Program Information & Executive Summary

1. **Describe the successes and challenges your unit has faced since the last comprehensive review.**

The Physics faculty have built one of the most vibrant communities on campus during this past year. The discipline has seen some retirements and is in the process of hiring for a new full-time contract faculty. Current contract and adjunct faculty are highly visible participating in a number of different professional development and campus-wide initiatives to increase student success, reduce equity gaps, clear and define pathways, and ease transfer. The Peer Mentoring program has grown into something truly inspiring providing a space for physics students to work, exchange ideas and support each other. One needs only to walk by MS 118 at any time during the week to see (and hear!) the excitement surrounding our physics community.

Courses in the PHYS discipline are primarily on pathways for different programs (Engineering, Biology, Chemistry, Radiologic Technology, Architecture, etc..), but there are several students who complete the PHYS AA, AS, ADT, and certificates. Recently, the PHYS department updated its certificate and AS degree requirements. Faculty reviewed degree requirements with different transfer partners to create a certificate and AS degree with enough rigor and flexibility to prepare students for a number of different options moving forward. Physics Program Outcomes were recently updated to clarify learning outcomes and to include new language regarding technological proficiency. A proposal was submitted to add a Hybrid option for PHYS 100. None of the courses in the PHYS discipline have DE status based on concerns related to student success and transferability. However, the PHYS 100 student population and curriculum was chosen as an experiment to allow for a partially online delivery of physics content. Faculty also completed a proposal for a new course, PHYS 19. PHYS 19 will be a supplemental course to prepare students for PHYS 195, PHYS 180A, and PHYS 125. The course has strong support both within the department and with our colleagues at City and Miramar Colleges.

The Physics discipline has had two retirements between Spring 2021 and Spring 2022. This has caused the department to rely more heavily on its adjunct instructors. The department has hired three new additional adjunct instructors in the last year to handle the load. Our adjunct instructors are an integral part of department life, and their presence has had many benefits. However, reliance on part-time instructors has raised concerns about student success and equity. The lack of a contract instructor has left the department without leadership for the PHYS 100 course in particular. A search for a new PHYS instructor in the Fall 2022 semester resulted in a failed search that was reopened in Spring 2023. We hope for success to move our department forward and continue to close equity gaps. The PHYS department has also hired a part-time Instructional Lab Technician to support evening physical science labs. This NANCE hire joins our two full-time ILT’s to support the increased diversity of lab courses available to students.

This is an exciting time to be on campus with many new initiatives coming from the HSI-STEM grant and PHYS faculty have been active in all aspects of it. The Curriculum Workgroup has been tasked with clarifying STEM pathways. As a result of being service courses for many different disciplines, physics faculty have been integral to plans for Biology and Engineering pathways in particular. This work has involved aligning content with other STEM disciplines, especially Biology and Engineering. Physics faculty have been working to verify that Physics courses are relevant, necessary and have the appropriate prerequisites. Also, in coordination with the Math faculty, Physics faculty have been reviewing math prerequisites and verifying physics courses are assuming the appropriate coursework from the math courses.

The Physics department was one of the first disciplines to get a new "Studio" Classroom space. Desktop computers and desks were removed from the department computer lab and replaced with laptops and moveable tables (See Photo Right). Students now face each other in groups of four to work together during class on worksheets and computer simulations. This has had positive effects on community building, attendance, and student success.

Peer Mentoring is one of the most exciting programs in the Physics department. Peer Mentors hold sessions in a designated classroom near the Physical Science Office Suite and in the STEM Center. Students from PHYS 195, 196, 197, 180A and 180B meet with Peer Mentors and each other to work on homework, reinforce ideas through supplemental worksheets, prepare for exams and have some fun interaction. In the Spring 2023 we had six mentors out of which three were female mentors, one being Latina. Significant fraction of all physics enrolled students participates in physics peer mentoring. This program has transformed the way we interact with students and has helped us build a vibrant community of physics learners that are supported by their peers and faculty outside of the classroom.

Physics faculty have also participated in Professional Development. Physics faculty have led and participated in Faculty Inquiry Groups (FIGs) on bringing culturally responsive practices to first-semester physics classes and on implementing mastery-based grading. Faculty have presented at national and local meetings associated with the American Association of Physics Teachers. A Physics Faculty member is working with other 2YC physics faculty through AAPT to produce a handbook for colleges to use to build, assess, and improve 2YC physics programs. Finally, a faculty member is working in collaboration with other professional science societies to increase participation of 2YC students and faculty in STEM programs.

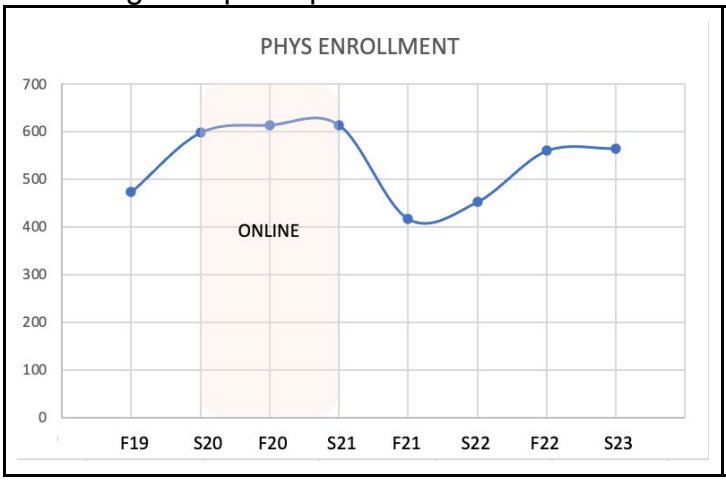
2. **Please confirm that the department has reviewed the Course Learning Outcomes listed in CurricuNet for each course and verify accuracy.**
   - **X Reviewed and accurate**
   - **☐Reviewed not accurate, update in progress**
   - **☐Reviewed not accurate, need support**

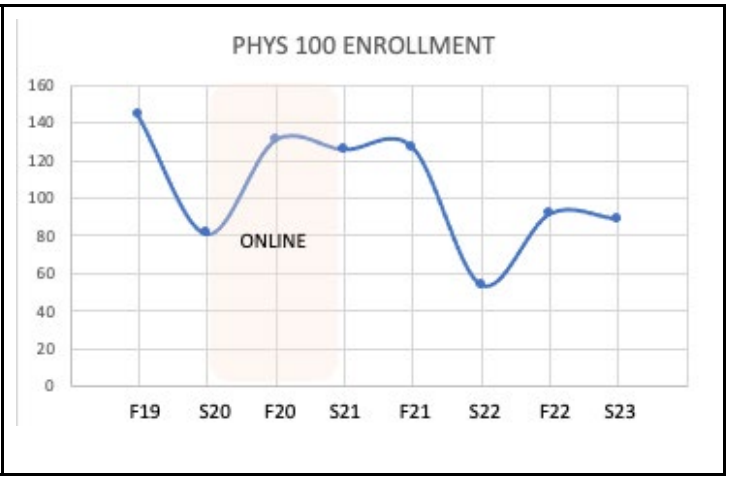
Data Reflection

1. **Describe the trends you see in your program/service area's data**

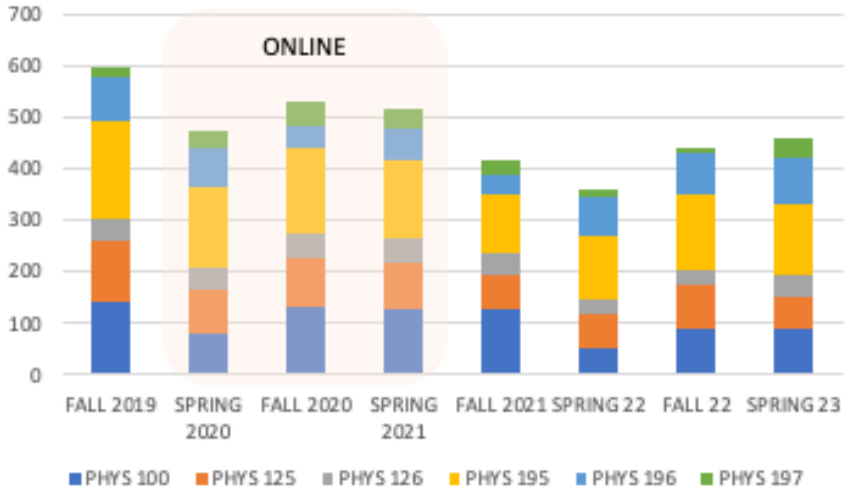
Courses in the PHYS department are primarily pathway courses for other programs, the largest being Biology and Engineering. The PHYS 100 course is populated by students interested in technical programs such as Radiologic Technology. The PHYS 125/126 and PHYS 180A/B sequences serve Biology programs and many pre-professional health science majors. Finally, PHYS 195/196/197 include Engineering and other Physical Science majors. Enrollment in PHYS courses as a whole decreased post-pandemic as can be seen in the Figure but is on its way back up to Spring 2020 Levels. One reason for this decrease could be a slight ebb in the pipeline feeding into our courses. All PHYS courses currently have math prerequisites that sometimes have prerequisites of their own. Students feeding into our courses may have been disrupted by preparation during the Pandemic. Another big reason for the variation in PHYS enrollment as a whole is due to the fluctuations of PHYS 100. As can be seen in the graph below, PHYS 100 enrollment has large fluctuations that do not seem to have been affected by the pandemic. This could be because PHYS 100 has a much lower-

level math course prerequisite. Also, PHYS 100 enrollment is tied more closely to the Radiologic Technology program whose current cohort started in Spring 2022 which means that Fall 2022 was the last semester for students to complete the required PHYS 100 course (Spring 2020 was the beginning of the last cohort). What is concerning here is that enrollment did not pick up in Fall 2022 or Spring 2023. This may indicate a smaller potential cohort for the Rad Tech program or that students are taking their prerequisite courses elsewhere.



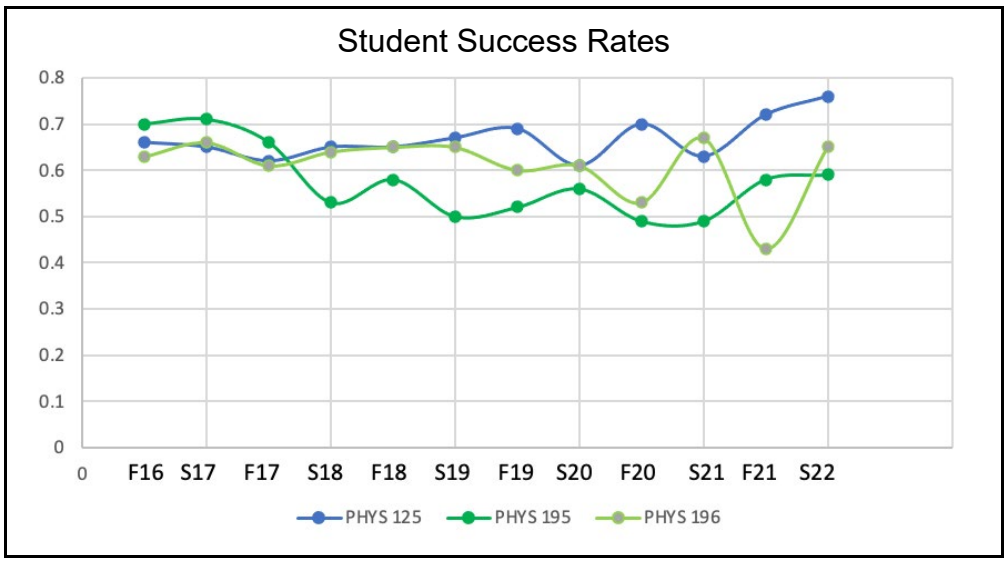


To see enrollment trends slightly more clearly, the following bar graph shows the total enrollment in PHYS courses for the past semesters. PHYS 180A/180B is not shown in the analysis because it is a fairly new offering whose trends are not apparent at this point in time. Enrollment for Spring 2023 is reaching Spring 2020 levels. Most of the blocks representing individual course enrollment do not change significantly from semester to semester. The only other courses we take note of are PHYS 196 (blue) and 197 (green). These are the second and third semester courses in the PHYS 195 sequence. These have also seen some fluctuations post-pandemic that appear to be returning to their previous levels. Still, we will track these courses going forward.



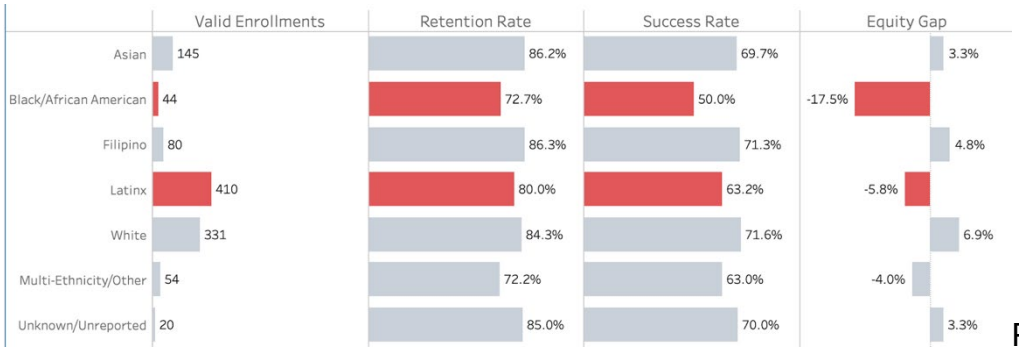
In terms of Student Success, we focus on the introductory courses PHYS 125, PHYS 195 and PHYS 196 since they have lower success rates and are considered “gateway” courses (See graph below). Success rates for PHYS 100 hover around 80% which make them less of a concern. Although PHYS 196 is not the first course in a sequence it is traditionally one of the hardest courses in the Engineering curriculum. Each of these courses are prerequisites for other courses in the sequence and for courses in the Engineering Program. As such, having to repeat PHYS 195 or 196 can delay graduation and transfer for students and affect retention. Success rates for both PHYS 125 and PHYS 195 are rising since the disastrous Spring 2020 semester. We regret that the Data Dashboards are behind the Enrollment dashboards and do not include Fall 2022 because we are eager to see if

this trend continues. Although success rates are on the rise, Success in PHYS 195 still hovers near 60%. This is also true for PHYS 196, which is deeply upsetting for a number of reasons.

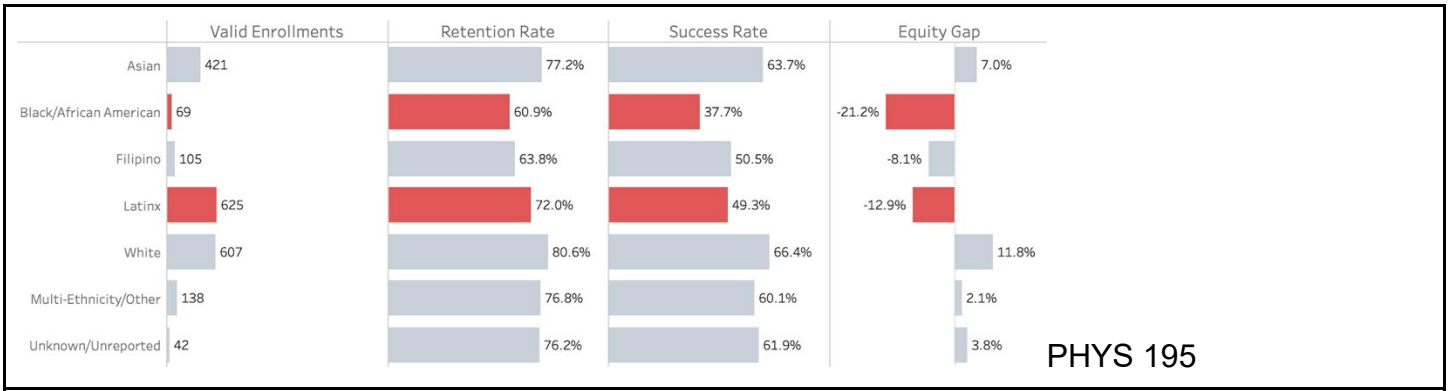


2. Describe any equity gaps you see in these data. Are there differences and/or patterns observed by demographics (e.g. race/ethnicity, gender, age, etc.)?

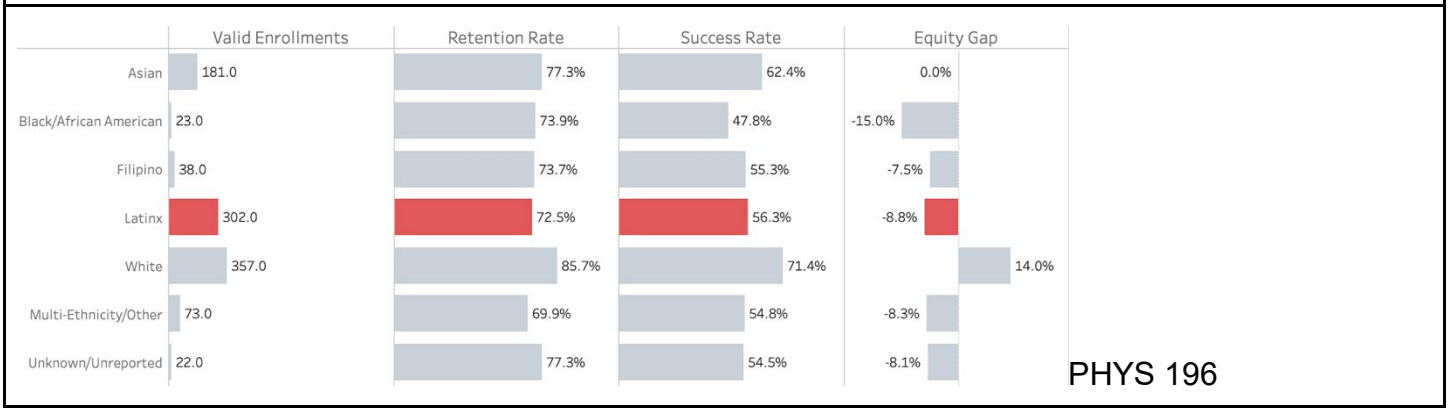
Within these low success rates, significant equity gaps for Black/African American and Latinx students also exist (See Tables below). Tracking of the equity gaps over time did not reveal any significant changes that would indicate trends resulting from interventions. However, we did notice that equity gaps for Black/African American students disappeared for some courses, but the reason for that was due to not having a B/AA population in the courses during that semester, which is disturbing for different reasons. Finally, no significant equity gaps due to gender differences were seen in the PHYS courses. However, we noted that although they weren't significant, Female students mostly had lower success rates than Male students in the PHYS 195/196/197 sequence. This is interesting only because the reverse is true for Mesa College as a whole. Lastly, when gender differences were significant, it was due to lower success for Male students.



PHYS 125



PHYS 195



PHYS 196

3. Describe the discussion(s) that took place about the unit's learning outcomes assessment data.

Discussions of SLO's focused primarily on the skills that students bring into the classroom. Physics is not typically the first course that a student will take on their pathway. All physics courses currently have Math prerequisites and/or corequisites. Those math courses often have prerequisites of their own. Students do not usually come to us without some success in STEM courses. Still, learning physics is a challenge. In any discussion of PHYS courses in any High School, College or University, faculty will talk about students' math skills. This discussion is not particularly new, but faculty have reported a decrease in math skills in terms of basic algebra and calculus. It is not clear if this is due to courses taken during the pandemic or impacts from AB1705 (more on this later). Something new is that faculty are reporting seeing problems with students' reading skills. Often students need to read and identify information from problems descriptions with multiple sentences. It appears that students are having trouble focusing and extracting the information that they need. It appears to go beyond the expected problem of students having difficulty translating written language into mathematical formulas. These are big concerns for both our lecture and laboratory courses.

Practice Reflection

1. Describe current practices your unit has engaged in that you believe impact the above data trends and equity gaps.

PHYS faculty have been working hard to increase enrollment, increase success rates and decrease equity gaps. Enrollment in PHYS 100 has been troubling. Since enrollment is tied to the Rad Tech program, we are making connections with faculty in that program to see where we can improve in terms of preparation for their students. We have already changed the DE status of the course to allow for a hybrid offering. We hope that this will be popular as we offer it in the Summer and Fall semesters. In addition, we recognize that the Rad Tech program does not require the lab for PHYS 100. We are in the process of separating the lecture from the lab and creating two separate courses.

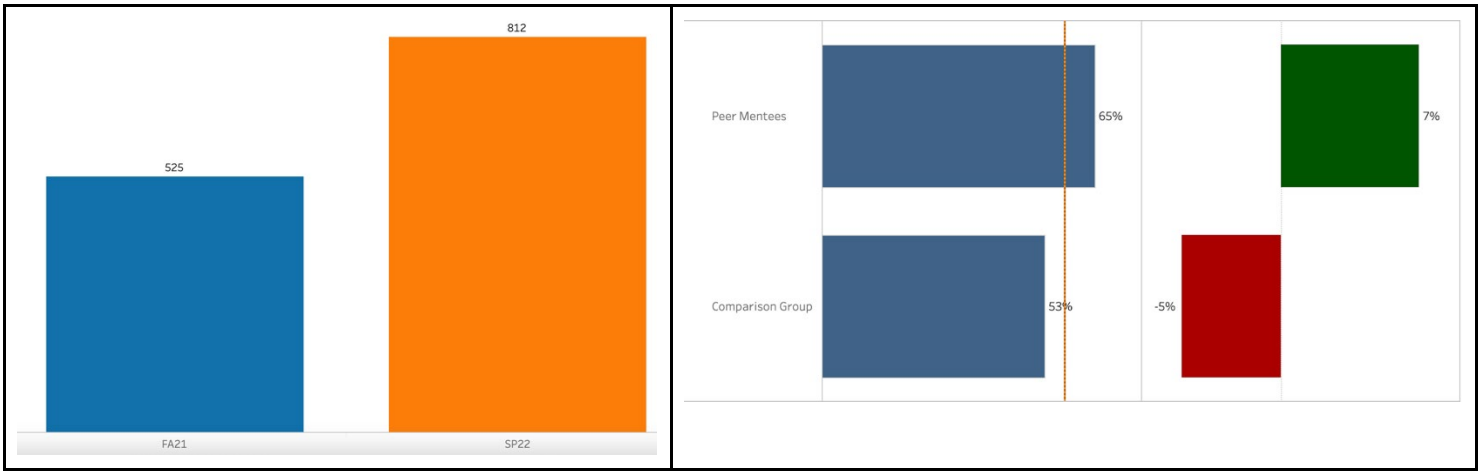
This would also make the course more attractive to students who are looking for a General Education course in Physical Science. This has support from our peers at City College as well. Separating the lecture from the lab is not a decision that we take lightly. We recognize that having separate lectures and labs makes it easier for scheduling, but we feel strongly that it weakens the course in a pedagogical sense since our labs are often used to support the lecture topics. We discussed the advantages with faculty in Counseling and were advised to stick with separating PHYS 100 at this time.

Our PHYS 180 and PHYS 125 series are still struggling with their identity on different pathways. It can be very challenging for students and counselors to put students into the correct physics sequence. We know from our experience that several students get misplaced each semester which results in students dropping or repeating courses. We have reached out to Counseling, and we reach out to students at the beginning of every semester in order to clarify, but it remains a problem because the correct course sequence varies widely with our transfer partners. This is especially true in Pre-Professional Medical areas such as Pre-Med, Pre-Dental, and Veterinary programs. We are considering creating a master list of all programs that have PHYS prerequisites with the appropriate course number for students to refer. Currently, we have made up a new flier that we have available at the Advising workshops and other venues where students seek this type of information. We have also designed and implemented an entirely new laboratory curriculum for PHYS 181A that focuses on experimental techniques and topics that are relevant for life scientists and health professionals.

PHYS faculty have also been working at different outreach events such as Jump Start and STEM Success days to encourage students to continue their physics studies at Mesa College. Our faculty are working to make themselves approachable to students both before the course begins and during the semester. We have a culture in our department of encouraging students and being a partner in their success in the course. Students acknowledge that we care deeply for them and their learning, but we have gotten a bit of a reputation for running challenging courses. That may or may not be true, but we feel that being warm demanders shows respect to our students and their abilities. We continue to seek opportunities to connect with students both in and out of the classroom. Physics faculty are also mentoring a new Physics Club to help physics students get involved in outreach, and to help connect with them transfer institutions and industries. The club has conducted Tesla coil demonstrations in multiple classrooms and at the “Madison at the Mesa Day” event for Madison High School students.

Success rates are beginning to rise in PHYS 125, PHYS 195 and PHYS 196 courses. Over the last year, PHYS 125 courses have benefitted from the move back to on campus learning. Community-building and cooperative learning, some of the hallmarks of culturally responsive teaching, was difficult to enact online. Since being back on campus, students have returned to group work in the classroom and in the laboratory. First semesters back on campus were rocky since students were not used to interacting and were wearing masks and told to “socially distance” themselves. As pandemic restrictions began to lift, the students have been more able and willing to work together. Our classroom has been outfitted with new tables, chairs, equipment, whiteboards, and projection equipment to make interaction easier for students. It is very early days for the PHYS 125 course, but comparisons between mean scores on the first exam for Spring 2022 and Spring 2023 show gains between a mean score of 71% in Spring 2022 and 76% in Spring 2023. The same is true in comparisons between scores in Spring 2022 and Fall 2022 students for Exam 2. Exam 2 had a mean score of 67% in Spring 2022 (Exam 2 is consistently harder than Exam 1) and a mean score of 72% in Fall 2022. It is too soon to attribute increased success to this physical space, but it is something that we will continue to study. Lab assignments have been rewritten to allow for more group work and focus on science skills.

Peer Mentoring is the most impactful intervention in the PHYS department in terms of student success, community building and student support. There aren't enough positive things to say about this program. The Peer Mentoring room is open M-F most of the day. Students congregate there to work on physics and support each other. During Spring of 2022, Peer Mentors saw 812 students (See Table below) which surpasses or equals the number of students in any other discipline and in the tutoring center. Also, students in Peer Mentoring are more successful in Physics courses than students who do not use Peer Mentoring (see Table below).



Based on the FIG that physics faculty participated in in fall of 2022, one Spring 2023 PHYS 195 section has implemented mastery-based grading. This is an alternative assessment scheme in which students are required to demonstrate mastery of each learning objective in the course, with their grade determined by how many objectives they master. This contrasts with traditional grading where students can acquire points through partial credit without ever demonstrating mastery of any single objective. Students are given multiple opportunities to demonstrate mastery of each objective and receive full credit regardless of how many tries they take. We look forward to seeing how this affects success rates and equity gaps in this section, and we plan to refine our implementation of mastery grading and expand it to more courses and sections.

2. What other factors (internal or external) might also impact the above data trends and equity gaps?

We expect that there will be strong implications on physics courses from AB1705. As discussed previously, physics courses rely heavily on math prerequisites. Any change in math curriculum will directly affect physics success. This is why physics faculty are working closely with math faculty. To clarify, this alliance is to ensure that math faculty understand what physics faculty expect students to know and for physics faculty to know whether those expectations are reasonable. Neither party expects to dictate curriculum to the other. Instead, the aim is to open communication for each to see the effect on student success. AB1705 adds ambiguity to this already difficult situation by altering the types of math prerequisites for some courses and the way that they are fulfilled. Our PHYS 195 sequence has calculus as a prerequisite, which is a pathway course for all the students who will enroll in the course. We don't expect AB 1705 to affect this prerequisite. However, PHYS 100 has a prerequisite of MATH 096 which must be removed. Both PHYS 125 and PHYS 180A have a prerequisite of MATH 116 (College Algebra). PHYS 180A also has co-requisite of MATH 121 (Applied Calculus). We are waiting for advice for what the math prerequisite for PHYS 100 should be. The course itself is conceptual and needs limited math. However, UCSD will not transfer the course without a MATH prerequisite. We are also waiting for clarification on the strength of having the MATH 116 prerequisite for PHYS 125 and PHYS 180A. It is not clear whether students can "opt out" of

MATH 116 since Calculus is the pathway course. This would be disastrous for PHYS 125 but would be catastrophic for PHYS 180A. One can imagine a situation in which a student opts out of MATH 116 and jumps right into both MATH 121 (Applied Calculus) and PHYS 180A at the same time to find themselves unprepared to take either. When we consider student success in our courses, the biggest impact on that is the preparation of our students. Historically, students in our Physics courses were not very different from students in Physics courses at other colleges because all students would have had to complete some level of college math. This ensures that they understand math and have had some success at being college students. AB 1705 has the potential to remove this, making it not necessarily more difficult to teach the courses, but more difficult for students to succeed.

We will continue to work with our excellent colleagues in the math department to serve students better in our courses. We also intend to communicate more directly with colleagues at our sister campuses. It is expected that we will need to put in curriculum changes for our math prerequisites for most of our PHYS courses. We need to agree on what those should be. We need to do this as soon as possible to keep the level of the courses where they should be. We are hearing from faculty in other disciplines about how they can't teach all the curriculum because they need to slow down for underprepared students. Most of the physics faculty have done curriculum projects as a part of ESCALA, CEER or other culturally responsive teaching workshops. As part of this, we have all taken hard looks at what we teach and focused on what we need students to know to make it to the next level. None of us are in a position where we can cut any remaining topics. Before AB1705, we had begun to plan for a PHYS 19 course that students could take as a refresher for some basic algebra, graphing, trigonometry, and calculus concepts as they appear in the physics classroom. The PHYS 19 course is making its way through the curriculum process, and we hope to be able to offer it in Intersession 2024. As we offer this course, we will make a very clear assessment plan to make sure that it is working for students.

As discussed previously, faculty are also reporting issues with students' ability to read and write. This problem appears widespread among the courses, but undefined. As with the difficulties with MATH, it is unclear where these problems are coming from and what their nature is. We plan to investigate this more fully in the coming year. Again, in relation to AB 1705, integration of basic skills into all coursework is more important than it was before. We intend to offer more opportunities for students to practice reading and writing skills.

We are currently interviewing for a new PHYS position. The PHYS hire is intended to take leadership of the PHYS 100 sequence. As discussed previously, this course has been having enrollment issues that need to be investigated. It is also in the process of being split into separate lecture and lab courses. The new hire will provide vision on how this change will affect curriculum. We also hope that the new PHYS hire will bring perspective that will increase discussion with faculty of all PHYS, PHYN, GEOL, ENGE, OCEA, and ASTR courses.

Unit Goals and Action Plans

1. **Unit Goals (Goals should connect to Data and Practice Reflections. Goals should be Specific, Measurable, Attainable, Relevant, and Time-bound.)**
   Goal 1: Increase enrollment in PHYS 100 and second semester courses such as PHYS 196 and PHYS 197.
   Goal 2: Increase Student success in PHYS 125, PHYS 195, and PHYS 196.
   Goal 3: Decrease equity gaps in PHYS 125, PHYS 195, and PHYS 196.

2. **Mesa2030 Roadmap Strategic Objective (SO) Alignment**

Goal 1: Increase enrollment in PHYS 100 and second semester courses such as PHYS 196 and PHYS 197.

- Completion 3: Design and promote programs and services that intentionally target a reduction in equity gaps in completion outcomes.
- Pathways and Partners 3: Increase community engagement, experiential learning, integrated career planning, and workforce training to prepare students for future careers.
- Scholarship 2: Evaluate and improve Diversity, Equity, and Inclusion practices in classroom environments, campus activities, departments, schools, and administrative units.
- Scholarship 3: Assess impact of prerequisites and corequisites on student success and revise curriculum, as needed.
- Scholarship 4: Expand the use of innovative and high-quality teaching, learning, and support practices that achieve equitable outcomes and increase student success

Goal 2: Increase Student success in PHYS 125, PHYS 195 and PHYS 196.

- Stewardship 3: Increase student access and schedule efficiency by coordinating schedules among departments/ disciplines.
- Scholarship 2: Evaluate and improve Diversity, Equity, and Inclusion practices in classroom environments, campus activities, departments, schools, and administrative units.
- Scholarship 3: Assess impact of prerequisites and corequisites on student success and revise curriculum, as needed.
- Scholarship 4: Expand the use of innovative and high-quality teaching, learning, and support practices that achieve equitable outcomes and increase student success

Goal 3: Decrease equity gaps in PHYS 125, PHYS 195 and PHYS 196.

- Completion 3: Design and promote programs and services that intentionally target a reduction in equity gaps in completion outcomes.
- Scholarship 2: Evaluate and improve Diversity, Equity, and Inclusion practices in classroom environments, campus activities, departments, schools, and administrative units.
- Scholarship 3: Assess impact of prerequisites and corequisites on student success and revise curriculum, as needed.
- Scholarship 4: Expand the use of innovative and high-quality teaching, learning, and support practices that achieve equitable outcomes and increase student success

3. **Identify specific actions your program/service area will engage in to accomplish this goal (Examples may include: policy or practice changes; unit initiatives, curricular changes, etc.).**

Goal 1: Increase enrollment in PHYS 100 and second semester courses such as PHYS 196 and PHYS 197.

1. Complete proposal for separate PHYS 100 lecture and lab
2. Continue to monitor success in PHYS 100 hybrid course
3. Participate in outreach events such as JumpStart and STEM Student Success and prepare written materials for advising events

Goal 2: Increase Student success in PHYS 125, PHYS 195 and PHYS 196.

1. Renovate classrooms to increase student collaboration.
2. Expand Peer Mentoring Program.
3. Continue work with the STEM Curriculum workgroup to explore Math prerequisites and connections to other disciplines and clear pathways for students.

4. Prepare curriculum proposals to change math prerequisites to PHYS 100, PHYS 125, PHYS 180A courses.
5. Prepare, present, and evaluate PHYS 19 course in Intersession 2024.

Goal 3: Decrease equity gaps in PHYS 125, PHYS 195 and PHYS 196.

1. Identify more clearly reading and writing problems for students in PHYS courses.
2. Expand work on potentially impactful practices such as community building and mastery grading.