There are many factors out of our control affecting enrollment. From record numbers of students accepted to UC and CSU, to enormous financial strain on our students, and direct COVID-19 impact on students and their families, it is most likely a combination of all these factors. The department's lowered enrollment is consistent with national and local trends of decreasing enrollment due to the pandemic.

Semester	Enrollment
Fall 2019	2680
Spring 2020	2773
Fall 2020	2625
Spring 2021	2613
Fall 2021	1924

The Chemistry Department is committed to preparing students for transfer to four year schools and provide a foundation in future work in science or professional schools. There were 8 Associate Degrees in Chemistry and 22 degrees in Liberal Arts and Sciences Science Studies-Chemistry conferred during Fall '19- Sp '21. 67% of the students were 18-24 in age, 63% were female, and 36.7% were Latinx. It should be noted that chemistry supports a wide variety of majors including high transfer majors of Biology and Engineering.

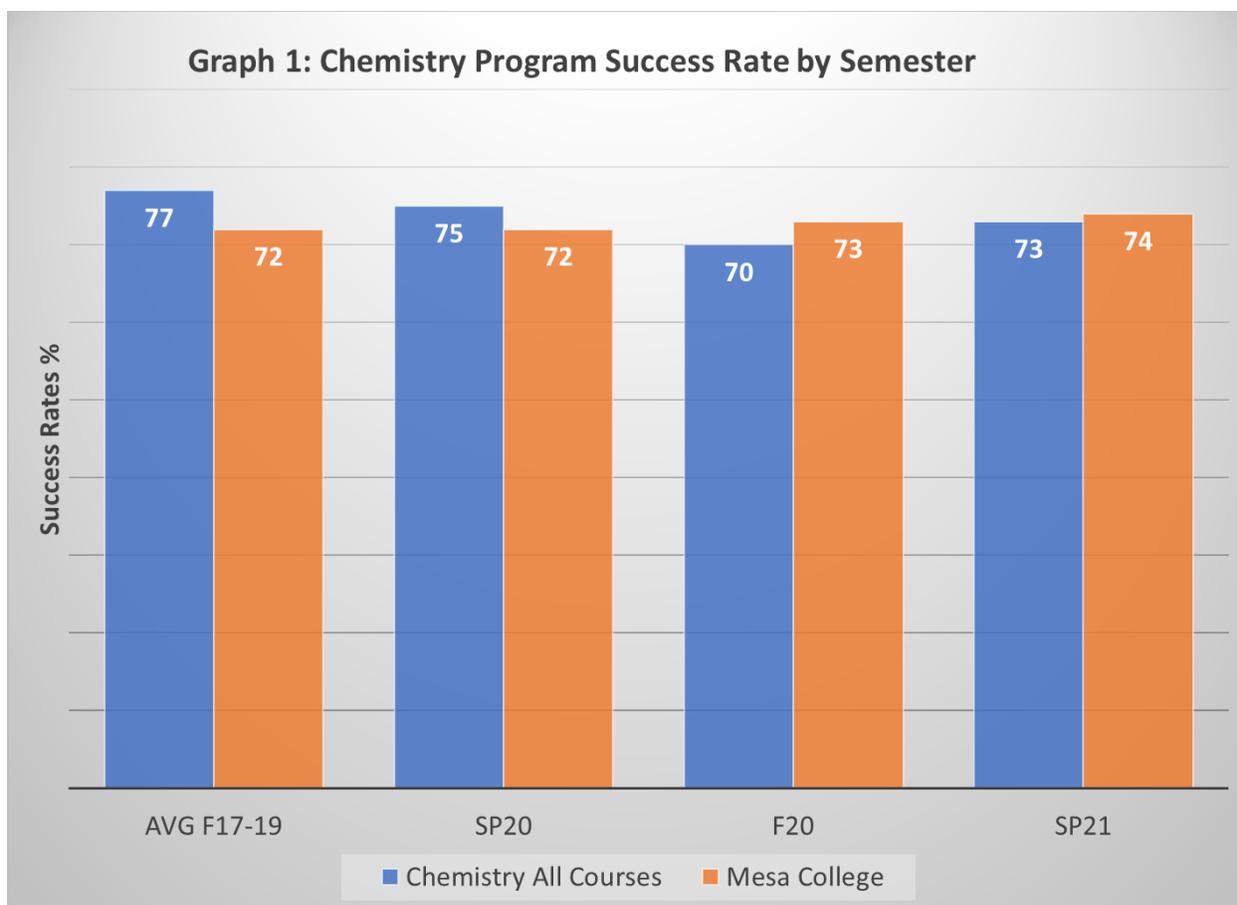
The philosophy of the department is to be student centered and equitable while upholding standards of excellence in scientific and critical thinking. Standards are important to our department while providing an engaging, supportive, and positive learning environment. This is achieved by communicating clear expectations to students, student centered pedagogy, equitable teaching practices, open door attitude to students, updating and improving laboratory courses, support courses, participation in embedded tutoring programs and Peer Mentoring, close relationship to counseling, and a focus on equity. Participation in and leading Professional Development training and opportunities in the college is also an important practice in the Chemistry Department.

The conversion to online on the part of STEM faculty was very stressful and involved countless hours of work to provide videos for students, adjusted teaching materials, adjusting of laboratory experiments and assignments, and developing equitable assessments that gave meaningful feedback to students. Challenges existed in the Canvas format in grading and exam preparation that cause significant stress for faculty where creating and grading has tripled the time that is usually spent on these tasks. In addition, academic dishonesty issues made it challenging to maintain quality. Many of our faculty exceeded expectations for communicating with students and even helped students at unusual hours to support them to be successful in online courses. We became 24/7 instructors because we wanted our students to succeed.

Many students struggled in this format despite our best efforts. Not having a safe and focused classroom free from household responsibilities is very difficult for students. Technology presented its own challenges with many students not having computer access and reliable Internet connections.

### **Success Rates**

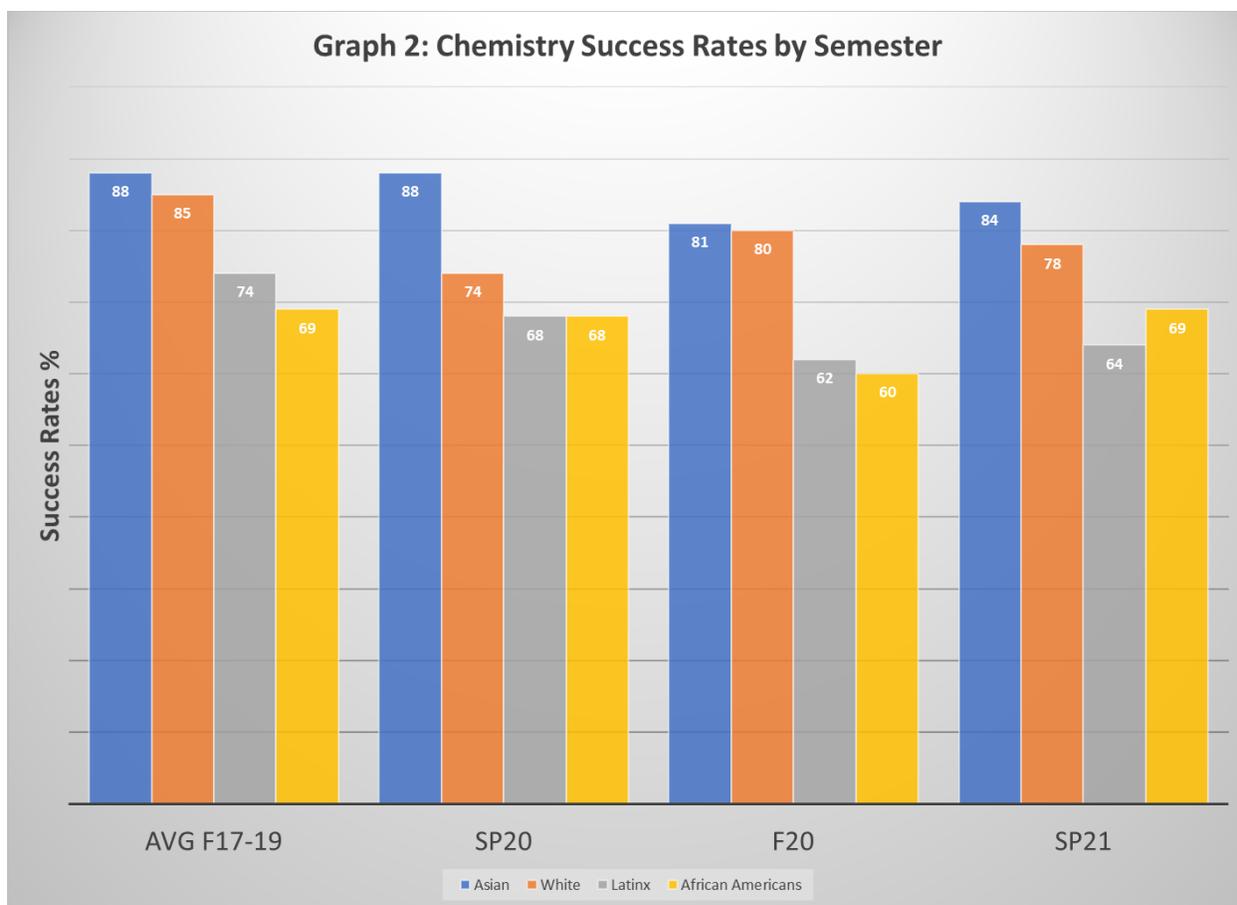
The change in modality from face to face to online/remote modality affected the Chemistry Department's success rate for all the courses that are offered. The data was compiled from the Mesa College Course Outcomes Dashboard. Because each semester has variations, Fall '17, Fall '18, and Fall '19 were averaged to provide a reference point of success rates before the COVID-19 pandemic. The average success rate in this time frame was 77% and this was higher than Mesa College's success rate at 72%. Graph 1 shows the decrease in success rates from Spring '20 with a 75% success rate to 70% in Fall '20 to 73% in Spring '21. Despite a lower success rate, the success rate was not significantly lower than the Mesa College overall success rates. Clearly, there has been a lowering of our success rates due to the switch from face to face modality to online.



Disaggregation of the data shows that not all students were affected similarly in the switch to online/remote. (Graph 2) Asian students show the least impact with Sp '20 success rate of 88%, F '20 88%, and Sp '21 84% which is similar to the average F'17, '18, '19 of 88%. White students did show a decrease in Sp '20 success rate of 74%, F '20 80%, and Sp '21 78% which is lower than the average F'17, '18, '19 of 85%. Despite the decrease, the success rates are still above the Mesa College averages of Sp '20 success rate of 72%, F '20 73%, and Sp '21 74%.

The equity gap between Latinx and non-Latinx students in Mesa College Chemistry courses was compared from pre-pandemic (comparison to Fall '17, Fall '18 and Fall '19 overall average Latinx 74%) has decreased due to the conversion to online. Latinx success rates were Spring '20 to 68%, Fall '20 to 61% and to 64% in Spring '21.

African American students showed the same success rates from pre-pandemic (comparison to Fall '17, Fall '18 and Fall '19 overall average 69%) except for that Fall 2020 showed a decrease. African American success rates were Spring '20 to 68%, Fall '20 to 60% and to 69% in Spring '21.



## General Chemistry

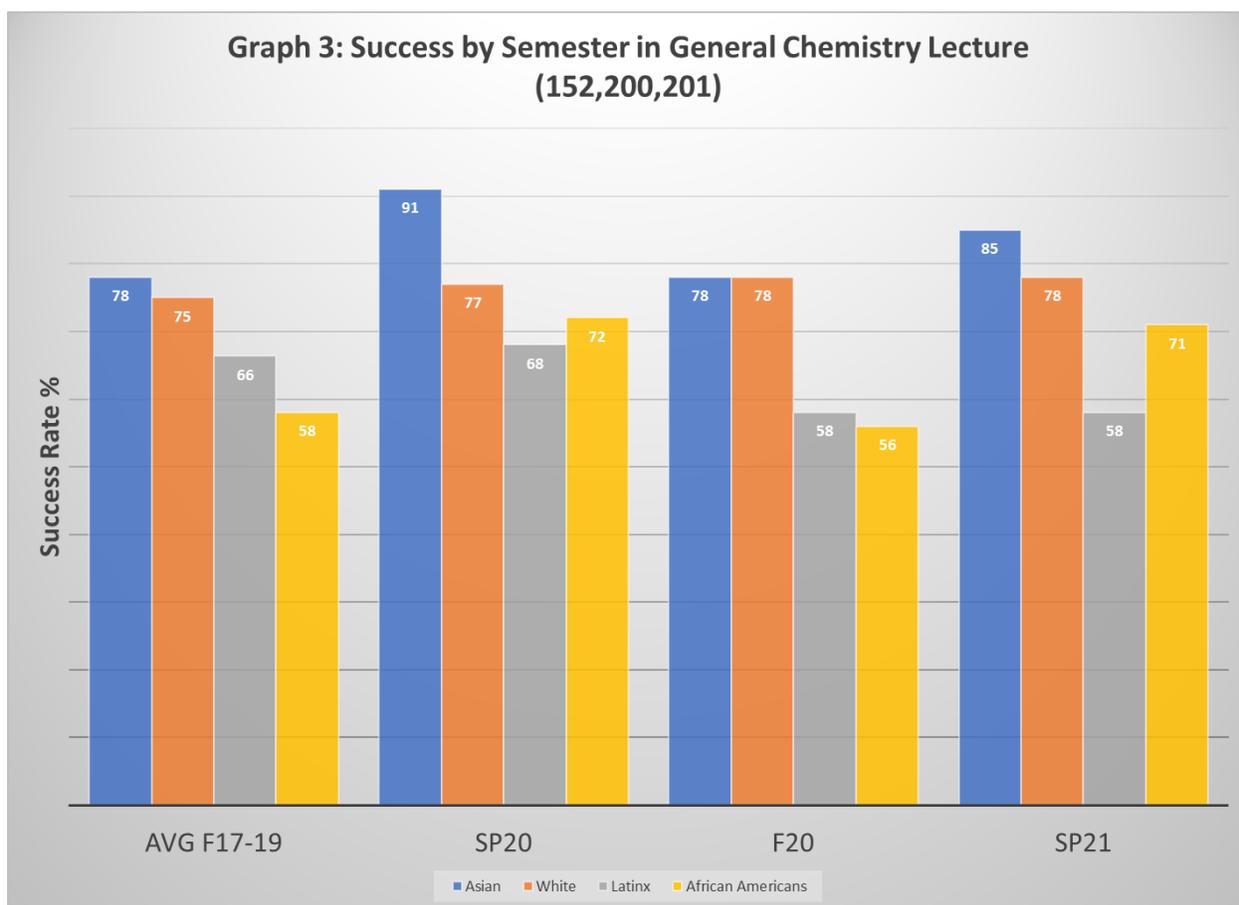
General Chemistry (Chemistry 152, 200, 201) is a significant portion of our enrollments and one or more of these courses are part of the curriculum for physics, biology, engineering, and variations of these degrees. Spring '20 was the “flip” from face to face to online. Fall '20 and Sp '21, our lecture courses were all online, with only a few partially face to face lab courses.

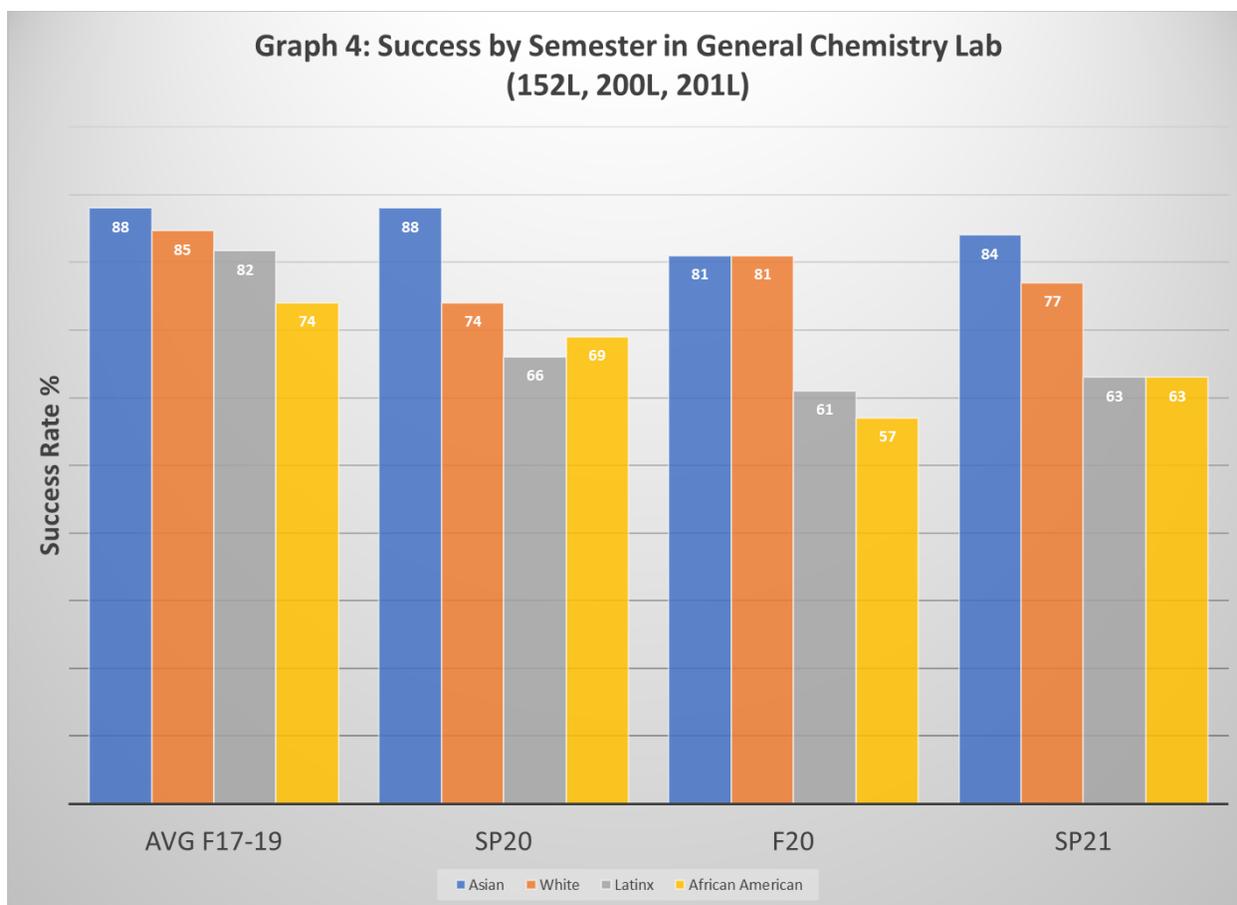
Success rates for Asian, White, Latinx, and African American students in the categories of General Chemistry Lecture courses (Chem 152, 200, 201) and General Chemistry Lab courses (Chem 152L, 200L, 201L) were compared. Data from F'17, F'18, and F'19 semesters were averaged (all face to face sections). That average was compared to Sp'20, F'20 data (all online, except for 201L which was partially face to face), and Sp '21 (all online except for 201L which was partially face to face). There was very little variance between the individual F'17, F'18, and F'19 semesters, so the average is very reliable.

Disaggregation of data for General Chemistry Lectures is shown (Graph 3) and for General Chemistry Laboratory (Graph 4). *In all cases analyzed, Latinx students are the most impacted from the pandemic. The online semesters of F'20 and Sp '21 showed a significantly lower success rate than the face to face semesters for Latinx students.* It should be noted that there was no significant decrease in enrollment for either Latinx or non-Latinx students during Fall '20. For all of Chem, Latinx enrollment increased by 2% in F20 as compared to the average of F '17-F'19, while non-Latinx showed a 5% decrease. Latinx

students represented 37% of enrollment in all chemistry courses as well as Gen Chem in F17-19, and 38% of enrollments in all of chemistry as well as Gen Chem in F20. This percentage is comparable to the percentage of Latinx students at Mesa College. It should also be noted that the negative trends in equity gaps for Latinx students is also apparent in laboratory courses (Graph 4).

It should be noted that African American students showed fluctuations in success rates from a low of 56% in F'20 which is similar to average F '17-F' 19 of 58% to highs of 72% in Sp '20 and 71% in Sp '21. It should be noted that the percentage of African Americans in the general chemistry sequence is 4.8% (N=133). This percentage is lower than the percentage of African American students that ranges from 5-6% at the college. The data has a small N value and can fluctuate dramatically with changes in success rates. Therefore, it is difficult to make strong conclusions regarding the data.

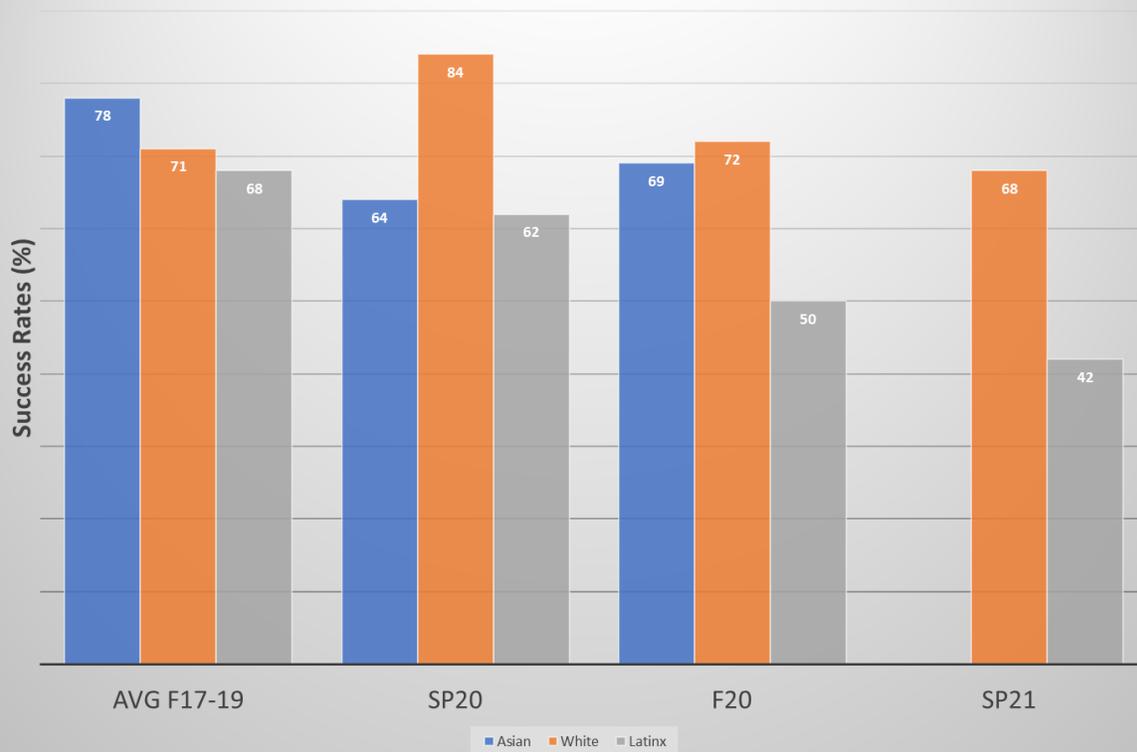


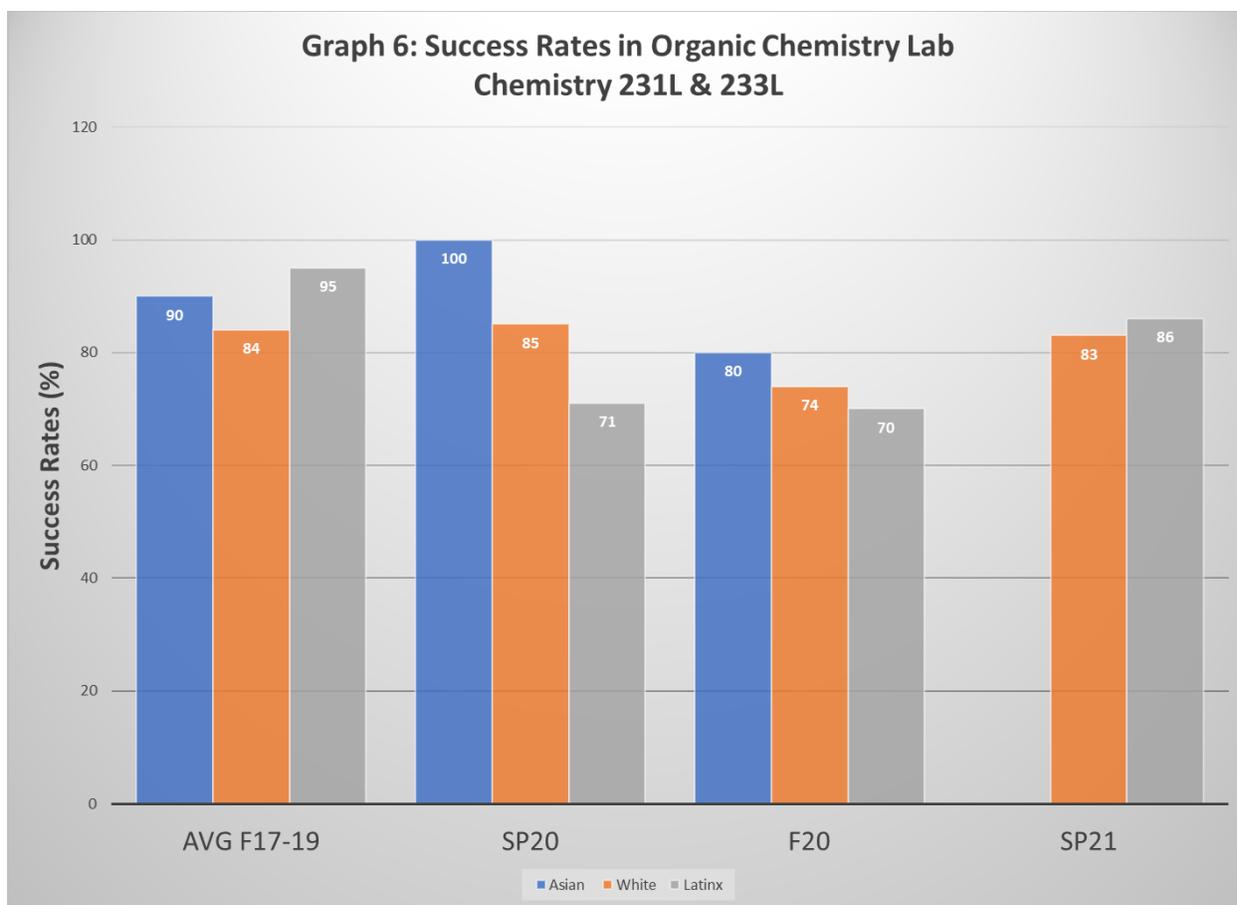


### Organic Chemistry

The Organic Chemistry courses show a decrease in success rates especially in regards to Latinx students. due to the switch in modality. The data from Organic Chemistry lecture is showing that Latinx students were the most impacted in the pandemic switch in modality where the drop from an average F'17-F'19 went from 68% to Sp'20 62%, F'20 50%, and Sp '21 42%. (N=104). In laboratory work, Latinx students showed a similar trend of lowered success rates. The drops in success rates for Asian students were also present (N=43). African American students are underrepresented in these courses. For example, during F'17-F'19 & Sp'20, F'20, and Sp '21(N=16). This is 3% of the total enrollments during this period (Graphs 5 & 6). Because of this low N value, further statistical analysis will not be valid. Instead we should focus on increasing their representation.

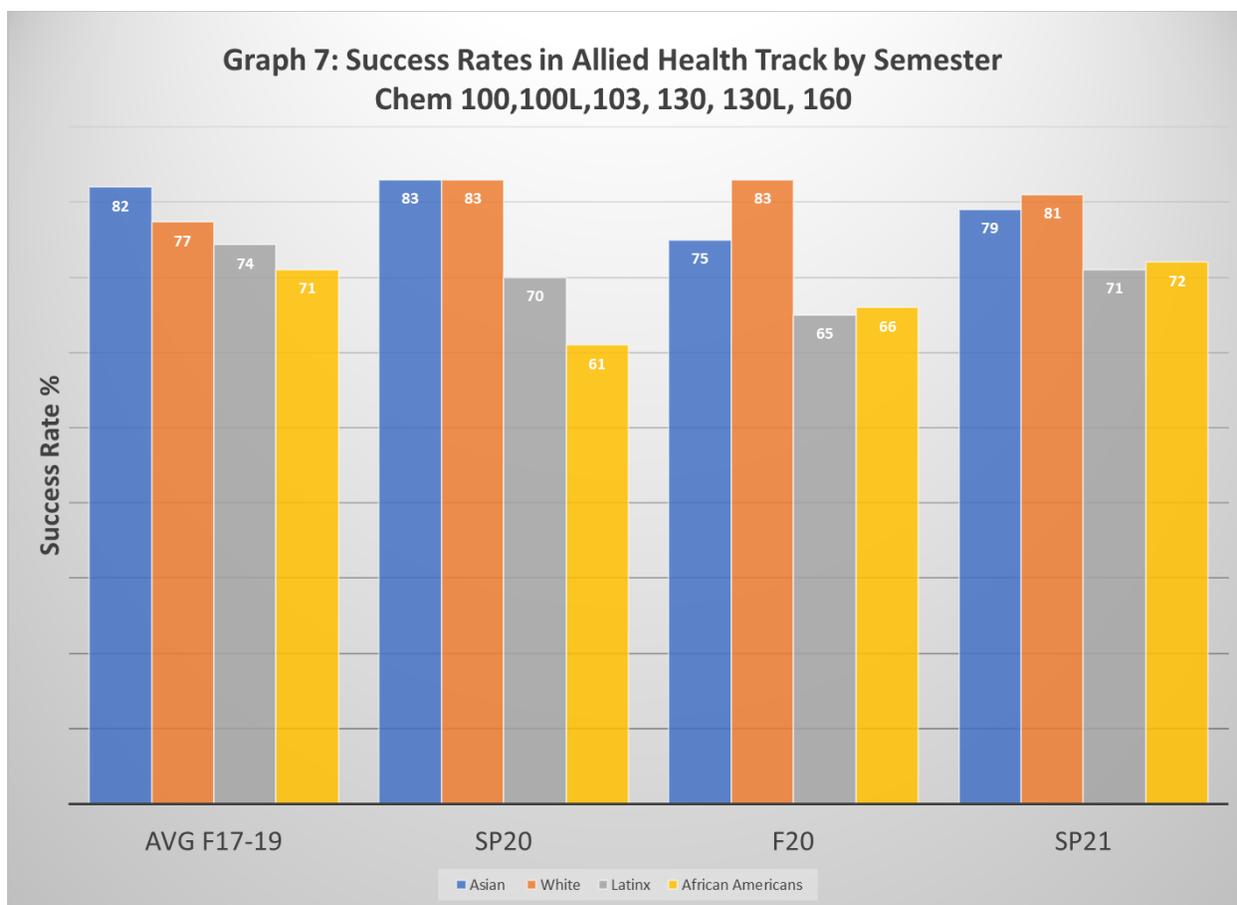
Graph 5: Success Rates in Organic Chemistry by Semester  
Chemistry 231 & 233





### **Allied Health Track: Nursing & Nutrition Majors**

Allied Health track includes the courses Chem 100, 100L, 103, 130L, and 160. The students in this sequence typically include nursing majors and nutrition majors. The trends in success rates show a fluctuation in Spring 2020, but it appears that the success rates are similar to average F '17-F' 19 in Spring 2021. Unlike the General Chemistry and Organic Chemistry, the Allied Health track students' success rates appears to be less affected by the switch in modality. (Graph 7)



### **Analytical Chemistry**

Analytical Chemistry is a hands-on technical course in learning instrumentation and analytical techniques. It is a required course for transfer for chemistry majors transferring to CSU. It has become a required course for students entering the Clinical Sciences Laboratory Technician Program at SDSU. Course Success Rates from Sp '17-Sp '19 were 83% (N=54). Spring '20 was a 94% success rate (N=17). Because of the nature of this course, it was not offered during Spring '21 and will not be offered in Spring '22. It is the department's goal to bring the course back in Spring '23.

### **General Education**

Chemistry 111/111L is a general education course for non-science majors. Its focus is on environmental chemistry and introduction to biochemistry/nutrition. As a department, we always work closely with counseling to encourage underrepresented groups to take the course as a wonderful opportunity to learn more about real world chemistry issues. Typically the course has a wide variety of majors from English to Fashion to Business majors.

Our general education courses (Chemistry 111/111L) exhibit success rates for all groups are statistically equivalent and range from 62-86% depending on group and semester. It should be noted that this is a

limited course with only one lecture and one lab section per semester. Therefore, it is difficult to interpret success rate trends.

One interesting observation in this course is that the percentage of African Americans in the course is roughly 8% (N=42) which is higher than the college's percentage of African American at the college which is between 5-6% depending on the semester. This reflects our good work in promoting the class to underrepresented groups in science through counseling. It provides an opportunity for us to encourage students to consider further work in the sciences.

### **Area of Further Analysis:**

#### **General Chemistry Success Rates by Ethnicity and Income**

Success rates in General Chemistry Lecture courses (Chem 152, 200, 201) were analyzed based on ethnicity and low-income vs non-low income status. All data was obtained from the Mesa HSI STEM Equity Dashboard. Data from F17, F18, and F19 were aggregated. Income data for F20 is not yet available on the dashboard, so these results are all pre-pandemic.

First, success rates in all three courses and all three semesters combined were obtained for various ethnic groups. Graph 1 shows this data for students identified as African American, Latinx, White, and Asian, broken into Low Income and non-Low Income categories. The dashboard uses financial aid status to determine if a student is low income.

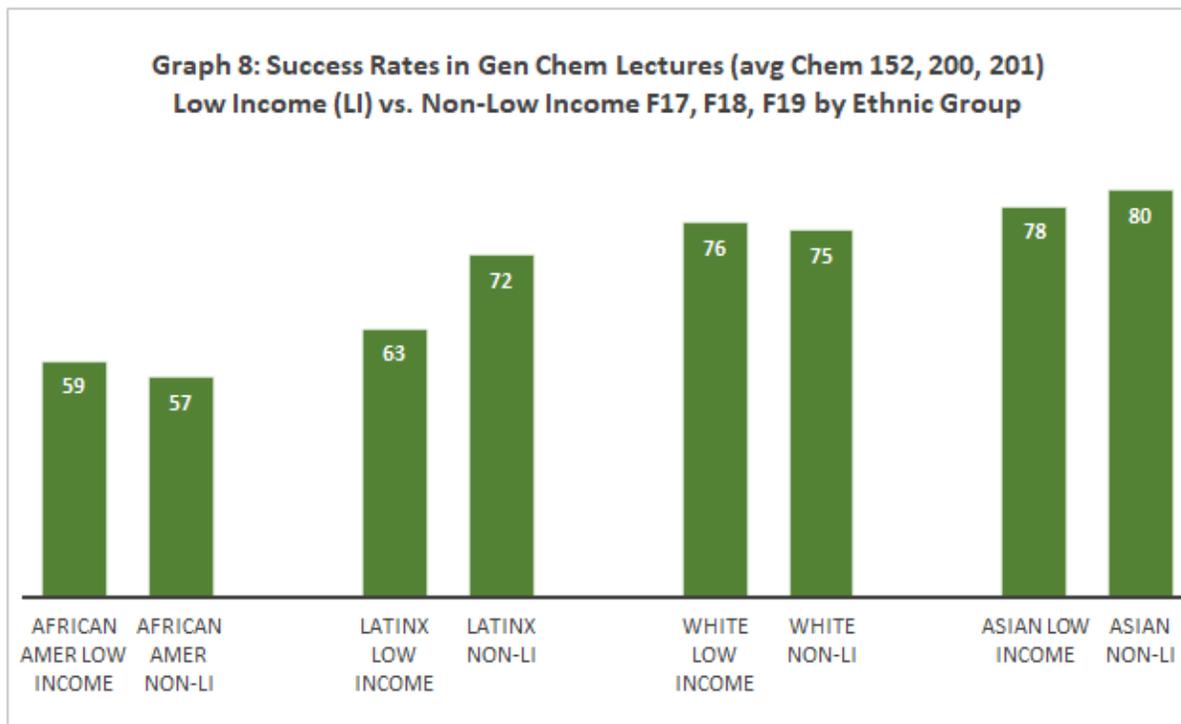
As the first graph shows, for the ethnicities included, all but Latinx shows a two percentage point or less difference between students of different income status. Latinx low income students had a success rate nine percentage points lower than their Latinx non-low income counterparts. Note: the n value for each category in Graph 1 is greater than 100, except for African American low income (n=80) and African American non-low income (n=23)

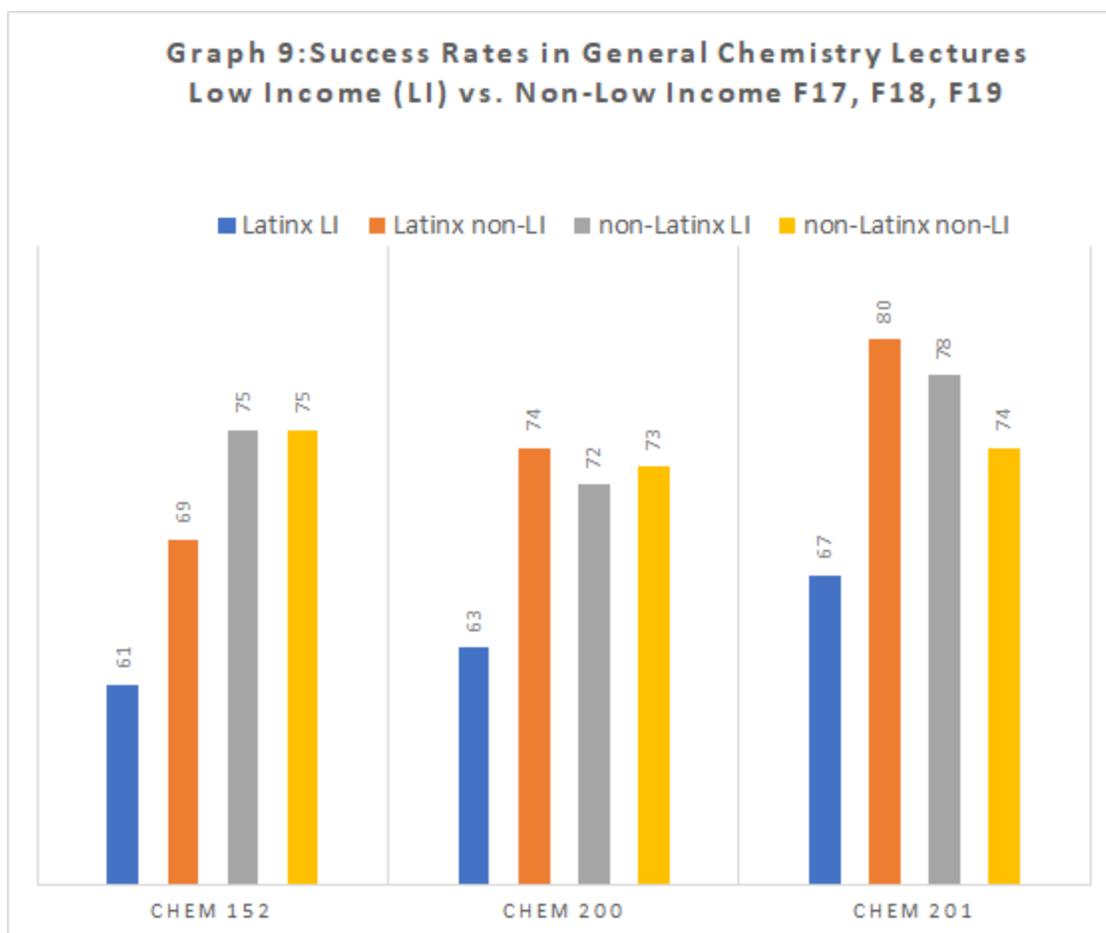
To further investigate this data, the courses Chem 152, 200, and 201 were looked at individually during the same three semesters. This time, the non-Latinx ethnic groups were combined into the same columns, while still looking at low income vs. non-low income status. These results, presented in Graph 2, show that there is an obvious equity gap between Latinx and non-Latinx students in Chem 152, with low-income Latinx students showing a 14 percentage point difference from their non-Latinx low-income counterparts. Non-low income Latinx students have a smaller gap of 6 percentage points.

Interestingly, the gap between non-low income Latinx students and non-Latinx students is completely erased once students get to Chem 200. However, the gap between low income Latinx students and other students remains, and they are now 11 percentage points behind their non-low income Latinx counterparts. This gap is widened further in Chem 201. (Note: all n values in Graph 2 are greater than 100, except for non-low income Latinx students in Chem 201, where n=65).

This data is limited to general chemistry lectures, for three fall semesters. It does not include any data from pandemic semesters when these courses were taught online. We are looking at general chemistry which represents our largest program, with over 900 students in these classes in F19 alone. Based on the analysis above, all low income Latinx students, and all African American/Black students in Chem 152,

200, and 201, as well as non-low income Latinx students in Chem 152, have success rates below 70%. In F19 these groups totaled 309 students. Efforts should be made to identify and target these students with support to help increase their success rates. Some of these supports are already in place, such as Chem 016, a companion workshop course to Chem 152, Chem 020 a prep course for Chem 200, Peer Mentoring in Chem 200 and 201, and Classroom Tutors for Chem 152. The difficult part is ensuring students in these groups take advantage of these and other supports. Many low income students, for example, need to work more hours or take care of family members making it more difficult for them to increase their time spent on these courses.





**What practice has your area/program implemented since the last program review cycle that you would like to improve/continue? Identify impacts on student success and equity.**

The return to on-campus learning was welcomed both by faculty and students. Our department is committed to in person instruction. However, there are pandemic online teaching practices that can help supplement and strengthen in person instruction and attain more equitable outcomes.

- A. Safety First: Chemistry faculty are used to laboratory safety procedures in our discipline. Extending this to mask usage in classrooms has been an extension of existing safety procedures. Our department has been vigilant in asking students to stay home when sick.
- B. Flexible assignments: Because our department is student centered, we are very aware of the difficulties for students during the pandemic. Our department has worked together to allow for flexibility. This is especially true because we are asking students to stay home if sick for any reason. This flexibility includes not only allowing students to drop an exam or laboratory assignment, but having clear policies for making up laboratory assignments or exams. For example, in Chemistry 152L, there are make up weeks for laboratories which is something that did not happen before the pandemic. Previously, if a student missed an experiment, they were allowed to make it up during another section, space allowing. To minimize possible covid exposure, this practice had to be discontinued.

- C. Supplemental Material: Because students may have to miss class, our department is encouraging the use of the supplemental materials so that student absences can be minimized. The videos that our faculty made in the pandemic have been useful for students if they miss class. Some students report using videos to clarify lecture material.
- D. Canvas usage: A greater percentage of faculty are using Canvas in a greater capacity than before the pandemic. Canvas allows for a centralized way to communicate with students, post course materials, and organize in a way that facilitates student engagement. It has become a great tool for communication with students.
- E. HSI Lab Redesign institute was led by Ms. Danica Moore during Summer 21. 10 instructors, 6 faculty and 4 adjuncts, from the department participated in the Lab Redesign. There were 8 different lab courses that were modified: Chem 100L, 103, 130L, 152L, 200L, 201L, 231L, and 233L. In Chem 100L, there were rewrites of lab worksheets that featured an online component to help students demonstrate mastery of the lab component. For Chem 103 there was an online extraction lab that was written to act as a supplemental for students who are unable to attend lab due to hardship or illness. In Chem 130L, there was creation of an online protein synthesis lab serving as a supplemental assignment for students who are unable to attend this lab due to hardship or illness. In Chem 152L, 10 out of 12 labs were shortened to ensure that students have ample time to finish experiments and post-lab questions in the allocated lab period. In Chem 200L, all post-lab questions were moved into Canvas for the purpose of making it easier to cycle through different question sets each semester (ensuring academic honesty). The first two worksheets were also revised and integrated into Canvas with added instructions for students who are unable to attend the first two weeks of class. In addition, the Beer's Law background section is rewritten to include more examples, more depth and be more visually oriented. In Chem 201L, the background sections of all labs were rewritten to improve language, include more sample calculations, and more visual aids. In addition, the pre-lab quizzes were developed in Canvas to help ensure that students are prepared for lab upon coming to campus. In Chem 231L/233L labs were all reformatted to include online content that was developed in the move to DE. This includes questions embedding in Canvas, updated figures and pre and post lab videos to help students ensure they are safe going into the lab, and understand what they did coming out of the lab.
- F. Scheduling of Chemistry 16 & 20: These are great support courses that had to be suspended from being offered during the pandemic. Chemistry 16 was found through a study (Dr. Fusco-Hernandez) to close equity gaps among Latinx students in Chemistry 152. It is a support course that stresses problem solving skills. They are returning this intercession and in Spring 2021.
- G. Return to Peer Mentoring: During the pandemic, chemistry did participate in Peer Mentoring in Spring '20 and Fall '20. Dr. Fusco-Hernandez and Dr. Sardo were Peer Mentor Leads. Dr. Hjorth-Gustin is active in recruiting students. But, it was difficult to find students who wanted to participate as mentors for Spring '21. This semester, she has recruited two students for Peer Mentor for Spring '22. This is an excellent program for our students to find support for General Chemistry.

## **Future Work & Goals for Chemistry Department**

1. HSI Grant: STEM E3 : Equity, Excellence and Éxito was funded through the Department of Education in Fall 2021 with Dr. Fusco-Hernandez as Principal Investigator. This grant is focused on increasing the number of Hispanic and other low-income students attaining STEM degrees and developing model articulation and transfer agreements in STEM with Four-Year Institutions. This 5 year, \$4.75 million program of integrated interventions and capacity building activities will increase the number of Hispanic and low income students attaining post secondary degrees in STEM and participating in the growing regional STEM economy. The following strategies are at the core of the grant:

1. Development of Free Online Homework System (Lead: Dr. Amanda Fusco Hernandez)
2. STEM Studio Classroom Development Coordinator (Lead: Dr. Budzynski)
3. Interdisciplinary STEM Curriculum Writing (Lead: Dr. Hjorth-Gustin)
4. Continuation and Expansion of Peer Mentoring
5. STEM Professional Learning Opportunities
6. STEM Student Orientation
7. Engineering Workshop Expansion and Biotechnology Workshop Development

This grant will be an incredible opportunity to work collaboratively with all disciplines in STEM to make lasting changes for students that help close equity gaps.

### 2. General Chemistry

Working through the Interdisciplinary STEM Curriculum Writing Group, focus on pathways for students to accelerate in the General Chemistry path for students with higher math levels and develop Chemistry 152 courses tailored to biology and engineering students to improve success, spark interests, and narrow equity gaps.

### 3. Goals for Allied Health Track

One of the main goals for the Allied Health track is to work collaboratively with Allied Health Faculty, Nutrition, and Biology Faculty to ensure that our chemistry courses are preparing students for their courses. In addition, the department will be forming an Allied Health Track Workgroup (Lead: Dr. Sardo) to analyze and assess the course outlines of records, modernize the Chemistry 130/130L curriculum keeping in mind equitable assignments. Our goal is to revitalize this track!

### 4. Goals for Analytical Chemistry

This course is an extension of General Chemistry for chemistry majors and now has a group of students preparing for Clinical Laboratory Sciences. One goal is to partner with transfer institutions for more communication and dialogue.

### 5. Goals for General Education

It is our hope that as the pandemic subsides that we can expand course offerings in this class.

## 6. Goals for Organic Chemistry

Over the last 3 years, there has been an enormous amount of work spent on modernizing the laboratory work. The courses continue to evolve and improve.

7. Increase representation of African American students: The goal of the department will be to seek ways to improve the numbers of African American students in General Chemistry and Organic Chemistry to at least match the 5-6%. One approach is to work more closely with counseling.

8. Obtain a tenure track faculty position: All of our goals will require support from the college by hiring at least one if not two full time tenure track faculty. We recently learned that one of our full time faculty will be retiring in January.

### **What practices has your area/program implemented since the last program review cycle that you would like to change/discontinue?**

Since March 2020, our department has been in constant change and pivoting to the needs of our students during a stressful world-wide pandemic.

For lectures, the conversion to online required a massive effort. Different instructors addressed the conversion online in different ways. In March 2020, we all taught remote on Zoom. Many instructors had to invest 1000+ dollars in technology to work from home. Zoom proved to be a tool that was both helpful and difficult. Students would have an opportunity to interact with their instructors on Zoom, but there were technical issues.

Student technological gaps became painfully obvious and the lack of equity for our students became clear to us. Students lacked the necessary technological resources to be able to take courses online. Our department donated 115 lap top computers to help students obtain a computer.

*I am sure this is true of students face-to-face also, however in the case of online, less tech literate students were disproportionately impacted. The instability of many student's internet connections caused much anxiety for myself and students during assessments. In some cases, students would be disconnected 2-15 times throughout the course of assessments. It is only through a concerted effort that I made sure that these students' grades were able to reflect their hard work and commitment to their studies. (D. Moore)*

Zoom fatigue is real and many students would express that they struggled to focus for an hour and half lecture on Zoom. The testing format was problematic as well.

*Each exam I wrote was done with question groups so students were taking different exams than their classmates. Those exams took me about 15-20 hours to write. I was able to reuse exams from the first to next semester. I wrote around 13 quizzes as well. Grading exams took about the same amount of time as writing them, because grading uploaded student work on Canvas is very difficult, and students needed to show their work for many chemistry problems. (D. Budzynski)*

When we went online in March 2020, the conversion of our lecture and laboratory courses was difficult to say the least. ***The Chemistry department created a combined total of 800 + videos during the course of the pandemic.*** Our laboratory assignments had to be adjusted, which took an enormous amount of work on the part of the full time faculty members. Dr. Toto & Dr. Hjorth-Gustin worked on the laboratory materials for Chemistry 201L. In March 2020, 6 new laboratory assignments were written that focused on data analysis. In Chemistry 200L, Dr. Budzynski wrote 6 new online laboratory assignments that also

focused on data analysis. In Chemistry 100L, Ms. Moore creatively adjusted Chem 100L to be self-contained modules with videos, worksheets, and questions. In Chemistry 152L, Dr. Fusco-Hernandez and Mr. Fremland began filming videos where they demonstrated all the laboratory procedures and re-wrote the manual to reflect the changes. Chemistry 231L and 233L were also re-written by Dr. Saidane. Dr. Sardo was actively involved in adjusting the Chemistry 103 laboratory materials. When most of our courses went fully online in Fall 2020, labs from the first half of the semester had to be adapted as well. In summary, 100+ numbers of experiments were written totaling hundreds of hours of work.

Despite our best efforts, our subject material does not lend itself to an online format for many reasons, and online teaching of chemistry widens equity gaps. Unless there is an emergency declaration regarding the pandemic, Mesa College chemistry will be discontinuing online modality as a viable option of instruction. Laboratory courses are by nature hands-on technical learning. Even with the most creative learning materials, online laboratories fall short. It is difficult for students to visualize the experimental procedure (even with videos). More than anything, the students work together in the laboratory to discuss and analyze data. This collaboration provides a foundation of equitable learning and is so essential for our students to learn not only laboratory techniques, but also to reinforce lecture material. It also provides a support and culture of STEM that helps students feel supported.

Because we are constantly analyzing our equity outcomes, as a department we realized that face to face instruction is necessary for our science majors. The Department Chairs in consultation with the full time faculty assessed the feasibility of offering some laboratory courses on campus for Fall 2020-Summer 2021 following safety protocols and COVID-19 mitigation strategies. So, we made a decision to bring back laboratory work in Chemistry 201L, 231L, and 233L. It was not feasible to bring back other laboratory courses. The planning and preparation required to do this was extensive. We were the only community college in San Diego County to bring back chemistry students in person during the pandemic! We followed the safety protocols established by the county and had to social distance the laboratory. On paper, social distancing laboratory work may sound easy. In practice it is not trivial and ***required another rewrite of the manuals for the three laboratory courses and a special schedule*** (written by Dr. Toto and Chairs). This is because the experiments had to be adjusted for the time blocks and students coming from online laboratories needed time to learn the basic skills so we had to make changes. In Chemistry 201L, the course is capped at 24 students. In order to social distance to 6 feet, only 8 students + instructor could be allowed in class. Students were placed in one of three groups. Essentially, they would come to class for an on campus lab once every three weeks. The alternative time was spent on data analysis AND another laboratory virtual assignment. Included here is the schedule. (Table 2)

Tentative Spring 2021 Chem 201 Lab Schedule

Week	Day	report to lab on your assigned Group A, B or C experiment days (in red).	Due <sup>A</sup>
1 Feb. 1	M T W Th F	Online Intro Video and intro Quizes. <b>Do NOT come to lab 1st week.</b>	ASAP (before 1st in lab meeting)
2 Feb. 8	M	Group A: EXPERIMENT 1 Groups B & C: OLA 1	<b>In Lab Experiments (ILE)</b>  EXPERIMENT 1 - Molar Mass of a solid & Chemical Kinetics  EXPERIMENT 2 - Equilibrium  EXPERIMENT 3 - Analysis of oxalate in a Transition Metal Complex  EXPERIMENT 4 - Voltaic Cell
3 Feb. 16	T W Th F	Group A: EXPERIMENT 1 Groups B & C: OLA 1	
4 Feb. 22	M F	Group B: EXPERIMENT 1 Group A & C : OLA 1	
5 Mar. 1	M F	Group C: EXPERIMENT 1 Group A & B: OLA 1	
6 Mar. 8	M F	Group A: EXPERIMENT 2 Group B & C: OLA 2	<b>Online Assignments (OLA)</b>  OLA 1 - Integrated Rate Law  OLA 2 - Error Analysis in Titration of an Antacid  OLA 3 - pH and Buffers  OLA 4 - Titration Curves  OLA 5 - Thermodynamics
7 Mar. 15	M F	Group B: EXPERIMENT 2 Group A & C: OLA 2	
8 Mar. 22	M F	Group C: EXPERIMENT 2 Group A and B: OLA 2	ILE 2 & OLA 2
9 Apr. 5	M F	Group A: EXPERIMENT 3 Group B & C: OLA 3	
10 Apr. 12	M F	Group B: EXPERIMENT 3 Group A & C: OLA 3	ILE 3 & OLA 3
11 Apr. 19	M F	Group C: EXPERIMENT 3 Group A & B: OLA 3	
12 Apr. 26	M F	Group A: EXP. 4 & Check Out Group B & C: OLA 4	ILE 4 & OLA 4
13 May 3	M F	Group B: EXP. 4 & Check Out Group A & C: OLA 4	
14 May 10	M F	Group C: EXP. 4 & Check Out Group A & B: OLA 4	OLE 5
15 May 17	M F	Group A, B, & C: OLA 5	
16 May 24			

<sup>A</sup>all reports should be uploaded into Canvas by Sunday, 11:59pm, at the end of indicated week.

Table 2

Organic Chemistry 231L and 233L have a cap of 18 so their social distancing involved splitting the students into two groups. This required another rewrite of the manuals courses and a special schedule not shown in this document.

It should also be noted that socially distanced laboratory courses taught from Fall 2020-Summer 2021 involved support on the part of our Instructional Laboratory Technicians who helped not only to prepare the labs but also to screen students for COVID-19.

In March of 2021, the STEM Department Chairs were proactive in requesting that more courses be allowed back to campus. Fueled by increasing equity gaps and difficult working conditions, we wrote a letter in support of more on-campus courses for Fall 2021. We felt supported by Dean Recalde and Vice President of Instruction Isabel O'Connor. At the same time, the District began negotiating with the AFT Union the vaccination requirements for faculty and students. This allowed for a larger return of 93% of our chemistry courses being offered in a face-to-face format in Fall 2021 and 100% of the laboratory courses being offered face-to-face.

**What college-wide practices implemented since the last program review cycle have affected your area or your program positively or negatively? Identify impacts on student success or equity.**

One college-wide practice that has positively affected our area are all of the Professional Development opportunities given to faculty to help convert courses to the online format during the change of modality and training for more equitable teaching practices.

The SDCCD Distance Education Certification allowed for all of the chemistry faculty to prepare their online courses for Canvas. All of our faculty participated and we work tirelessly to adapt our course materials to the online format. There were still issues with the platform for a quantitative field like chemistry in terms of assessment and ease of use in the software (mentioned in previous sections). Canvas was not designed for quantitative fields. However, now that we are back to face to face instruction, the Canvas training allows for faculty to continue effectively using Canvas to supplement face to face learning. The department faculty really supported each other in what felt like 24/7 constant communication (nickname for this group is The Hive). This camaraderie helped carry us through learning all the new technologies. Our faculty attended Zoom training sessions provided by the LOFT and supplemented instruction by learning Canvas Studio, Proctorio, Pronto, Discord, and screencasting.

Our full-time professors work hard to train on equitable teaching practices. Many are involved in attending conferences. For example, Dr. Fusco-Hernandez attended the 2021 AHSIE (Alliance of Hispanic Serving Institution Educators) Best Practices Conference. This conference offered “over 80 concurrent sessions showcasing the creativity, innovation, and commitment of HSI practitioners from dozens of colleges and universities from across the nation. Dr. Hjorth-Gustin attended the Academic Senate Fall 2021 Plenary and attended many equity focused presentations “All Things Ethnic Studies” and “From Equity Theory to Equity Practice: Activating Our Agency as Practitioners”. Ms. Moore attended “Equity in Assignments, African American Male Network (A2MEND)” conferences, and “Culturally Responsive Teaching”. Dr. Sardo was involved in Reading Apprenticeship in STEM-Improving academic literacy in STEM.

In support of all the above, my self-directed study in the appropriate use of technology in the classroom while taking advantage of professional development opportunities, Flex, Mesa LOFT, my participation in Mesa Buddies Program (summer 2020), and my completion of a SWC - Remote Teaching Certificate (Winter 2020), and secondly, sharing these experiences with others by participating in department and school meetings, conferences, etc. have helped me with personal growth. (D. Gergens)

These are a few examples of many Professional Development opportunities that are leading to marked changes within our classrooms where instructors strive to use more inclusive language and assignments. Giving examples to students regarding influential scientists from underrepresented groups in science (Latinx, women), discussing issues of disproportionate impact of climate change, and environmental racism discussions are all part of the ways we bring discussions of equity into our classrooms.

Online Education Resources (OER) in our department had been spearheaded by Mr. Fremland. Building on this, Dr. Fusco-Hernandez as part of the *E3: Equity, Excellence, and Exito* grant will be building a free online homework system for chemistry courses. She has other interested faculty in other disciplines as well. This will be a fantastic addition to our learning materials. Many instructors have experimented with free online laboratory manuals which had pros and cons.

In F'20 - S'21, the college supported the writing and submission of the aforementioned HSI STEM grant that was awarded this semester. To this end, the college hired an outside grant writer. Mesa Chemistry was highly involved in this six month development and writing process. Drs. Fusco-Hernandez and Budzynski were on the grant writing team, along with Dr. Snyder from Physical Sciences. Dr. Budzynski led a STEM Grants Workgroup to involve faculty from other STEM disciplines in the development process. We appreciate the support of President Luster and Vice President O'Connor for these ideas and projects, and are thrilled to begin implementation in S'22.

While the college has done its very best to support students during the pandemic, a digital equity gap persists. As demonstrated in our General Chem data, low income Latinx students have a lower success rate than several other groups. While there are a multitude of reasons for this, as the college continues its return to in person instruction, lack of computer and internet access must continue to be addressed. As mentioned above, we are using Canvas more now, especially for students who need to miss class due to the pandemic. If such a student does not have easy access to the internet and a computer, the accommodations we put in place may not help. Hopefully, some of this will be alleviated with the reopening of the STEM Center for in person access, as well as more access to in person computer labs. Even with that, the digital equity gap is something the college should continually focus on. It impacts students in courses across all disciplines, but is especially prevalent in quantitative, tech heavy areas such as Chemistry. As instructors, we must remain cognizant of this. In Chemistry for example, Professor Moore worked with the bookstore to ensure that printed copies of the OER textbook would be available for students who prefer that. Many students have expressed that while they like the lower cost of OER, it is not always possible for them to access it online when needed, especially in households that are sharing a computer. Dr. Budzynski has been providing printed copies of lecture notes to her General Chemistry students, as well as pdf files on Canvas. This helps students who do not have easy access to a printer, or tablet to take notes with to have the same access as those who do. The college should encourage these types of practices.

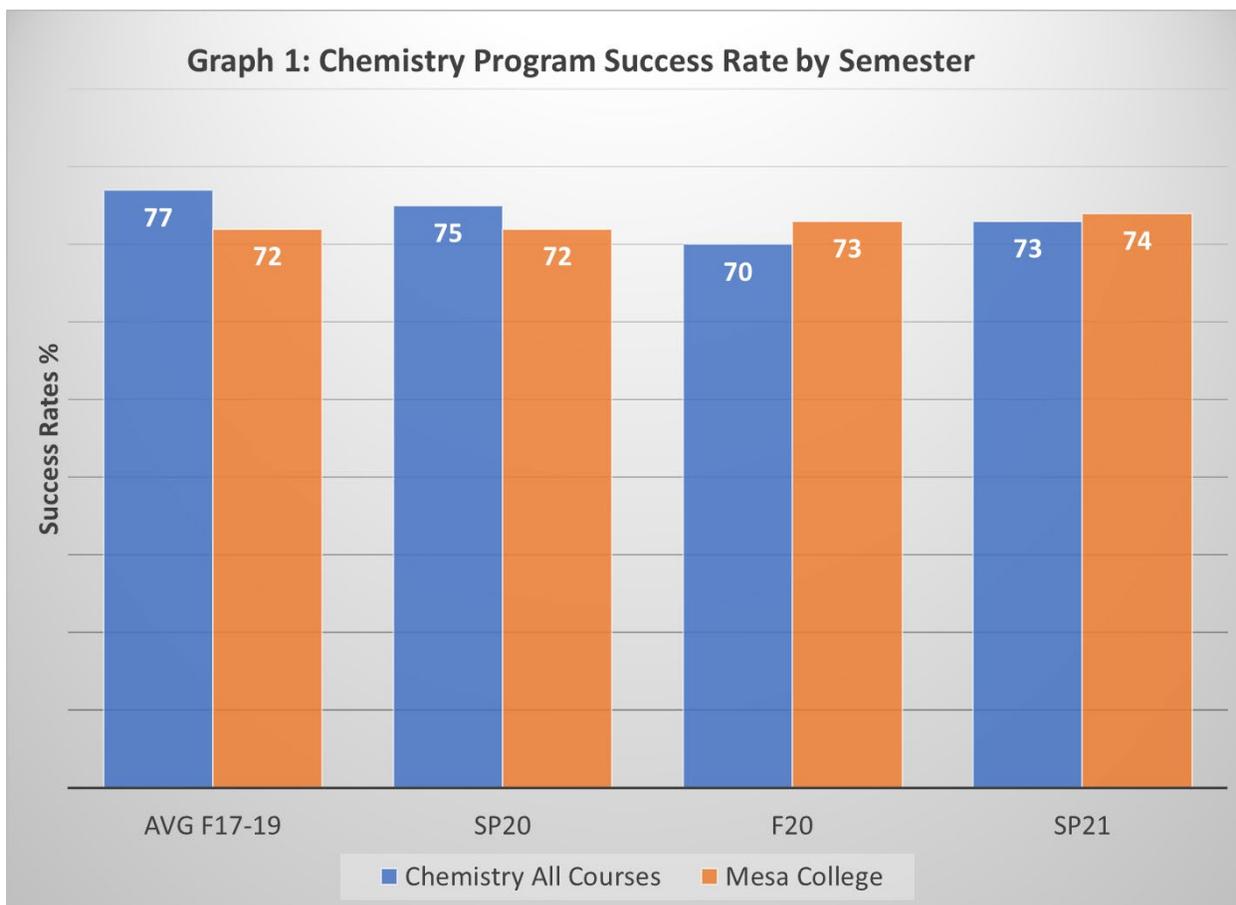
Another college-wide practice that has affected Chemistry positively is the commitment of the college to shared governance. Campus wide engagement and leadership is important to the Chemistry Department. Dr. Budzynski has served as a mentor Department Chair to other new Chairs in STEM. Her leadership has provided a great working relationship with Physical Sciences, Biology, and Mathematics. The culture she has set in the department is one of great respect for our adjunct faculty. She has been sensitive to their employment issues during our downsizing. Because of her expertise, she was a presenter in New Chairs

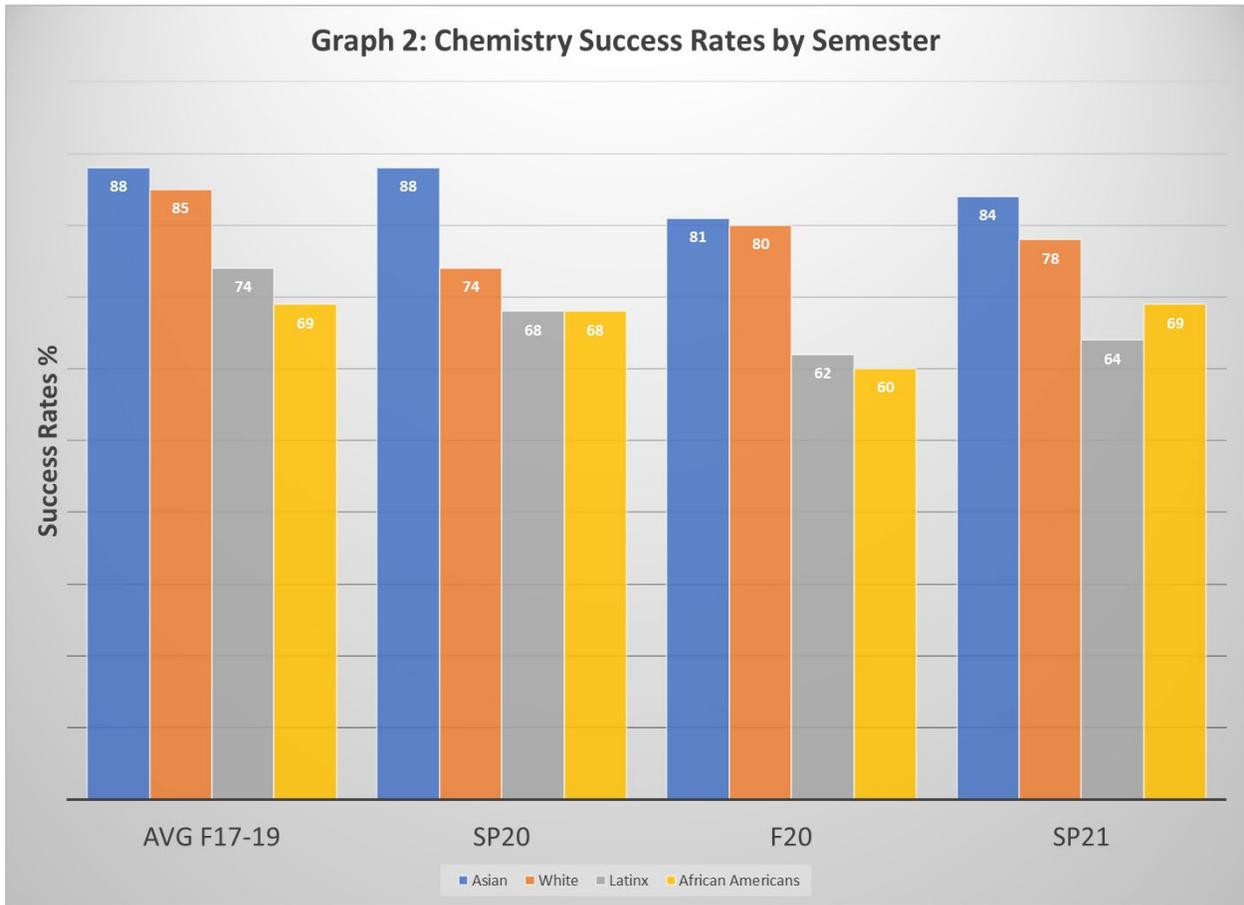
Academy in Fall 2021 for Best Practices in Scheduling. In addition, there is no limit to her advocacy for STEM students and faculty. Problem solving is her forte and if there is a problem, she seeks solutions. Dr. Hjorth-Gustin (Asst. Chair) was elected to Chair of Chairs and has built relationships outside of the MS school that helps our ability to solve problems. Coming back in a hybrid modality and then face to face has taken a vision and organization. Both Chairs have worked relentlessly with Dean(s), Vice President of Instruction Isabel O'Connor, President Luster, Facilities, Student Services, Health Services, and District personnel such as Vice Chancellor Topham to provide clear guidelines and processes for reopening. The reopening efforts have been all consuming for Chairs and included implementation of vaccination requirements and classroom and office readiness. Dr. Hjorth-Gustin has been actively co-chairing the Red Zone group whose main goal was to provide a support system to communicate information regarding reopening issues and information. She hosted the Red Zone Reopening Meeting in August which was very well attended, but too large for Zoom. Currently, she is collaborating with Deans to develop a document with links to all important information regarding the reopening efforts. Reopening is so vital to our equity efforts as the data shows how impacted our Latinx students have been learning a difficult subject online!

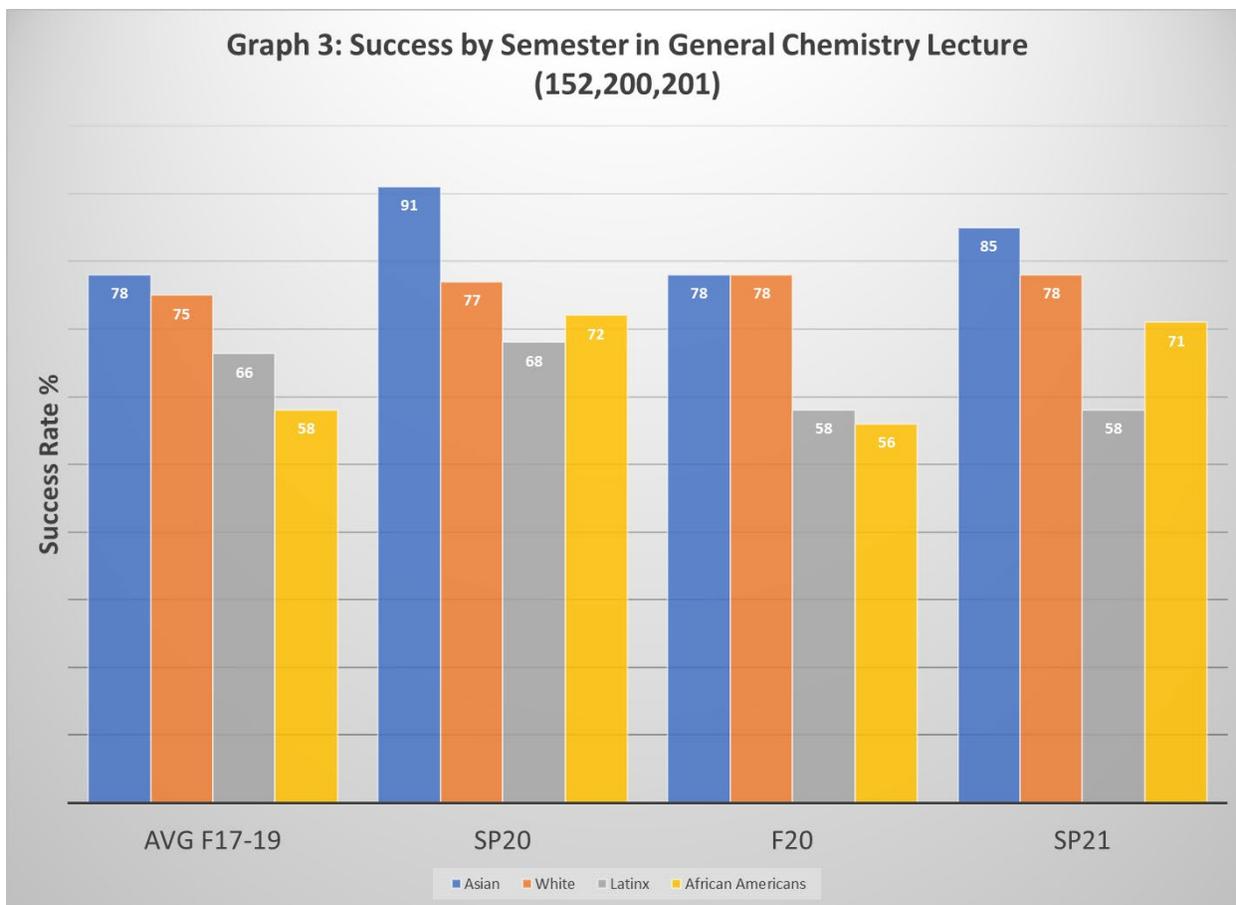
We will not be able to completely solve the issues that students are facing in the pandemic. Many are outside of our control. However, the Mesa Chemistry Department is committed to providing high quality instruction with a student centered approach and a commitment to closing equity gaps in particular for Latinx students that make up 38% of Chemistry students. The faculty in this department are extremely hardworking and committed to students and their success. Returning to campus is our major means of providing more equitable instruction during the pandemic. What is important to note is that all of our goals will require support from the college by hiring at least one if not two full time tenure track faculty. This will allow us to continue our HSI grant work, leadership positions in the college, and make effective and institutional changes that close equity gaps.

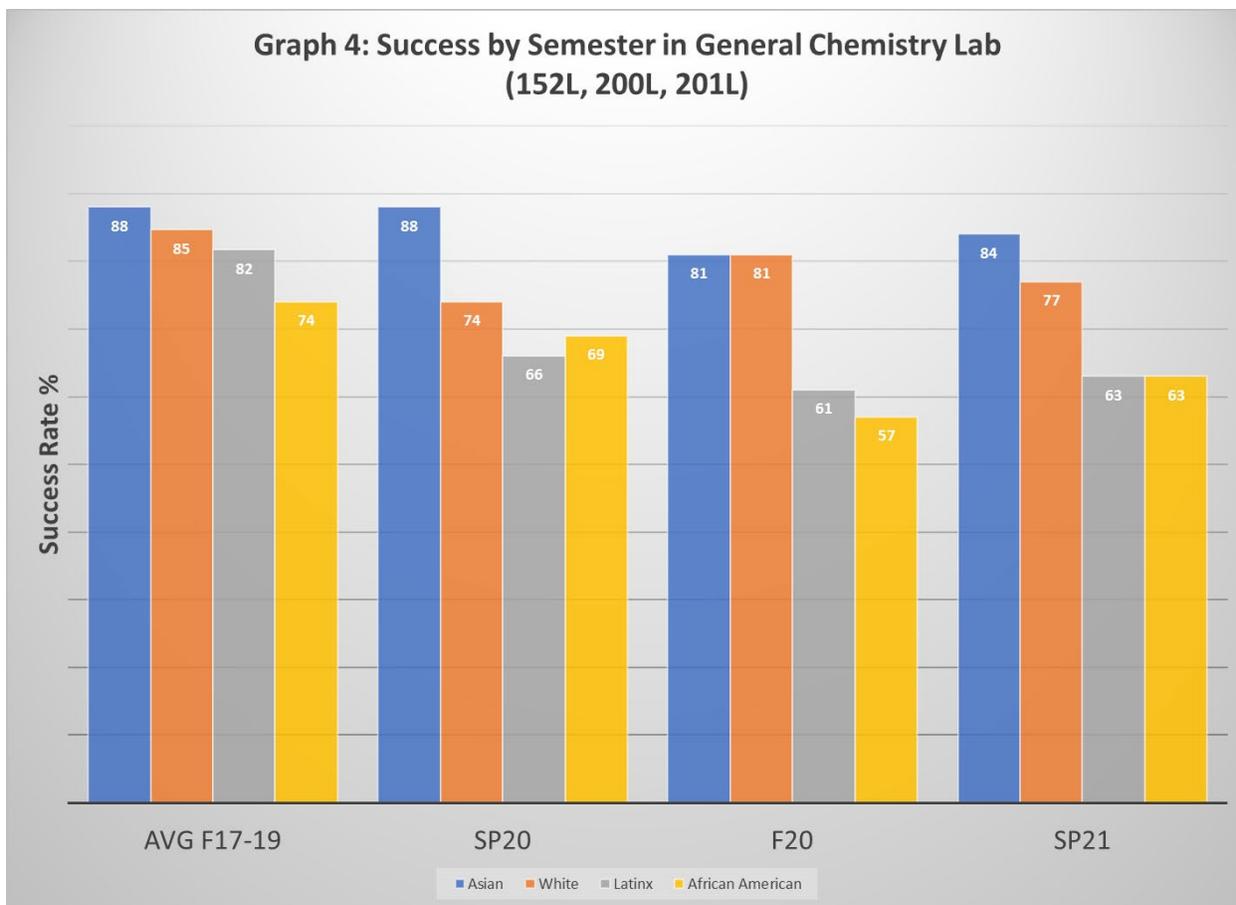
Tables and Graphs for Chemistry Program Review Fall 2021

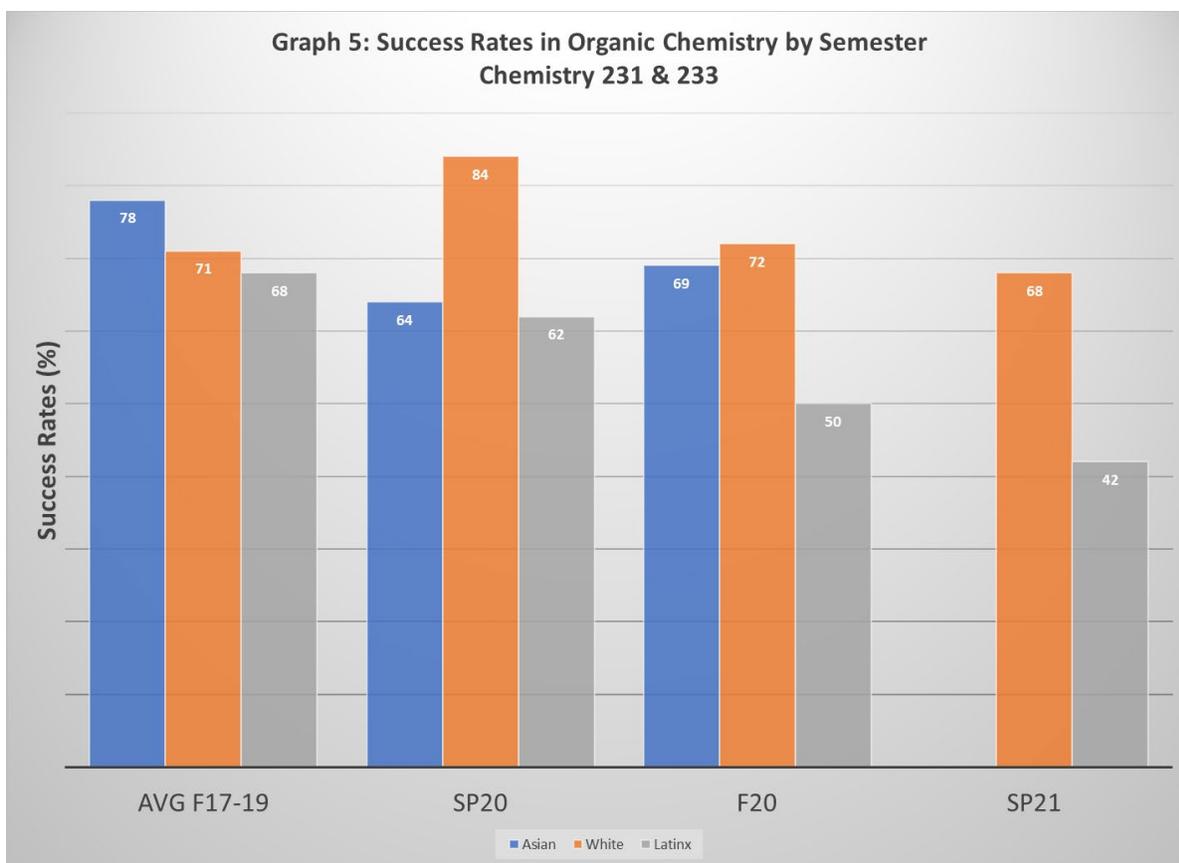
Table 1	
Semester	Enrollment
Fall 2019	2680
Spring 2020	2773
Fall 2020	2625
Spring 2021	2613
Fall 2021	1924

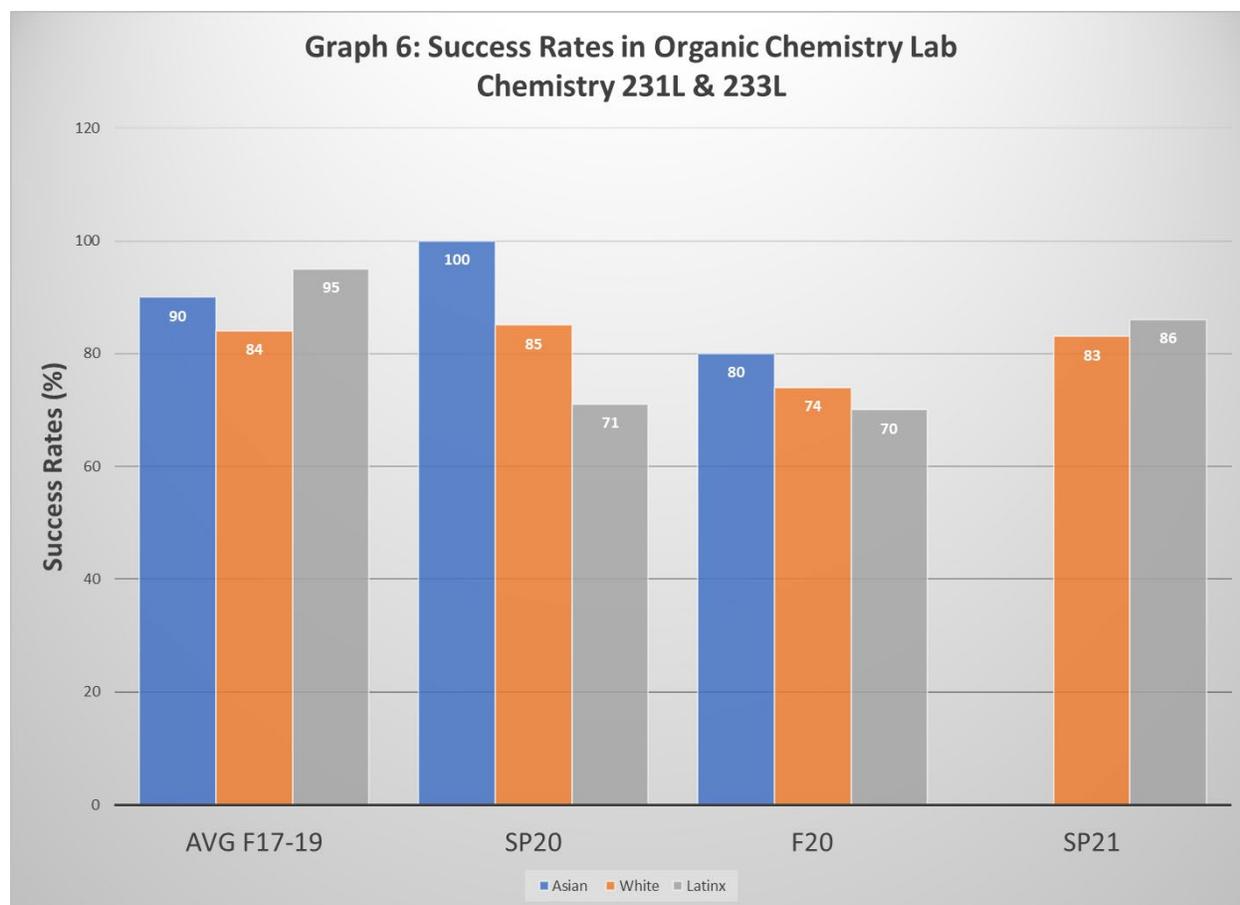


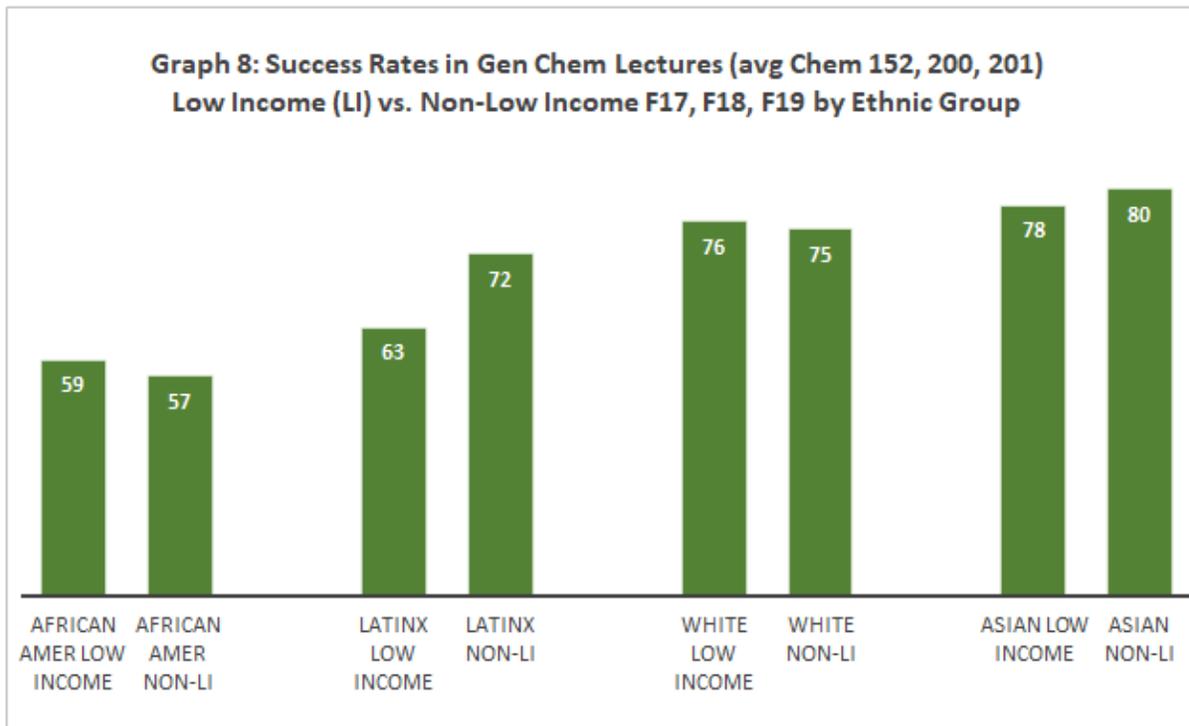
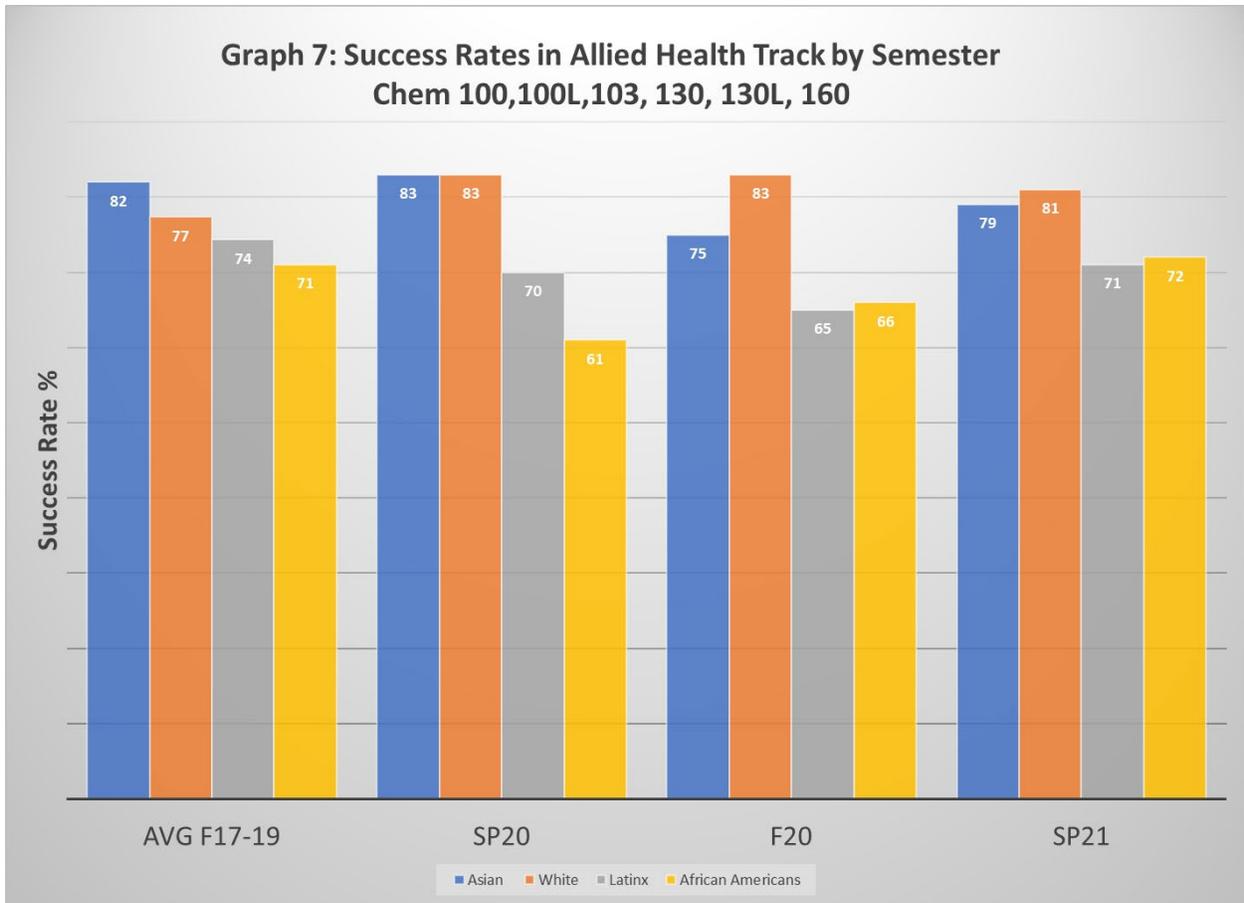


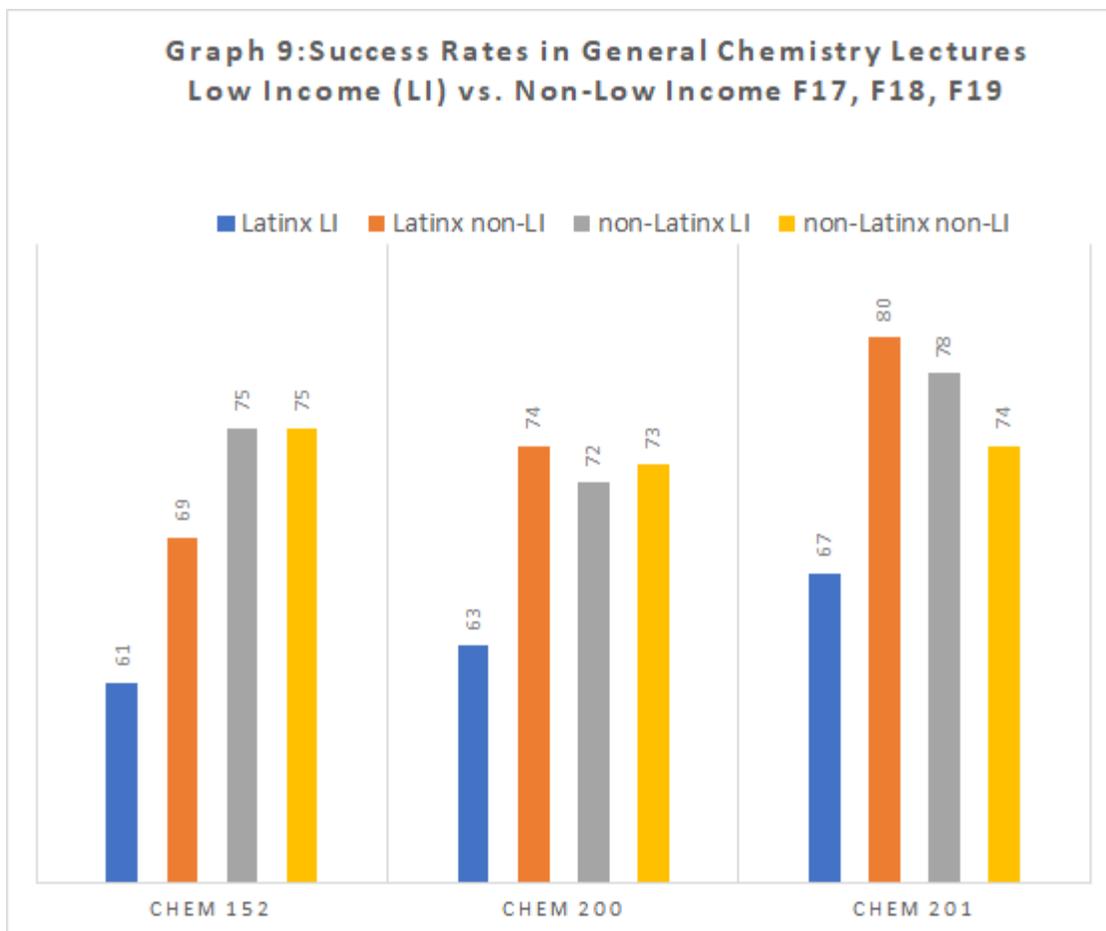












# Tables and Graphs for Chemistry Program Review Fall 2021

Tentative Spring 2021 Chem 201 Lab Schedule

Week	D a y	report to lab on your assigned Group A, B or C experiment days (in red).	Due <sup>A</sup>
1 Feb. 1	M T W Th F	Online Intro Video and intro Quizzes. Do <b>NOT</b> come to lab 1st week.	ASAP (before 1st in lab meeting)
2 Feb. 8	M	Group A: EXPERIMENT 1 Groups B & C: OLA 1	<b>In Lab Experiments (ILE)</b>  EXPERIMENT 1 - Molar Mass of a solid & Chemical Kinetics  EXPERIMENT 2 - Equilibrium  EXPERIMENT 3 - Analysis of oxalate in a Transition Metal Complex  EXPERIMENT 4 - Voltaic Cell
3 Feb. 16	T W Th F	Group A: EXPERIMENT 1 Groups B & C: OLA 1	
4 Feb. 22	M- F	Group B: EXPERIMENT 1 Group A & C: OLA 1	
5 Mar. 1	M- F	Group C: EXPERIMENT 1 Group A & B: OLA 1	
6 Mar. 8	M- F	Group A: EXPERIMENT 2 Group B & C: OLA 2	ILE 1 & OLA 1
7 Mar. 15	M- F	Group B: EXPERIMENT 2 Group A & C: OLA 2	
8 Mar. 22	M- F	Group C: EXPERIMENT 2 Group A and B: OLA 2	ILE 2 & OLA 2
9 Apr. 5	M- F	Group A: EXPERIMENT 3 Group B & C: OLA 3	
10 Apr. 12	M- F	Group B: EXPERIMENT 3 Group A & C: OLA 3	ILE 3 & OLA 3
11 Apr. 19	M- F	Group C: EXPERIMENT 3 Group A & B: OLA 3	
12 Apr. 26	M- F	Group A: EXP. 4 & Check Out Group B & C: OLA 4	ILE 4 & OLA 4
13 May 3	M- F	Group B: EXP. 4 & Check Out Group A & C: OLA 4	
14 May 10	M- F	Group C: EXP. 4 & Check Out Group A & B: OLA 4	OLE 5
15 May 17	M- F	Group A, B, & C: OLA 5	
16 May 24			

**Online Assignments (OLA)**  
  
OLA 1 - Integrated Rate Law  
OLA 2 - Error Analysis in Titration of an Antacid  
OLA 3 - pH and Buffers  
OLA 4 - Titration Curves  
OLA 5 - Thermodynamics

<sup>A</sup>all reports should be uploaded into Canvas by Sunday, 11:59pm, at the end of indicated week.

Table 2

## **Program Review Fall 2021**

**In what ways (if any) did changes to an online/remote modality due to COVID-19 impact student success and equity in your area/program? Please provide evidence.**

Chemistry is considered to be the central science because physics, engineering, biology, and allied health majors, and many other majors require courses in chemistry. Because of this, the Chemistry Department offers many courses ranging from preparatory chemistry, general chemistry, organic chemistry, analytical chemistry, allied health prerequisites, and a general education course with an emphasis in environmental issues. The department has 10 full time professors (including tenure track), 20 adjuncts, and 4 Instructional Laboratory Technicians. The Chemistry Department creates a supportive learning environment that spans across our curriculum. We constantly assess our student success across courses that form a sequence (e.g. Majors Preparation Track 152->200->201 or Allied Health Track 100->130->160). Our department works hard to establish a set core of standards so that students can succeed as they move through our courses. Laboratory courses provide an equitable way to present hands-on learning that supports lecture material. Laboratory work also provides a venue for students to work collaboratively and make STEM relationships that can support them through their courses. The Chemistry department prides itself on having student centered teaching and providing high quality equitable instruction grounded in standards for scientific work that will allow students to be successful at four year schools. The hallmark skills that our department fosters are critical thinking and hands-on experiential learning . Our professors use lecture presentations, small group discussions, worksheets, application to the real world, and hands-on laboratory training to help students understand and learn what is considered to be a very difficult and intimidating subject. Critical also is our interaction with students via office hours, review sessions, support courses such as Chem 16 and Chem 20, and Canvas.

The enrollments have changed with the pandemic (Table 1). There has been a 27% drop from Fall '20 to Fall '21. (Table 1) There are many factors out of our control affecting enrollment. From record numbers of students accepted to UC and CSU, to enormous financial strain on our students, and direct COVID-19 impact on students and their families, it is most likely a combination of all these factors. The department's lowered enrollment is consistent with national and local trends of decreasing enrollment due to the pandemic.

Table 1	
Semester	Enrollment
Fall 2019	2680
Spring 2020	2773
Fall 2020	2625
Spring 2021	2613
Fall 2021	1924

The Chemistry Department is committed to preparing students for transfer to four year schools and provide a foundation in future work in science or professional schools. There were 8 Associate Degrees in Chemistry and 22 degrees in Liberal Arts and Sciences Science Studies-Chemistry conferred during Fall '19- Sp '21. 67% of the students were 18-24 in age, 63% were female, and 36.7% were Latinx. It should be noted that chemistry supports a wide variety of majors including high transfer majors of Biology and Engineering.

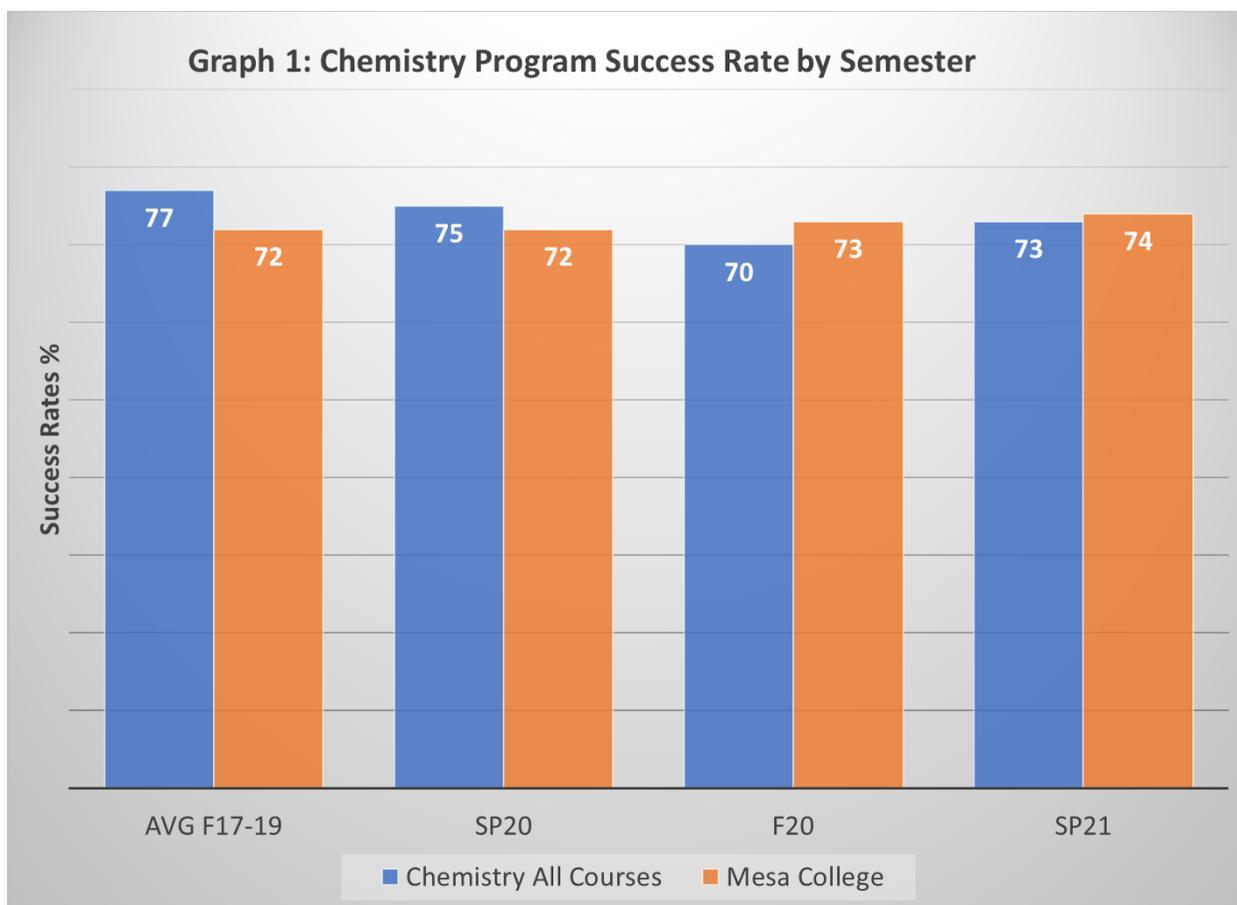
The philosophy of the department is to be student centered and equitable while upholding standards of excellence in scientific and critical thinking. Standards are important to our department while providing an engaging, supportive, and positive learning environment. This is achieved by communicating clear expectations to students, student centered pedagogy, equitable teaching practices, open door attitude to students, updating and improving laboratory courses, support courses, participation in embedded tutoring programs and Peer Mentoring, close relationship to counseling, and a focus on equity. Participation in and leading Professional Development training and opportunities in the college is also an important practice in the Chemistry Department.

The conversion to online on the part of STEM faculty was very stressful and involved countless hours of work to provide videos for students, adjusted teaching materials, adjusting of laboratory experiments and assignments, and developing equitable assessments that gave meaningful feedback to students. Challenges existed in the Canvas format in grading and exam preparation that cause significant stress for faculty where creating and grading has tripled the time that is usually spent on these tasks. In addition, academic dishonesty issues made it challenging to maintain quality. Many of our faculty exceeded expectations for communicating with students and even helped students at unusual hours to support them to be successful in online courses. We became 24/7 instructors because we wanted our students to succeed.

Many students struggled in this format despite our best efforts. Not having a safe and focused classroom free from household responsibilities is very difficult for students. Technology presented its own challenges with many students not having computer access and reliable Internet connections.

### **Success Rates**

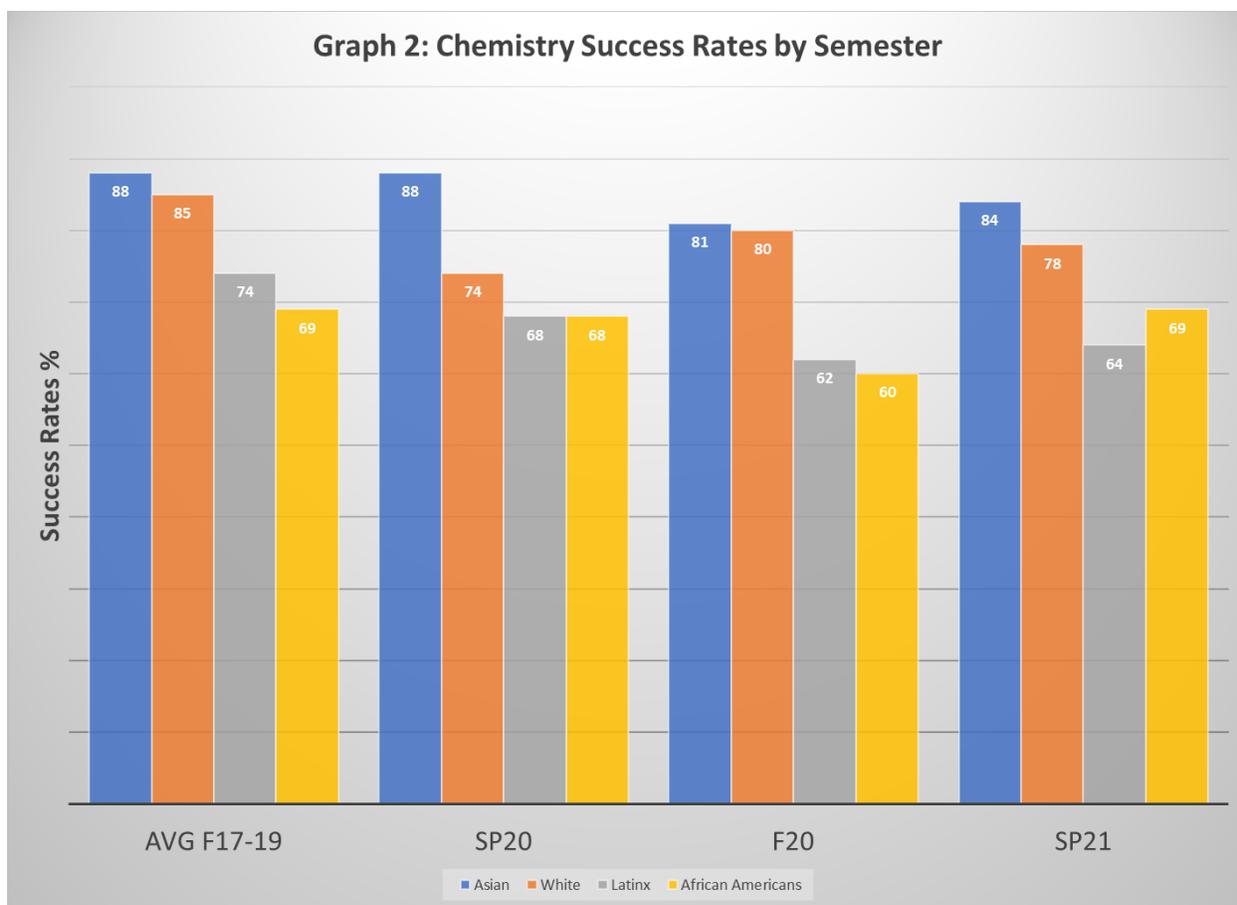
The change in modality from face to face to online/remote modality affected the Chemistry Department's success rate for all the courses that are offered. The data was compiled from the Mesa College Course Outcomes Dashboard. Because each semester has variations, Fall '17, Fall '18, and Fall '19 were averaged to provide a reference point of success rates before the COVID-19 pandemic. The average success rate in this time frame was 77% and this was higher than Mesa College's success rate at 72%. Graph 1 shows the decrease in success rates from Spring '20 with a 75% success rate to 70% in Fall '20 to 73% in Spring '21. Despite a lower success rate, the success rate was not significantly lower than the Mesa College overall success rates. Clearly, there has been a lowering of our success rates due to the switch from face to face modality to online.



Disaggregation of the data shows that not all students were affected similarly in the switch to online/remote. (Graph 2) Asian students show the least impact with Sp '20 success rate of 88%, F '20 88%, and Sp '21 84% which is similar to the average F'17, '18, '19 of 88%. White students did show a decrease in Sp '20 success rate of 74%, F '20 80%, and Sp '21 78% which is lower than the average F'17, '18, '19 of 85%. Despite the decrease, the success rates are still above the Mesa College averages of Sp '20 success rate of 72%, F '20 73%, and Sp '21 74%.

The equity gap between Latinx and non-Latinx students in Mesa College Chemistry courses was compared from pre-pandemic (comparison to Fall '17, Fall '18 and Fall '19 overall average Latinx 74%) has decreased due to the conversion to online. Latinx success rates were Spring '20 to 68%, Fall '20 to 61% and to 64% in Spring '21.

African American students showed the same success rates from pre-pandemic (comparison to Fall '17, Fall '18 and Fall '19 overall average 69%) except for that Fall 2020 showed a decrease. African American success rates were Spring '20 to 68%, Fall '20 to 60% and to 69% in Spring '21.



## General Chemistry

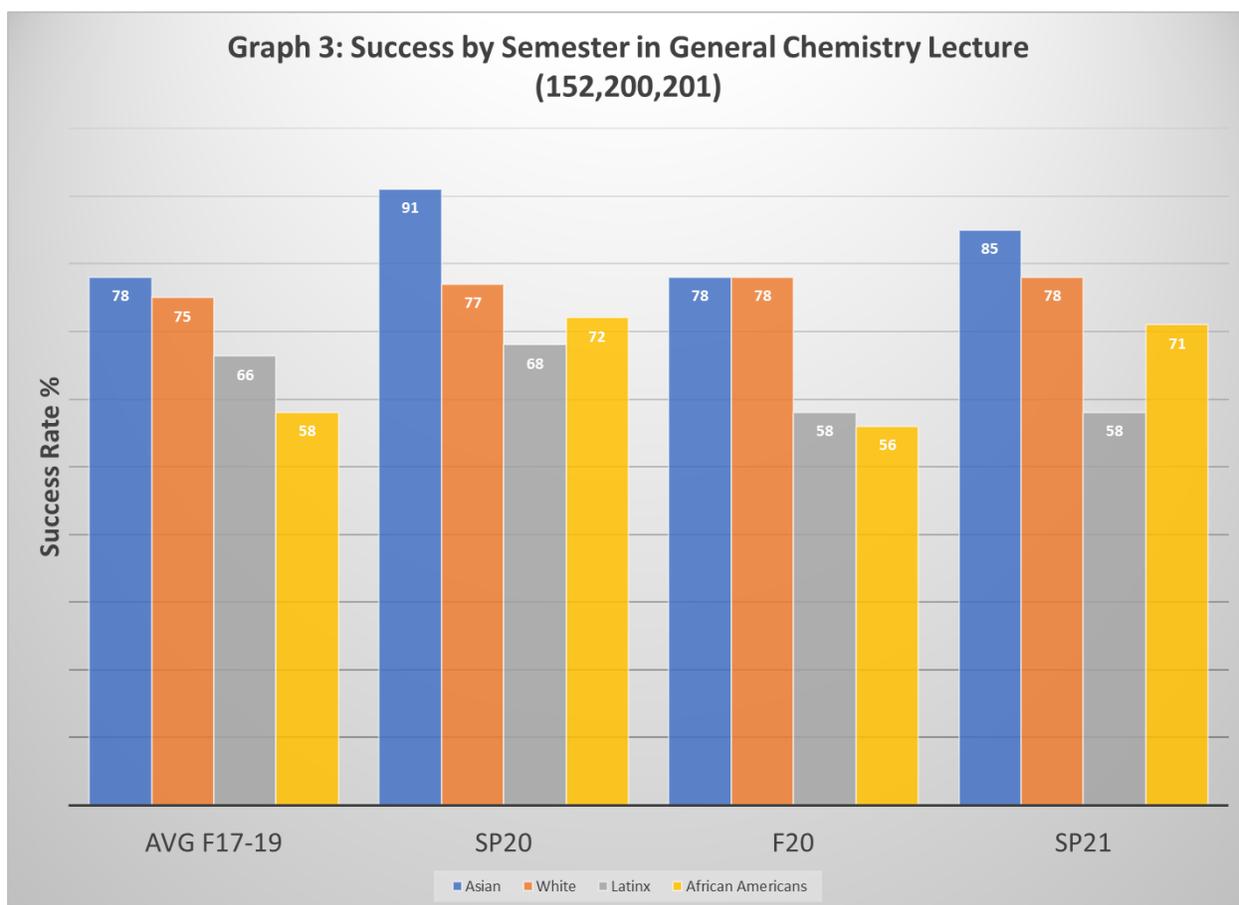
General Chemistry (Chemistry 152, 200, 201) is a significant portion of our enrollments and one or more of these courses are part of the curriculum for physics, biology, engineering, and variations of these degrees. Spring '20 was the “flip” from face to face to online. Fall '20 and Sp '21, our lecture courses were all online, with only a few partially face to face lab courses.

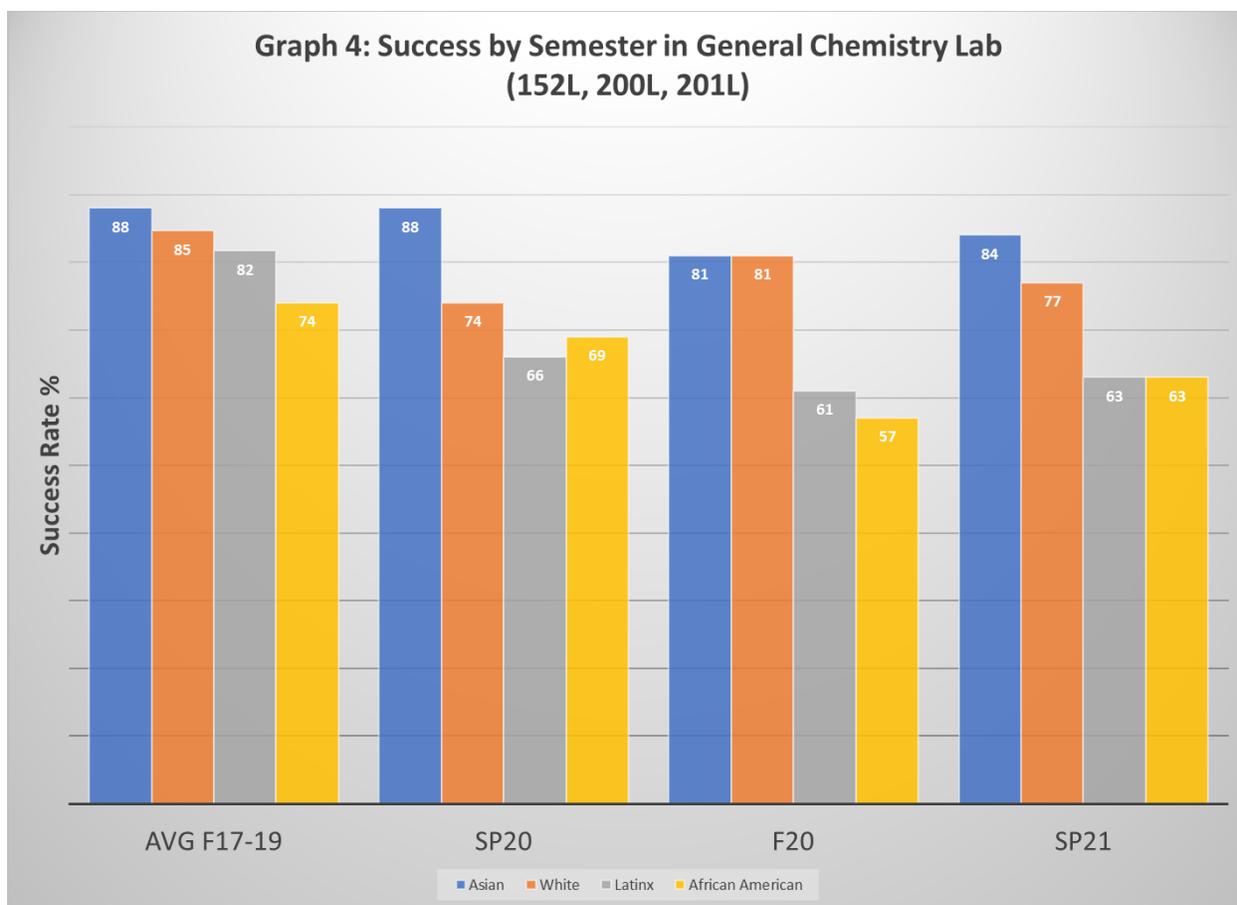
Success rates for Asian, White, Latinx, and African American students in the categories of General Chemistry Lecture courses (Chem 152, 200, 201) and General Chemistry Lab courses (Chem 152L, 200L, 201L) were compared. Data from F'17, F'18, and F'19 semesters were averaged (all face to face sections). That average was compared to Sp'20, F'20 data (all online, except for 201L which was partially face to face), and Sp '21 (all online except for 201L which was partially face to face). There was very little variance between the individual F'17, F'18, and F'19 semesters, so the average is very reliable.

Disaggregation of data for General Chemistry Lectures is shown (Graph 3) and for General Chemistry Laboratory (Graph 4). *In all cases analyzed, Latinx students are the most impacted from the pandemic. The online semesters of F'20 and Sp '21 showed a significantly lower success rate than the face to face semesters for Latinx students.* It should be noted that there was no significant decrease in enrollment for either Latinx or non-Latinx students during Fall '20. For all of Chem, Latinx enrollment increased by 2% in F20 as compared to the average of F '17-F'19, while non-Latinx showed a 5% decrease. Latinx

students represented 37% of enrollment in all chemistry courses as well as Gen Chem in F17-19, and 38% of enrollments in all of chemistry as well as Gen Chem in F20. This percentage is comparable to the percentage of Latinx students at Mesa College. It should also be noted that the negative trends in equity gaps for Latinx students is also apparent in laboratory courses (Graph 4).

It should be noted that African American students showed fluctuations in success rates from a low of 56% in F'20 which is similar to average F '17-F' 19 of 58% to highs of 72% in Sp '20 and 71% in Sp '21. It should be noted that the percentage of African Americans in the general chemistry sequence is 4.8% (N=133). This percentage is lower than the percentage of African American students that ranges from 5-6% at the college. The data has a small N value and can fluctuate dramatically with changes in success rates. Therefore, it is difficult to make strong conclusions regarding the data.

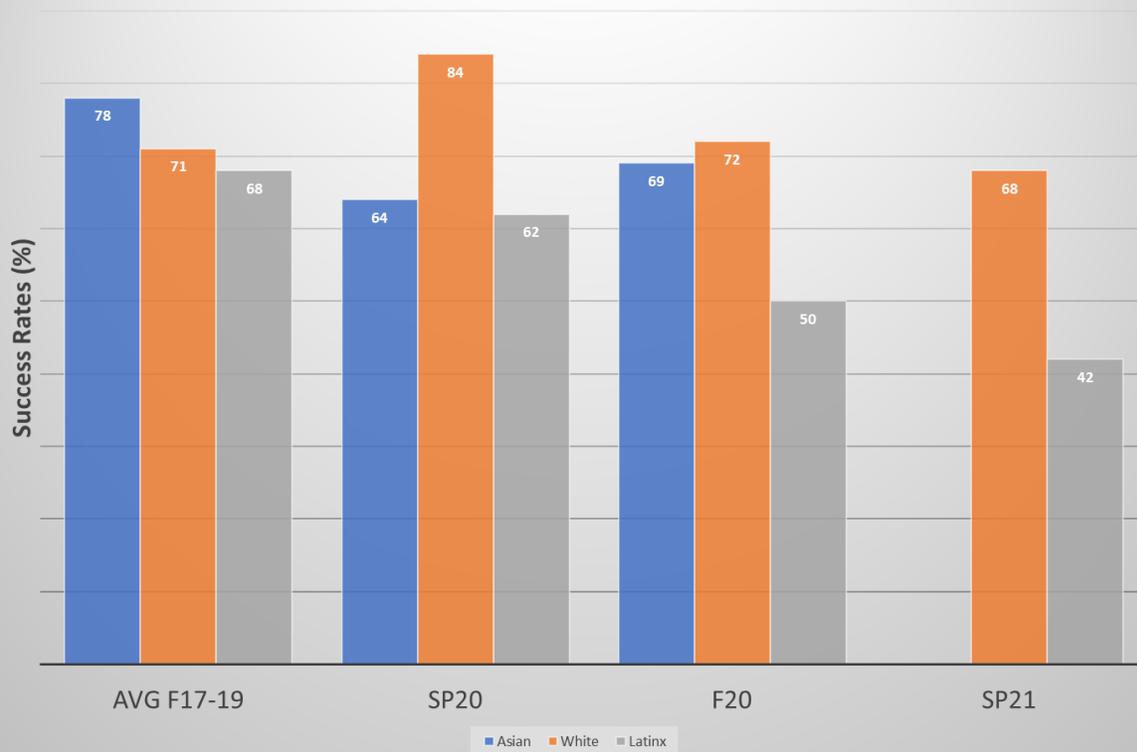


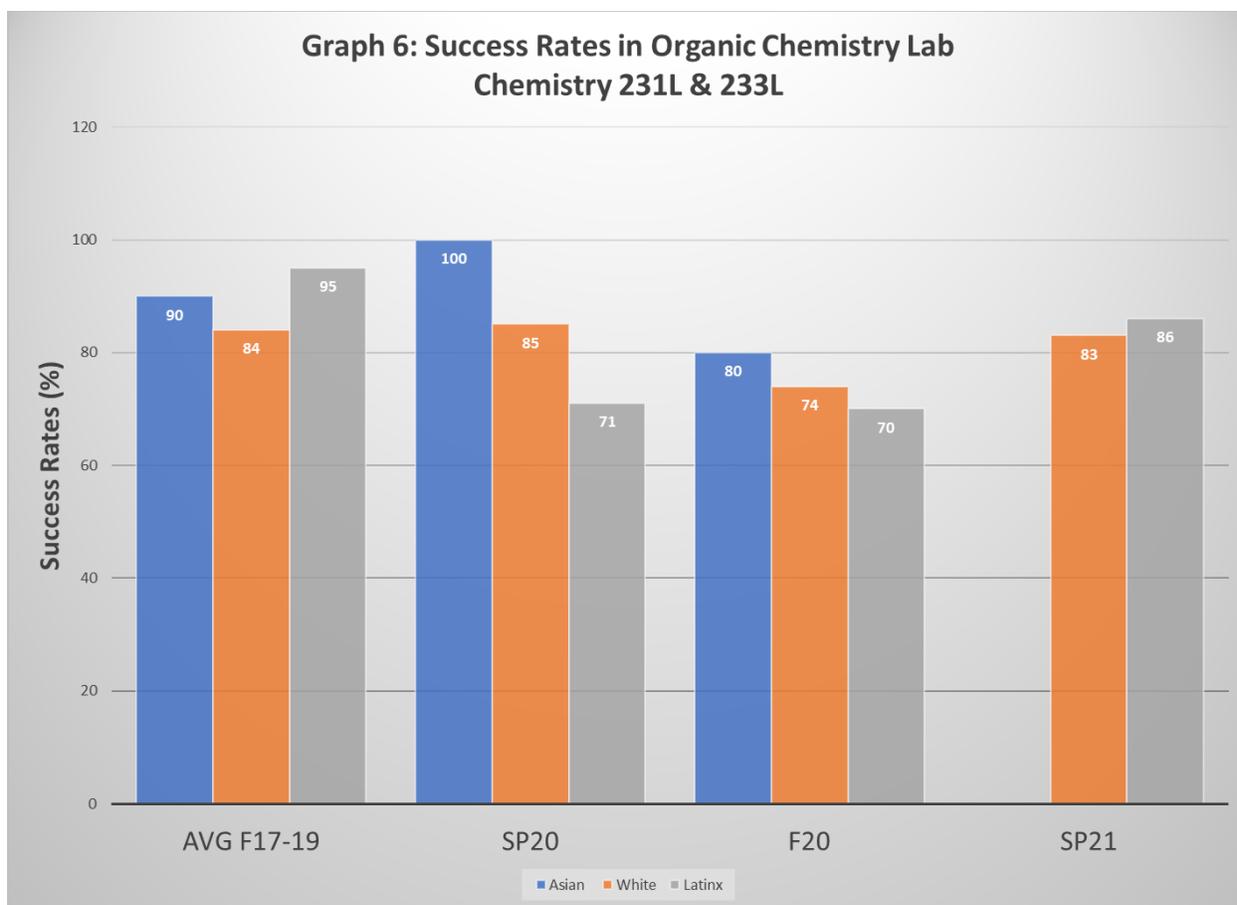


### Organic Chemistry

The Organic Chemistry courses show a decrease in success rates especially in regards to Latinx students. due to the switch in modality. The data from Organic Chemistry lecture is showing that Latinx students were the most impacted in the pandemic switch in modality where the drop from an average F'17-F'19 went from 68% to Sp'20 62%, F'20 50%, and Sp '21 42%. (N=104). In laboratory work, Latinx students showed a similar trend of lowered success rates. The drops in success rates for Asian students were also present (N=43). African American students are underrepresented in these courses. For example, during F'17-F'19 & Sp'20, F'20, and Sp '21(N=16). This is 3% of the total enrollments during this period (Graphs 5 & 6). Because of this low N value, further statistical analysis will not be valid. Instead we should focus on increasing their representation.

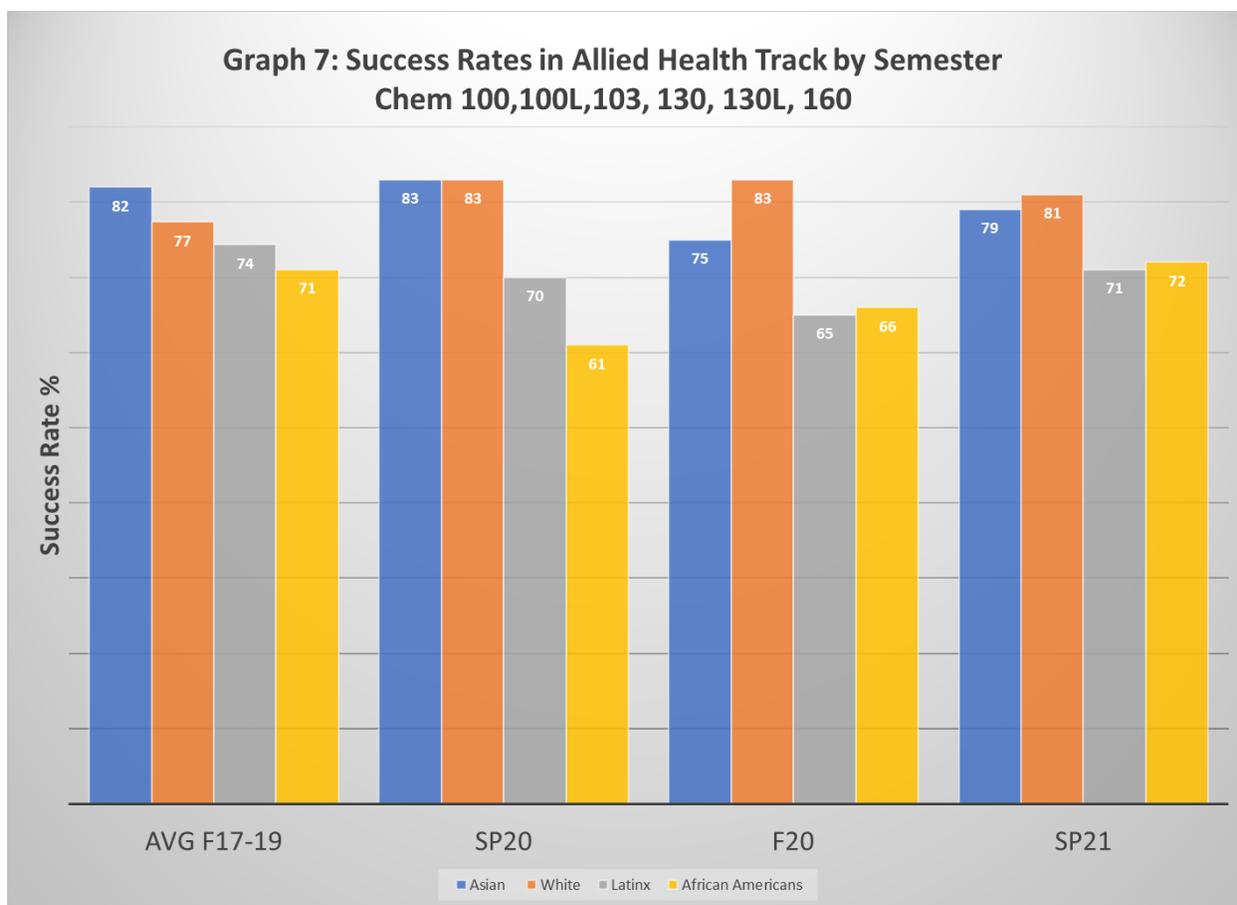
Graph 5: Success Rates in Organic Chemistry by Semester  
Chemistry 231 & 233





### **Allied Health Track: Nursing & Nutrition Majors**

Allied Health track includes the courses Chem 100, 100L, 103, 130L, and 160. The students in this sequence typically include nursing majors and nutrition majors. The trends in success rates show a fluctuation in Spring 2020, but it appears that the success rates are similar to average F '17-F' 19 in Spring 2021. Unlike the General Chemistry and Organic Chemistry, the Allied Health track students' success rates appears to be less affected by the switch in modality. (Graph 7)



### Analytical Chemistry

Analytical Chemistry is a hands-on technical course in learning instrumentation and analytical techniques. It is a required course for transfer for chemistry majors transferring to CSU. It has become a required course for students entering the Clinical Sciences Laboratory Technician Program at SDSU. Course Success Rates from Sp '17-Sp '19 were 83% (N=54). Spring '20 was a 94% success rate (N=17). Because of the nature of this course, it was not offered during Spring '21 and will not be offered in Spring '22. It is the department's goal to bring the course back in Spring '23.

### General Education

Chemistry 111/111L is a general education course for non-science majors. Its focus is on environmental chemistry and introduction to biochemistry/nutrition. As a department, we always work closely with counseling to encourage underrepresented groups to take the course as a wonderful opportunity to learn more about real world chemistry issues. Typically the course has a wide variety of majors from English to Fashion to Business majors.

Our general education courses (Chemistry 111/111L) exhibit success rates for all groups are statistically equivalent and range from 62-86% depending on group and semester. It should be noted that this is a

limited course with only one lecture and one lab section per semester. Therefore, it is difficult to interpret success rate trends.

One interesting observation in this course is that the percentage of African Americans in the course is roughly 8% (N=42) which is higher than the college's percentage of African American at the college which is between 5-6% depending on the semester. This reflects our good work in promoting the class to underrepresented groups in science through counseling. It provides an opportunity for us to encourage students to consider further work in the sciences.

### **Area of Further Analysis:**

#### **General Chemistry Success Rates by Ethnicity and Income**

Success rates in General Chemistry Lecture courses (Chem 152, 200, 201) were analyzed based on ethnicity and low-income vs non-low income status. All data was obtained from the Mesa HSI STEM Equity Dashboard. Data from F17, F18, and F19 were aggregated. Income data for F20 is not yet available on the dashboard, so these results are all pre-pandemic.

First, success rates in all three courses and all three semesters combined were obtained for various ethnic groups. Graph 1 shows this data for students identified as African American, Latinx, White, and Asian, broken into Low Income and non-Low Income categories. The dashboard uses financial aid status to determine if a student is low income.

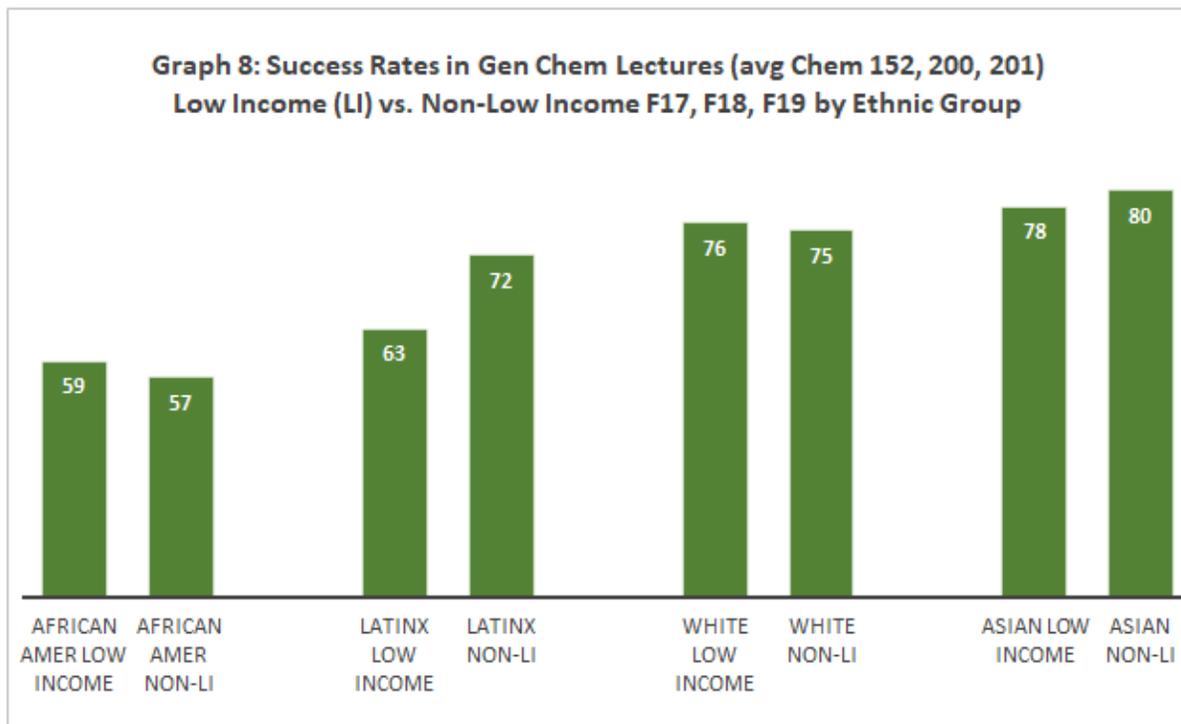
As the first graph shows, for the ethnicities included, all but Latinx shows a two percentage point or less difference between students of different income status. Latinx low income students had a success rate nine percentage points lower than their Latinx non-low income counterparts. Note: the n value for each category in Graph 1 is greater than 100, except for African American low income (n=80) and African American non-low income (n=23)

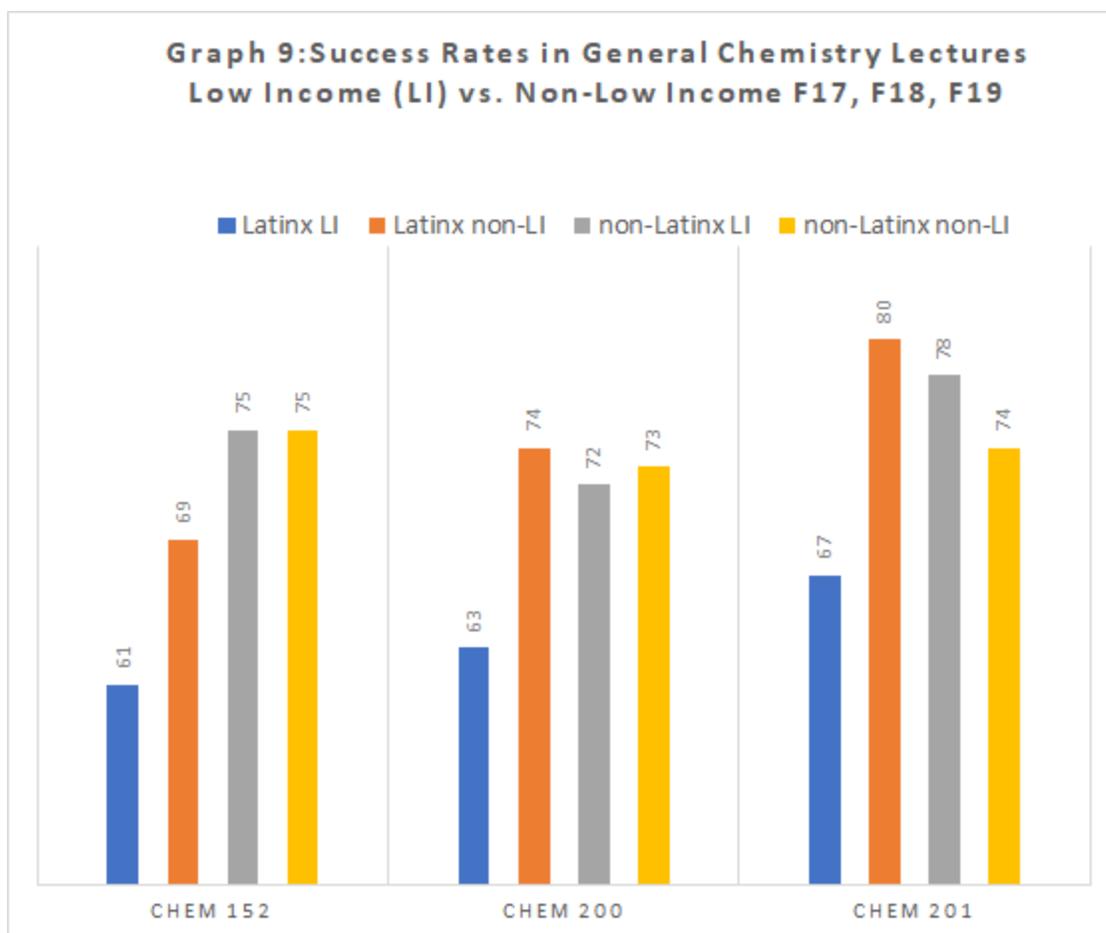
To further investigate this data, the courses Chem 152, 200, and 201 were looked at individually during the same three semesters. This time, the non-Latinx ethnic groups were combined into the same columns, while still looking at low income vs. non-low income status. These results, presented in Graph 2, show that there is an obvious equity gap between Latinx and non-Latinx students in Chem 152, with low-income Latinx students showing a 14 percentage point difference from their non-Latinx low-income counterparts. Non-low income Latinx students have a smaller gap of 6 percentage points.

Interestingly, the gap between non-low income Latinx students and non-Latinx students is completely erased once students get to Chem 200. However, the gap between low income Latinx students and other students remains, and they are now 11 percentage points behind their non-low income Latinx counterparts. This gap is widened further in Chem 201. (Note: all n values in Graph 2 are greater than 100, except for non-low income Latinx students in Chem 201, where n=65).

This data is limited to general chemistry lectures, for three fall semesters. It does not include any data from pandemic semesters when these courses were taught online. We are looking at general chemistry which represents our largest program, with over 900 students in these classes in F19 alone. Based on the analysis above, all low income Latinx students, and all African American/Black students in Chem 152,

200, and 201, as well as non-low income Latinx students in Chem 152, have success rates below 70%. In F19 these groups totaled 309 students. Efforts should be made to identify and target these students with support to help increase their success rates. Some of these supports are already in place, such as Chem 016, a companion workshop course to Chem 152, Chem 020 a prep course for Chem 200, Peer Mentoring in Chem 200 and 201, and Classroom Tutors for Chem 152. The difficult part is ensuring students in these groups take advantage of these and other supports. Many low income students, for example, need to work more hours or take care of family members making it more difficult for them to increase their time spent on these courses.





**What practice has your area/program implemented since the last program review cycle that you would like to improve/continue? Identify impacts on student success and equity.**

The return to on-campus learning was welcomed both by faculty and students. Our department is committed to in person instruction. However, there are pandemic online teaching practices that can help supplement and strengthen in person instruction and attain more equitable outcomes.

- A. Safety First: Chemistry faculty are used to laboratory safety procedures in our discipline. Extending this to mask usage in classrooms has been an extension of existing safety procedures. Our department has been vigilant in asking students to stay home when sick.
- B. Flexible assignments: Because our department is student centered, we are very aware of the difficulties for students during the pandemic. Our department has worked together to allow for flexibility. This is especially true because we are asking students to stay home if sick for any reason. This flexibility includes not only allowing students to drop an exam or laboratory assignment, but having clear policies for making up laboratory assignments or exams. For example, in Chemistry 152L, there are make up weeks for laboratories which is something that did not happen before the pandemic. Previously, if a student missed an experiment, they were allowed to make it up during another section, space allowing. To minimize possible covid exposure, this practice had to be discontinued.

- C. Supplemental Material: Because students may have to miss class, our department is encouraging the use of the supplemental materials so that student absences can be minimized. The videos that our faculty made in the pandemic have been useful for students if they miss class. Some students report using videos to clarify lecture material.
- D. Canvas usage: A greater percentage of faculty are using Canvas in a greater capacity than before the pandemic. Canvas allows for a centralized way to communicate with students, post course materials, and organize in a way that facilitates student engagement. It has become a great tool for communication with students.
- E. HSI Lab Redesign institute was led by Ms. Danica Moore during Summer 21. 10 instructors, 6 faculty and 4 adjuncts, from the department participated in the Lab Redesign. There were 8 different lab courses that were modified: Chem 100L, 103, 130L, 152L, 200L, 201L, 231L, and 233L. In Chem 100L, there were rewrites of lab worksheets that featured an online component to help students demonstrate mastery of the lab component. For Chem 103 there was an online extraction lab that was written to act as a supplemental for students who are unable to attend lab due to hardship or illness. In Chem 130L, there was creation of an online protein synthesis lab serving as a supplemental assignment for students who are unable to attend this lab due to hardship or illness. In Chem 152L, 10 out of 12 labs were shortened to ensure that students have ample time to finish experiments and post-lab questions in the allocated lab period. In Chem 200L, all post-lab questions were moved into Canvas for the purpose of making it easier to cycle through different question sets each semester (ensuring academic honesty). The first two worksheets were also revised and integrated into Canvas with added instructions for students who are unable to attend the first two weeks of class. In addition, the Beer's Law background section is rewritten to include more examples, more depth and be more visually oriented. In Chem 201L, the background sections of all labs were rewritten to improve language, include more sample calculations, and more visual aids. In addition, the pre-lab quizzes were developed in Canvas to help ensure that students are prepared for lab upon coming to campus. In Chem 231L/233L labs were all reformatted to include online content that was developed in the move to DE. This includes questions embedding in Canvas, updated figures and pre and post lab videos to help students ensure they are safe going into the lab, and understand what they did coming out of the lab.
- F. Scheduling of Chemistry 16 & 20: These are great support courses that had to be suspended from being offered during the pandemic. Chemistry 16 was found through a study (Dr. Fusco-Hernandez) to close equity gaps among Latinx students in Chemistry 152. It is a support course that stresses problem solving skills. They are returning this intercession and in Spring 2021.
- G. Return to Peer Mentoring: During the pandemic, chemistry did participate in Peer Mentoring in Spring '20 and Fall '20. Dr. Fusco-Hernandez and Dr. Sardo were Peer Mentor Leads. Dr. Hjorth-Gustin is active in recruiting students. But, it was difficult to find students who wanted to participate as mentors for Spring '21. This semester, she has recruited two students for Peer Mentor for Spring '22. This is an excellent program for our students to find support for General Chemistry.

## **Future Work & Goals for Chemistry Department**

1. HSI Grant: STEM E3 : Equity, Excellence and Éxito was funded through the Department of Education in Fall 2021 with Dr. Fusco-Hernandez as Principal Investigator. This grant is focused on increasing the number of Hispanic and other low-income students attaining STEM degrees and developing model articulation and transfer agreements in STEM with Four-Year Institutions. This 5 year, \$4.75 million program of integrated interventions and capacity building activities will increase the number of Hispanic and low income students attaining post secondary degrees in STEM and participating in the growing regional STEM economy. The following strategies are at the core of the grant:

1. Development of Free Online Homework System (Lead: Dr. Amanda Fusco Hernandez)
2. STEM Studio Classroom Development Coordinator (Lead: Dr. Budzynski)
3. Interdisciplinary STEM Curriculum Writing (Lead: Dr. Hjorth-Gustin)
4. Continuation and Expansion of Peer Mentoring
5. STEM Professional Learning Opportunities
6. STEM Student Orientation
7. Engineering Workshop Expansion and Biotechnology Workshop Development

This grant will be an incredible opportunity to work collaboratively with all disciplines in STEM to make lasting changes for students that help close equity gaps.

### 2. General Chemistry

Working through the Interdisciplinary STEM Curriculum Writing Group, focus on pathways for students to accelerate in the General Chemistry path for students with higher math levels and develop Chemistry 152 courses tailored to biology and engineering students to improve success, spark interests, and narrow equity gaps.

### 3. Goals for Allied Health Track

One of the main goals for the Allied Health track is to work collaboratively with Allied Health Faculty, Nutrition, and Biology Faculty to ensure that our chemistry courses are preparing students for their courses. In addition, the department will be forming an Allied Health Track Workgroup (Lead: Dr. Sardo) to analyze and assess the course outlines of records, modernize the Chemistry 130/130L curriculum keeping in mind equitable assignments. Our goal is to revitalize this track!

### 4. Goals for Analytical Chemistry

This course is an extension of General Chemistry for chemistry majors and now has a group of students preparing for Clinical Laboratory Sciences. One goal is to partner with transfer institutions for more communication and dialogue.

### 5. Goals for General Education

It is our hope that as the pandemic subsides that we can expand course offerings in this class.

## 6. Goals for Organic Chemistry

Over the last 3 years, there has been an enormous amount of work spent on modernizing the laboratory work. The courses continue to evolve and improve.

7. Increase representation of African American students: The goal of the department will be to seek ways to improve the numbers of African American students in General Chemistry and Organic Chemistry to at least match the 5-6%. One approach is to work more closely with counseling. Recruiting and retaining African American students in STEM will require a more community outreach with high schools and working closely with a counseling representative.

8. Obtain a tenure track faculty position: All of our goals will require support from the college by hiring at least one if not two full time tenure track faculty. We recently learned that one of our full time faculty will be retiring in January.

**What practices has your area/program implemented since the last program review cycle that you would like to change/discontinue?**

Since March 2020, our department has been in constant change and pivoting to the needs of our students during a stressful world-wide pandemic.

For lectures, the conversion to online required a massive effort. Different instructors addressed the conversion online in different ways. In March 2020, we all taught remote on Zoom. Many instructors had to invest 1000+ dollars in technology to work from home. Zoom proved to be a tool that was both helpful and difficult. Students would have an opportunity to interact with their instructors on Zoom, but there were technical issues.

Student technological gaps became painfully obvious and the lack of equity for our students became clear to us. Students lacked the necessary technological resources to be able to take courses online. Our department donated 115 lap top computers to help students obtain a computer.

*I am sure this is true of students face-to-face also, however in the case of online, less tech literate students were disproportionately impacted. The instability of many student's internet connections caused much anxiety for myself and students during assessments. In some cases, students would be disconnected 2-15 times throughout the course of assessments. It is only through a concerted effort that I made sure that these students' grades were able to reflect their hard work and commitment to their studies. (D. Moore)*

Zoom fatigue is real and many students would express that they struggled to focus for an hour and half lecture on Zoom. The testing format was problematic as well.

*Each exam I wrote was done with question groups so students were taking different exams than their classmates. Those exams took me about 15-20 hours to write. I was able to reuse exams from the first to next semester. I wrote around 13 quizzes as well. Grading exams took about the same amount of time as writing them, because grading uploaded student work on Canvas is very difficult, and students needed to show their work for many chemistry problems. (D. Budzynski)*

When we went online in March 2020, the conversion of our lecture and laboratory courses was difficult to say the least. ***The Chemistry department created a combined total of 800 + videos during the course of the pandemic.*** Our laboratory assignments had to be adjusted, which took an enormous amount of work on the part of the full time faculty members. Dr. Toto & Dr. Hjorth-Gustin worked on the laboratory materials for Chemistry 201L. In March 2020, 6 new laboratory assignments were written that focused on data analysis. In Chemistry 200L, Dr. Budzynski wrote 6 new online laboratory assignments that also

focused on data analysis. In Chemistry 100L, Ms. Moore creatively adjusted Chem 100L to be self-contained modules with videos, worksheets, and questions. In Chemistry 152L, Dr. Fusco-Hernandez and Mr. Fremland began filming videos where they demonstrated all the laboratory procedures and re-wrote the manual to reflect the changes. Chemistry 231L and 233L were also re-written by Dr. Saidane. Dr. Sardo was actively involved in adjusting the Chemistry 103 laboratory materials. When most of our courses went fully online in Fall 2020, labs from the first half of the semester had to be adapted as well. In summary, 100+ numbers of experiments were written totaling hundreds of hours of work.

Despite our best efforts, our subject material does not lend itself to an online format for many reasons, and online teaching of chemistry widens equity gaps. Unless there is an emergency declaration regarding the pandemic, Mesa College chemistry will be discontinuing online modality as a viable option of instruction. Laboratory courses are by nature hands-on technical learning. Even with the most creative learning materials, online laboratories fall short. It is difficult for students to visualize the experimental procedure (even with videos). More than anything, the students work together in the laboratory to discuss and analyze data. This collaboration provides a foundation of equitable learning and is so essential for our students to learn not only laboratory techniques, but also to reinforce lecture material. It also provides a support and culture of STEM that helps students feel supported.

Because we are constantly analyzing our equity outcomes, as a department we realized that face to face instruction is necessary for our science majors. The Department Chairs in consultation with the full time faculty assessed the feasibility of offering some laboratory courses on campus for Fall 2020-Summer 2021 following safety protocols and COVID-19 mitigation strategies. So, we made a decision to bring back laboratory work in Chemistry 201L, 231L, and 233L. It was not feasible to bring back other laboratory courses. The planning and preparation required to do this was extensive. We were the only community college in San Diego County to bring back chemistry students in person during the pandemic! We followed the safety protocols established by the county and had to social distance the laboratory. On paper, social distancing laboratory work may sound easy. In practice it is not trivial and ***required another rewrite of the manuals for the three laboratory courses and a special schedule*** (written by Dr. Toto and Chairs). This is because the experiments had to be adjusted for the time blocks and students coming from online laboratories needed time to learn the basic skills so we had to make changes. In Chemistry 201L, the course is capped at 24 students. In order to social distance to 6 feet, only 8 students + instructor could be allowed in class. Students were placed in one of three groups. Essentially, they would come to class for an on campus lab once every three weeks. The alternative time was spent on data analysis AND another laboratory virtual assignment. Included here is the schedule. (Table 2)

Tentative Spring 2021 Chem 201 Lab Schedule

Week	Day	report to lab on your assigned Group A, B or C experiment days (in red).	Due <sup>A</sup>
1 Feb. 1	M T W Th F	Online Intro Video and intro Quizes. <b>Do NOT come to lab 1st week.</b>	ASAP (before 1st in lab meeting)
2 Feb. 8	M	Group A: EXPERIMENT 1 Groups B & C: OLA 1	<b>In Lab Experiments (ILE)</b>  EXPERIMENT 1 - Molar Mass of a solid & Chemical Kinetics  EXPERIMENT 2 - Equilibrium  EXPERIMENT 3 - Analysis of oxalate in a Transition Metal Complex  EXPERIMENT 4 - Voltaic Cell
3 Feb. 16	T W Th F	Group A: EXPERIMENT 1 Groups B & C: OLA 1	
4 Feb. 22	M F	Group B: EXPERIMENT 1 Group A & C : OLA 1	
5 Mar. 1	M F	Group C: EXPERIMENT 1 Group A & B: OLA 1	
6 Mar. 8	M F	Group A: EXPERIMENT 2 Group B & C: OLA 2	<b>Online Assignments (OLA)</b>  OLA 1 - Integrated Rate Law  OLA 2 - Error Analysis in Titration of an Antacid  OLA 3 - pH and Buffers  OLA 4 - Titration Curves  OLA 5 - Thermodynamics
7 Mar. 15	M F	Group B: EXPERIMENT 2 Group A & C: OLA 2	
8 Mar. 22	M F	Group C: EXPERIMENT 2 Group A and B: OLA 2	ILE 2 & OLA 2
9 Apr. 5	M F	Group A: EXPERIMENT 3 Group B & C: OLA 3	
10 Apr. 12	M F	Group B: EXPERIMENT 3 Group A & C: OLA 3	ILE 3 & OLA 3
11 Apr. 19	M F	Group C: EXPERIMENT 3 Group A & B: OLA 3	
12 Apr. 26	M F	Group A: EXP. 4 & Check Out Group B & C: OLA 4	ILE 4 & OLA 4
13 May 3	M F	Group B: EXP. 4 & Check Out Group A & C: OLA 4	
14 May 10	M F	Group C: EXP. 4 & Check Out Group A & B: OLA 4	OLE 5
15 May 17	M F	Group A, B, & C: OLA 5	
16 May 24			

<sup>A</sup>all reports should be uploaded into Canvas by Sunday, 11:59pm, at the end of indicated week.

Table 2

Organic Chemistry 231L and 233L have a cap of 18 so their social distancing involved splitting the students into two groups. This required another rewrite of the manuals courses and a special schedule not shown in this document.

It should also be noted that socially distanced laboratory courses taught from Fall 2020-Summer 2021 involved support on the part of our Instructional Laboratory Technicians who helped not only to prepare the labs but also to screen students for COVID-19.

In March of 2021, the STEM Department Chairs were proactive in requesting that more courses be allowed back to campus. Fueled by increasing equity gaps and difficult working conditions, we wrote a letter in support of more on-campus courses for Fall 2021. We felt supported by Dean Recalde and Vice President of Instruction Isabel O'Connor. At the same time, the District began negotiating with the AFT Union the vaccination requirements for faculty and students. This allowed for a larger return of 93% of our chemistry courses being offered in a face-to-face format in Fall 2021 and 100% of the laboratory courses being offered face-to-face.

**What college-wide practices implemented since the last program review cycle have affected your area or your program positively or negatively? Identify impacts on student success or equity.**

One college-wide practice that has positively affected our area are all of the Professional Development opportunities given to faculty to help convert courses to the online format during the change of modality and training for more equitable teaching practices.

The SDCCD Distance Education Certification allowed for all of the chemistry faculty to prepare their online courses for Canvas. All of our faculty participated and we work tirelessly to adapt our course materials to the online format. There were still issues with the platform for a quantitative field like chemistry in terms of assessment and ease of use in the software (mentioned in previous sections). Canvas was not designed for quantitative fields. However, now that we are back to face to face instruction, the Canvas training allows for faculty to continue effectively using Canvas to supplement face to face learning. The department faculty really supported each other in what felt like 24/7 constant communication (nickname for this group is The Hive). This camaraderie helped carry us through learning all the new technologies. Our faculty attended Zoom training sessions provided by the LOFT and supplemented instruction by learning Canvas Studio, Proctorio, Pronto, Discord, and screencasting.

Our full-time professors work hard to train on equitable teaching practices. Many are involved in attending conferences. For example, Dr. Fusco-Hernandez attended the 2021 AHSIE (Alliance of Hispanic Serving Institution Educators) Best Practices Conference. This conference offered “over 80 concurrent sessions showcasing the creativity, innovation, and commitment of HSI practitioners from dozens of colleges and universities from across the nation. Dr. Hjorth-Gustin attended the Academic Senate Fall 2021 Plenary and attended many equity focused presentations “All Things Ethnic Studies” and “From Equity Theory to Equity Practice: Activating Our Agency as Practitioners”. Ms. Moore attended “Equity in Assignments, African American Male Network (A2MEND)” conferences, and “Culturally Responsive Teaching”. Dr. Sardo was involved in Reading Apprenticeship in STEM-Improving academic literacy in STEM.

*In support of all the above, my self-directed study in the appropriate use of technology in the classroom while taking advantage of professional development opportunities, Flex, Mesa LOFT, my participation in Mesa Buddies Program (summer 2020), and my completion of a SWC -Remote Teaching Certificate (Winter 2020), and secondly, sharing these experiences with others by participating in department and school meetings, conferences, etc. have helped me with personal growth. (D. Gergens)*

These are a few examples of many Professional Development opportunities that are leading to marked changes within our classrooms where instructors strive to use more inclusive language and assignments. Giving examples to students regarding influential scientists from underrepresented groups in science (Latinx, women), discussing issues of disproportionate impact of climate change, and environmental racism discussions are all part of the ways we bring discussions of equity into our classrooms.

Online Education Resources (OER) in our department had been spearheaded by Mr. Fremland. Building on this, Dr. Fusco-Hernandez as part of the *E3: Equity, Excellence, and Exito* grant will be building a free online homework system for chemistry courses. She has other interested faculty in other disciplines as well. This will be a fantastic addition to our learning materials. Many instructors have experimented with free online laboratory manuals which had pros and cons.

In F'20 - S'21, the college supported the writing and submission of the aforementioned HSI STEM grant that was awarded this semester. To this end, the college hired an outside grant writer. Mesa Chemistry was highly involved in this six month development and writing process. Drs. Fusco-Hernandez and Budzynski were on the grant writing team, along with Dr. Snyder from Physical Sciences. Dr. Budzynski led a STEM Grants Workgroup to involve faculty from other STEM disciplines in the development process. We appreciate the support of President Luster and Vice President O'Connor for these ideas and projects, and are thrilled to begin implementation in S'22.

While the college has done its very best to support students during the pandemic, a digital equity gap persists. As demonstrated in our General Chem data, low income Latinx students have a lower success rate than several other groups. While there are a multitude of reasons for this, as the college continues its return to in person instruction, lack of computer and internet access must continue to be addressed. As mentioned above, we are using Canvas more now, especially for students who need to miss class due to the pandemic. If such a student does not have easy access to the internet and a computer, the accommodations we put in place may not help. Hopefully, some of this will be alleviated with the reopening of the STEM Center for in person access, as well as more access to in person computer labs. Even with that, the digital equity gap is something the college should continually focus on. It impacts students in courses across all disciplines, but is especially prevalent in quantitative, tech heavy areas such as Chemistry. As instructors, we must remain cognizant of this. In Chemistry for example, Professor Moore worked with the bookstore to ensure that printed copies of the OER textbook would be available for students who prefer that. Many students have expressed that while they like the lower cost of OER, it is not always possible for them to access it online when needed, especially in households that are sharing a computer. Dr. Budzynski has been providing printed copies of lecture notes to her General Chemistry students, as well as pdf files on Canvas. This helps students who do not have easy access to a printer, or tablet to take notes with to have the same access as those who do. The college should encourage these types of practices.

Another college-wide practice that has affected Chemistry positively is the commitment of the college to shared governance. Campus wide engagement and leadership is important to the Chemistry Department. Dr. Budzynski has served as a mentor Department Chair to other new Chairs in STEM. Her leadership has provided a great working relationship with Physical Sciences, Biology, and Mathematics. The culture she has set in the department is one of great respect for our adjunct faculty. She has been sensitive to their employment issues during our downsizing. Because of her expertise, she was a presenter in New Chairs

Academy in Fall 2021 for Best Practices in Scheduling. In addition, there is no limit to her advocacy for STEM students and faculty. Problem solving is her forte and if there is a problem, she seeks solutions. Dr. Hjorth-Gustin (Asst. Chair) was elected to Chair of Chairs and has built relationships outside of the MS school that helps our ability to solve problems. Coming back in a hybrid modality and then face to face has taken a vision and organization. Both Chairs have worked relentlessly with Dean(s), Vice President of Instruction Isabel O'Connor, President Luster, Facilities, Student Services, Health Services, and District personnel such as Vice Chancellor Topham to provide clear guidelines and processes for reopening. The reopening efforts have been all consuming for Chairs and included implementation of vaccination requirements and classroom and office readiness. Dr. Hjorth-Gustin has been actively co-chairing the Red Zone group whose main goal was to provide a support system to communicate information regarding reopening issues and information. She hosted the Red Zone Reopening Meeting in August which was very well attended, but too large for Zoom. Currently, she is collaborating with Deans to develop a document with links to all important information regarding the reopening efforts. Reopening is so vital to our equity efforts as the data shows how impacted our Latinx students have been learning a difficult subject online!

Shared governance has impacted student success and equity directly in the sense that the college collaborates among faculty, administration, and staff. Without this dialogue we would not be able to remain tackling the issues that we are facing as we move from pandemic to endemic phase of the virus. Questions will still remain on how the pandemic will affect enrollment trends, student access to classes, and equity gaps. Can we as a college still address equity gaps as our mission and vision are being altered by the new normal?

We will not be able to completely solve the issues that students are facing in the pandemic. Many are outside of our control. However, the Mesa Chemistry Department is committed to providing high quality instruction with a student centered approach and a commitment to closing equity gaps in particular for Latinx students that make up 38% of Chemistry students. The faculty in this department are extremely hardworking and committed to students and their success. Returning to campus is our major means of providing more equitable instruction during the pandemic. What is important to note is that all of our goals will require support from the college by hiring at least one if not two full time tenure track faculty. This will allow us to continue our HSI grant work, leadership positions in the college, and make effective and institutional changes that close equity gaps.