LDC Program Review – Annual Discipline Update for 2021-2022
PART A

SECTION 1: BASIC PROGRAM/DISCIPLINE INFORMATION

SAC Name: **Physics**

Disciplines included in this SAC: Physics

SAC Chair(s): Darrell Lim

Faculty Department Chair(s): Jim Schneider (SY), Vicki Schroeder (RC), Tony Zable (CA), Lee Collins (SE)

Program Dean/ SAC Administrative Liaison: Kenneth Friedrich

Pathway Dean: Alyson Lighthart

Please highlight where your classes are offered.

Classes/Services offered at: CA / RC / SE / SY / NB / HC / WCC / Metro / CLIMB
Other:

SECTION 2: REFLECTING ON DATA

All data cited below can be found here:
https://www.pcc.edu/institutional-effectiveness/program-profiles/
***Note the row of Tabs just below your Bookmarks Bar. Begin on the Home Tab. This is where you will choose your selection criteria for your data. Return to the Home Tab whenever you want to change your selection criteria. See the Help and Data Dictionary Tabs as well as the Data Directions Document included in the email with this template for more information.

Please include data from at least the last three years and up to the last five years. A 3-year enrollment review is recommended. SACs may have unique circumstances and reasons for looking more or less broadly.

2A.Enrollment (SFTE) per year; Location (where course is taught); Modality

SEE Student FTE Tab

2A1. Does this data suggest any questions that the SAC would like to pursue?

SFTE for Physics by campus and year

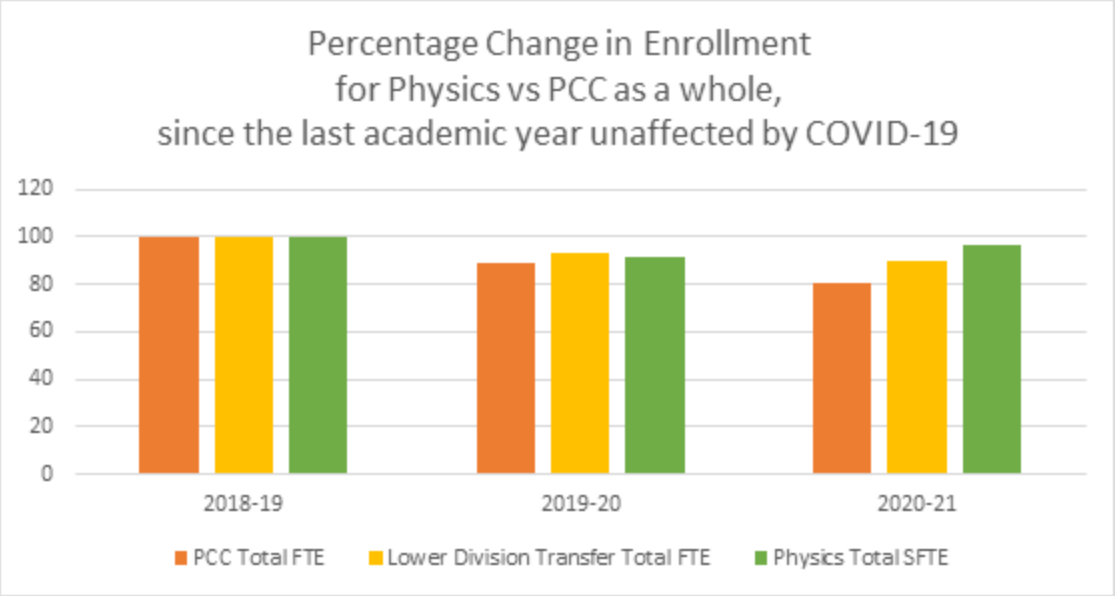
(modality not listed here, since the most recent academic year was entirely remote/online due to the COVID-19 pandemic):

	2018-19	2019-20	2020-21
Sylvania	186.5	165.6	162.8
Cascade	78.5	64	79.7
Rock Creek	79.5	86.4	91.6
Southeast	30.8	25.8	28
Total	**375.3**	**341.8**	**362.1**

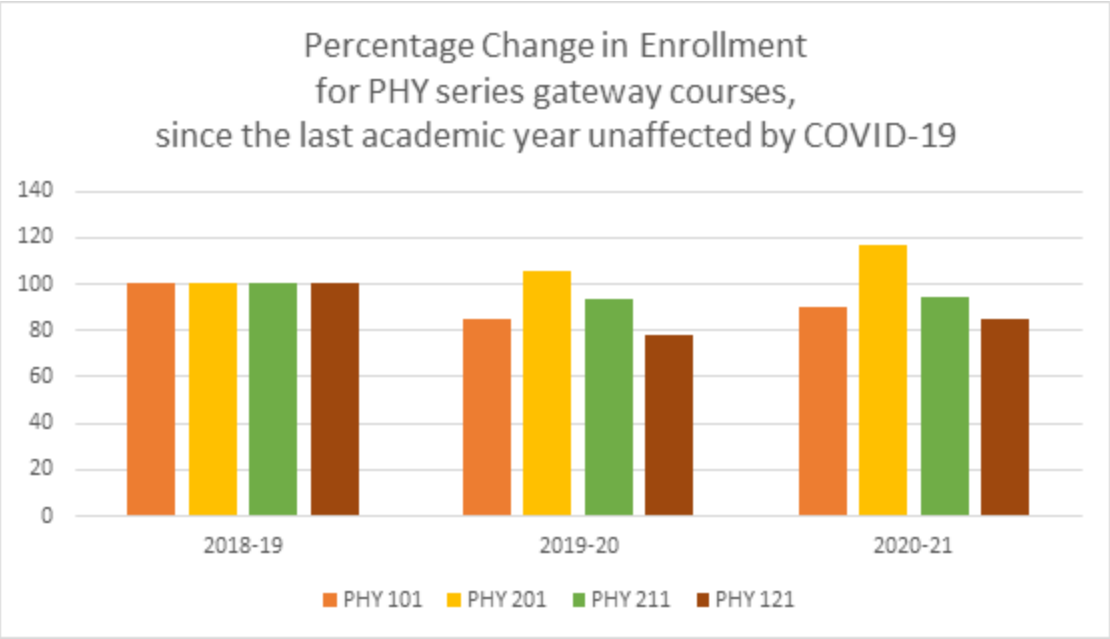
The table shows that total Physics SFTE decreased by 8.9% from 2018-19 to 2019-20, and then increased by 5.9% from 2019-20 to 2020-21. This leads to several questions:

- How does PHY enrollment compare to PCC's college wide enrollment during this time?
- Was there significant variation between enrollment in different series (PHY 101, PHY 201, PHY 211 and PHY 121)?
- How did the overall PHY enrollment trends compare to other lab science courses at PCC?

The following charts provide the answers to these questions:

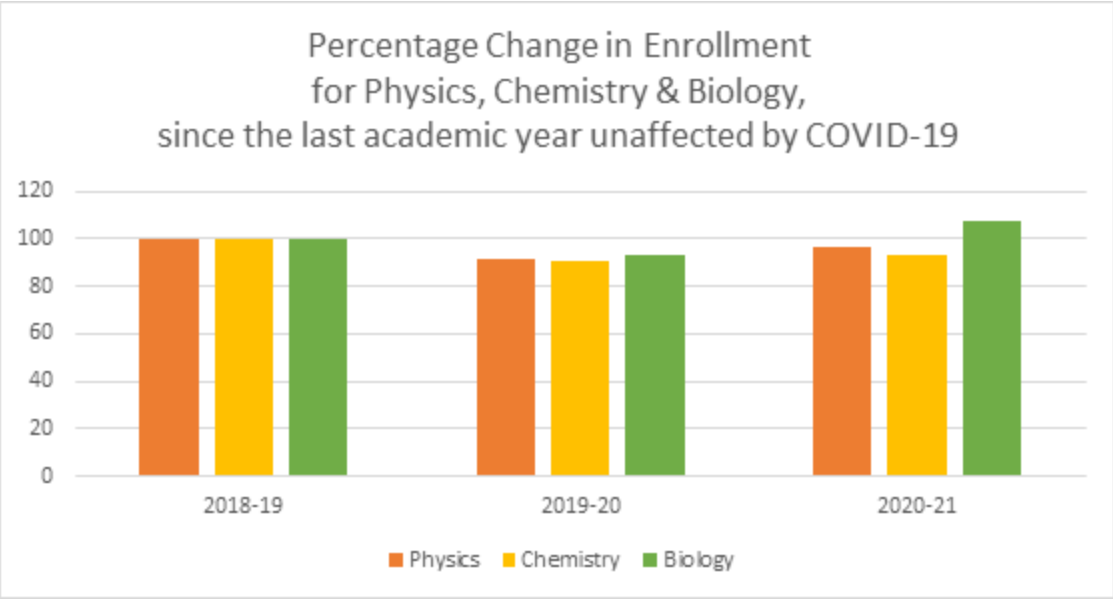


Physics appears to initially follow the general trend at PCC by experiencing a decrease in enrollment from 2018-19 to 2019-20. However, unlike the college as a whole, Physics experienced an increase in enrollment from 2019-20 to 2020-21.



PHY 101, 211, and 121 all followed the larger trend for Physics by experiencing a decrease in enrollment from 2018-19 to 2019-20, followed by an increase from 2019-20 to 2020-21.

Unlike the other gateway courses, PHY 201 experienced a continuous enrollment increase over this time period.



Physics, Chemistry and Biology all followed similar enrollment trends over this time period, with Biology notably exceeding their pre-pandemic enrollment in 2020-2021.

2A2. Do the data suggest adjustments be made in your discipline, such as schedule or course offerings, with regards to enrollment? If yes, what ideas/strategies do you have that you would like to implement or have help with in the upcoming academic year?

Because our enrollment remained relatively strong, and all gateway courses (PHY 101, 201, 211 & 121) experienced an increase in enrollment from 2019-20 to 2020-21, this suggests that we should continue to offer more of our content online in the future. The Physics SAC has always agreed in the past that labs for the PHY 101, 201 & 211 series should remain on campus whenever possible, so this means that some of our post-pandemic courses will now have a hybrid format, while others will return to campus for both lectures and labs. In short, we plan to offer a wider variety of modalities than we did pre-pandemic.

At this time, we have not discussed the possibility of offering online labs after the end of remote operations. That may be something for the Physics SAC to discuss at some point in the future. We would need to consider national trends in college level physics education as well as the transferability of our courses to other institutions.

For the Physics SAC, our biggest concern with total remote operations has been the issue of students cheating on tests by using sites such as Chegg and Quizlet. Individual instructors have developed various strategies to attempt to combat this cheating. The one thing we all agree upon is that the PCC administration has provided no guidance and little assistance in dealing with this remote epidemic of student cheating.

2A3. Are there other data reports that you would find informative/useful with regards to enrollment? How would this information support decision-making for the SAC/discipline?

We have already compared Physics enrollment to PCC as a whole, and to various disciplines within the college. It would be interesting to see how other community colleges and 4-year universities enrollment has been affected during this period of remote operations.

It would also be useful to see the trends in our enrollment *during the term* to determine how many students are dropping courses in the first several weeks. Generating two separate reports, one on the first day of the term and the other at the end of week 2, would give a clearer picture of how many students we lose at the beginning of the term. If this is significant, we could seek ways to retain these students before they drop Physics courses.

2A4. Is your program aware of any external influences that strongly affect recent enrollment? For example, state requirements, transferability challenges, other university policies, etc. Please explain.

The overwhelming external factor influencing the most recent enrollment is clearly the COVID-19 pandemic. It would be difficult to distinguish any other subtle influences in the face of such dramatic circumstances. We are grateful that Physics managed to maintain a higher percentage of its enrollment than the average for PCC's Lower Division Transfer courses during this challenging time. We are also reassured to see that our enrollment has followed the general trend of other lab science courses.

2B. Course Success Rates

Data Definition: Success rate represents the percentage of students who successfully complete a course. It is calculated as:

$$\%\ S = \frac{\textit{Number of students receiving a grade of A, B, C, P, PR, or CM}}{\textit{Number of students receiving a grade of A, B, C, D, F, P, NP, I, W, PR, CM, N, UP}}$$

PR, CM, N, and UP are non-credit grades used in the Adult Basic Education program.

Success rates for gender and race are not calculated when the enrollment is less than 5. For any success rate that is not calculated, the total for that column is also not calculated.

% Success By Course and Modality

SEE Modality Tab, Appendix Table 2B-A

2B1a. Are there any courses with lower or higher pass rates than others (over time, over many sections, or a notably higher or lower rate)? If so, which ones?

Gateway courses Physics 101, 201 and 211 have consistently lower pass rates. PHY101 is the first class of conceptual physics and is taken by many students to fulfill General Education requirements. PHY 201 is the first General Physics class with algebra and is taken primarily by students majoring in biology, chemistry, allied-health sciences, medical fields, and other majors not requiring calculus-based physics. PHY 211 is the first General Physics class with calculus and is taken by students majoring in engineering, computer science, physical and biological sciences, and others desiring to enter STEM fields.

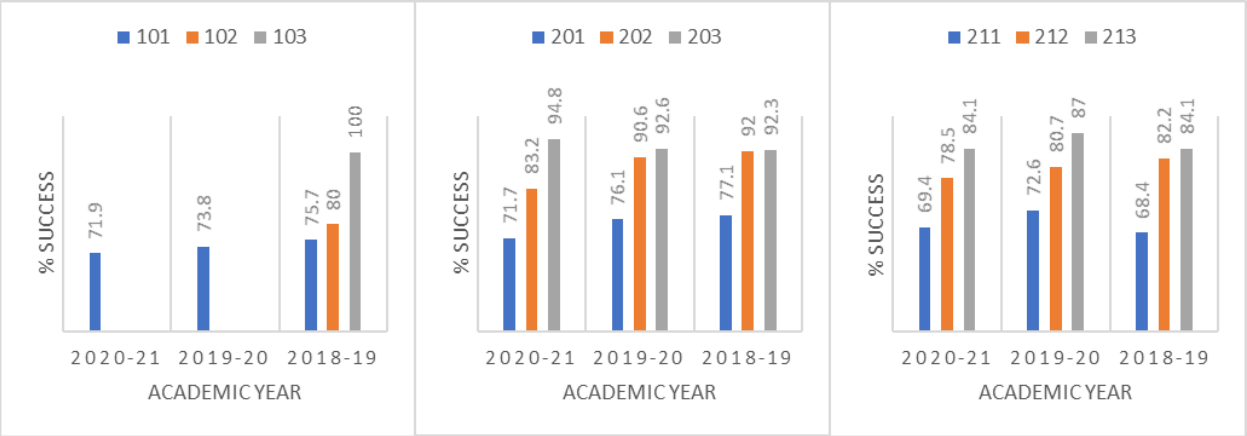


Figure 2B-1: Success Rates of PHY 101/102/103, PHY 201/202/203, and PHY 211/212/213

Physics 203 has noticeably higher pass rates. Physics 203 is the third course in algebra based general physics and is taken by students who have completed 201 and, in most cases, also 202.

2B1b. Are there any modalities with lower or higher pass rates than others (over time, over many sections, or a notably higher or lower rate)? If so, which ones?

1. Hybrid and Blended modalities have lower pass rates than Onsite and Remote modalities for PHY101. Pass rates of onsite and remote modalities are comparable.

Table 2B-1 Enrollment (Enrl) and Success Rate (% S) by Modality in Physics 101

Course ID	Year	Onsite		Remote		Hybrid		Blended	
		Enrl	% S	Enrl	% S	Enrl	% S	Enrl	% S
PHY 101	2020-21			316	73.1			22	
	2019-20	208	74	63	76.2	25	56	24	58.3
	2018-19	318	78.6			57	59.6		

2. Online modality has lower pass rates than Onsite and Remote modalities for PHY 121/122/123. Pass rates of onsite and remote modalities are comparable. PHY121/122/123 are introductory astronomy series and are taken by students to fulfill General Education requirements.

Table 2B-2 Enrollment (Enrl) and Success Rate (% S) by Modality in Physics 121/122/123

Course ID	Year	Onsite		Remote		Online	
		Enrl	% S	Enrl	% S	Enrl	% S
PHY 121	2020-21			23	100	109	74.3
	2019-20	15	93.3			109	75.2
	2018-19	37	89.2			119	68.1
PHY 122	2020-21			25	96	43	79.1
	2019-20	13	100			78	66.7
	2018-19	21	100			94	61.7
PHY 123	2020-21			24	87.5	21	76.2
	2019-20			21	90.5	40	72.5
	2018-19	23	87			42	78.6

2B2. Strategy Insights

What strategies have you used to maintain high success rates? What can be learned that might be applied to courses with lower success rates? What are possible actions to be taken to understand/address lower success rates? Please clearly explain how your discipline intends to explore content/curriculum, pedagogy/teaching, course material selection, etc. using culturally responsive teaching approaches throughout the next year. Try to identify a realistic one year goal.

The physics SAC is considering creating a math pre-test for PHY211 to identify math skill deficiencies and provide direction for the student regarding specific areas they should focus and improve on as early in the course as possible. This assessment can also open a discussion with the math SAC to coordinate the best course of action in narrowing this skills gap for future students. Other strategies, such as embedded tutoring, flexible early assignment deadlines, and allowing redoes for assignments are considered and adopted by faculty members to close the gap between repetitive learners and first-time learners. The SAC also discussed how ALEKS software could help advance equitable student success.

Overall, there is no conclusive difference in pass rates between onsite and remote modalities. Both onsite and remote modalities show higher pass rates than other modalities, including online, hybrid, and blended. As the college reopens and more courses resume onsite, it is worth exploring continued remote modality for its flexibility. The SAC is considering adopting McGraw Hill online labs as an integrated system in D2L for Winter 2022. Adopting these labs is not mandatory for FT and PT instructors, as many faculty members have invested extensively in developing remote labs in the past year. Faculty members will collaborate with other university studies to compare the outcomes of the remote and conventional labs.

Enrollment and % Passing By Course and Student Demographics

SEE Gender, Race, and Pell Tabs, Appendix Table 2B-B, 2B-C, 2B-D

2B3. The data may indicate a pattern of inequities (in gender, race, or Pell eligibility) in student enrollment or success. Please clearly explain how your program intends to explore content/curriculum, pedagogy/teaching, course material selection, etc. using culturally responsive teaching approaches throughout the next year. Try to identify a realistic one year goal.

Gender:

1. PHY101 demonstrates lower enrollment but higher pass rates of female students.

Table 2B-3 Enrollment (Enrl) and Success Rate (% S) by Gender in PHY 101

Course ID		Year	Female		Male	
			Enrl	% S	Enrl	% S
PHY	101	2020-21	123	74.8	200	68.5
		2019-20	142	77.5	164	72
		2018-19	118	78	246	74.8

2. PHY201/202/203 courses show higher enrollment and higher pass rates of female students in comparison of male students. PHY201/202/203 courses are for pre-medical, pre-dental, pre-chiropractic and pre-physical therapy students and the enrollment data reflects the national

statistics that the majority of health care occupations with bachelor's degrees in the U.S. are occupied by women, according to U.S. Census Bureau.

Table 2B-4 Enrollment (Enrl) and Success Rate (% S) by Gender in PHY 201/202/203

Course ID		Year	Female		Male	
			Enrl	% S	Enrl	% S
PHY	201	2020-21	274	72.6	218	70.2
		2019-20	242	81.8	199	69.8
		2018-19	216	83.3	211	70.6
PHY	202	2020-21	146	83.6	78	80.8
		2019-20	112	92.9	80	88.8
		2018-19	105	97.1	91	85.7
PHY	203	2020-21	94	96.8	55	92.7
		2019-20	76	92.1	51	94.1
		2018-19	89	93.3	77	90.9

3. PHY211/212/213 courses show significantly higher enrollment of male students; however, pass rates of female students are higher in PHY211 and 212. PHY211/212/213 courses are for science and engineering majors; the enrollment data reflects the national statistics that women make up only 27% of all STEM workers in 2019, according to U.S. Census Bureau.

Table 2B-5 Enrollment (Enrl) and Success Rate (% S) by Gender in PHY 211/212/213

Course ID		Year	Female		Male	
			Enrl	% S	Enrl	% S
PHY	211	2020-21	113	71.7	314	69.4
		2019-20	106	75.5	321	71.3
		2018-19	92	72.8	370	66.5
PHY	212	2020-21	74	83.8	236	76.7
		2019-20	68	86.8	236	79.7
		2018-19	58	82.8	267	81.3
PHY	213	2020-21	66	83.3	200	84.5
		2019-20	48	87.5	195	86.7
		2018-19	48	79.2	215	85.1

An AAUW report presented profound research findings analyzing why so few women pursue STEM career paths. While the common belief of biological gender differences is yet to be further studied, the differences of women's participation and achievements in STEM across different cultures and time also point towards cultural factors to explain the disparity.

People often consider STEM as a "male" field. Research finds that with similar past mathematical achievements, girls assess their mathematical skills lower than do boys. Additionally, girls hold themselves to a higher standard and believe they must be exceptional to

succeed in STEM. Students who lack confidence to succeed in STEM fields are less likely to major in STEM and will give up more easily when facing obstacles.

Research also shows that women excel in “masculine” positions, such as scientist or engineer, they are considered less likable. Workplace environment, bias, and family responsibilities all contribute to the fact that women leave STEM professions at a higher rate than do their male colleagues. As a result, lack of successful female role models in STEM fields negatively impacts younger female students’ confidence in STEM career paths.

Research found that by creating a “growth mindset” environment, instructors can encourage girls’ and women’s achievement and interest in STEM. A “growth mindset” views intelligence as “a changeable, malleable attribute that can be developed through effort”; in contrast, a “fixed mindset” views intelligence as “an inborn, uncontrollable trait”. A growth mindset is likely to lead to greater persistence while facing difficulties; it protects girls and women from the influence of the stereotype that women are not as good as men in STEM.

Race:

1. The pass rates of Black and Latinx students are lower than other races in PHY101, in the most recent academic years of 2020-21 and 2019-20.

Table 2B-6 Enrollment (Enrl) and Success Rate (% S) by Race in PHY 101

Course ID	Year	Asian		Black		Latinx		White		Multi-Racial		Unknown	
		Enrl	% S	Enrl	% S	Enrl	% S	Enrl	% S	Enrl	% S	Enrl	% S
PHY 101	2020-21	29	79.3	14	50	54	55.6	188	75.5	26	76.9	13	92.3
	2019-20	21	71.4	17	52.9	37	59.5	188	77.7	21	76.2	20	65
	2018-19	24	66.7	16	50	31	71	225	79.6	32	65.6	19	84.2

2. The difference in pass rates among Black, Latinx, and White students in the gateway PHY201 courses is insignificant in 2020-21. Due to the low enrollment of Black students in the PHY 202/203 courses, a few students’ performance could have significantly impacted on the pass rates.

Table 2B-7 Enrollment (Enrl) and Success Rate (% S) by Race in PHY 201/202/203

Course ID	Year	Asian		Black		Latinx		White	
		Enrl	% S	Enrl	% S	Enrl	% S	Enrl	% S
PHY 201	2020-21	78	85.9	16	68.8	71	66.2	260	68.5
	2019-20	76	82.9	23	69.6	60	61.7	205	77.6
	2018-19	62	87.1	13	53.8	43	69.8	230	78.7
PHY 202	2020-21	51	86.3	14	57.1	29	62.1	92	88
	2019-20	44	95.5	3		23	73.9	90	88.9
	2018-19	40	92.5	7	71.4	11	100	107	91.6
PHY 203	2020-21	43	97.7	7	71.4	14	92.9	56	98.2
	2019-20	32	90.6	4		15	93.3	53	96.2
	2018-19	40	90	3		10	100	87	90.8

3. The difference in pass rates among Black, Latinx, and White students in the gateway PHY211 courses is also insignificant in 2020-21. However, during 2019-20, pass rates of Black students are lower, possibly caused by the pandemic that disproportionately hit the Black community. The low enrollment of Black students makes it difficult to draw conclusions as the performance of one or two individuals can drastically change the results.

Table 2B-8 Enrollment (Enrl) and Success Rate (% S) by Race in PHY 211/212/213

Course ID	Year	Asian		Black		Latinx		White	
		Enrl	% S	Enrl	% S	Enrl	% S	Enrl	% S
PHY 211	2020-21	56	76.8	16	68.8	49	61.2	246	67.9
	2019-20	50	74	13	38.5	43	67.4	244	76.6
	2018-19	61	67.2	17	82.4	43	58.1	255	67.1
PHY 212	2020-21	46	82.6	8	62.5	36	69.4	160	81.3
	2019-20	34	85.3	8	37.5	33	63.6	184	82.1
	2018-19	44	86.4	16	81.3	22	81.8	179	81
PHY 213	2020-21	41	95.1	8	75	29	86.2	135	83
	2019-20	35	94.3	5		24	79.2	133	86.5
	2018-19	31	90.3	10	80	17	82.4	142	83.8

Pell eligibility:

Student recipients of the Pell Grant demonstrate lower pass rates in almost every course and every year, except PHY203, indicating financial disadvantage is among the most decisive factors negatively impacting a student's academic performance. Appendix Table 2B-D

2B4. What support does your SAC need to fully explore inequities in enrollment or student success? For example, are there any other data reports you would find useful to have related to student success?

It would be helpful to see the data of students utilizing PCC resources, such as tutoring services, and how it correlates with individual student's success and pass rates in physics courses to identify the most effective services.

The SAC is concerned that online teaching is not serving our own community. It helps to have students' geographic data to see the percentage of students that are located within the Portland Metro area and how it correlates with students' success. It also helps to identify how local demographics match or mismatch the proportion of students of different races enrolled in the physics courses.

SECTION 3: REFLECTION ON ASSESSMENT OF STUDENT LEARNING

3A. Assessment Reports

Please note: The following questions link directly to your Annual Learning Assessment Reports for the Learning Assessment Council. Feel free to cut and paste between this document and your other assessment documentation.

3A1. Which student learning outcomes from your SAC's available courses will you assess this year and will you use direct assessment strategies?
(These can be larger, program-level outcomes or course-level outcomes from your CCOGs).

Being a part of the Science, Computer Science, and Math disciplines, we are assessing Quantitative Reasoning. We will assess quantitative reasoning through graphical analysis.

In order to evaluate quantitative reasoning, a google survey is given out to all students taking PHY 211 this Fall 2021. This is a direct assessment strategy. Data from the google survey will then be inputted into an excel spreadsheet to be analyzed.

3A2. Which courses do you plan to assess this year; how and why will your SAC choose the sections?

This year, we as a SAC have decided to evaluate PHY 211 classes campuswide. We are evaluating classes in a three-year cycle, which include PHY 101, PHY 201, and PHY 211. Needless to say, we've evaluated PHY 201 last year and are continuing the cycle this year to PHY 211.

3A3. In general terms, describe the assessment project for the year from implementation to data collection. What steps will you take in carrying out the project?

As stated earlier, quantitative reasoning will be assessed through graphical analysis, which looks into how students set up, display, and interpret graphs. This assessment is implemented by having all faculty who are teaching a PHY 211 class this term to give a google survey link to their students. All students must use their PCC email account to access this link. It is made known that the assessment will not be graded and all students have 10 minutes to complete the survey. Because of the fact that the assessment is non-graded, it is unlikely that students will abuse the link privileges by retaking the assessment at a later time or taking longer than 10 minutes to complete the assessment. As an added security, data from the assessment is taken within a week of all classes completing the pre-assessment so that it's less likely for students to revisit the link and retake the survey.

Post-assessments work much the same way as pre-assessments: students are informed that they are not being graded on the assessment, students get 10 minutes to complete it, and data is taken from the google survey page within a week of completion from all faculty teaching PHY

211 to ensure that students don't revisit the link with a different pcc email account to add answers.

Once the assessments are completed, both pre- and post-assessments are compiled into a spreadsheet that analyzes each student's data by comparing the pre-assessment and post-assessment from each G#.

3B. Response to LAC Assessment Question

Please respond to the question below, which relates to your SAC's 2020-2021 Learning Assessment Report to the Learning Assessment Council (LAC).

Commendations: The SAC has submitted a well thought out & organized assessment. They have discussed & analyzed the data, as well as listing areas of concern that could be affecting the results. The SAC has also worked together to list ways to improve the students competencies for the next assessment period.

Suggestions: As the SAC has already concluded, the survey would be beneficial to student learning if it were a graded assignment.

Questions: If the SAC chooses to move forward with grading the assessment survey, what are other distribution avenues besides a google survey that would be effective for the SAC to use? If the SAC focuses on the value of hands-on labs, what are some specific instructional changes that could be implemented that might increase student success in graphical competency?

SAC Response:
It was discussed that other facets to ensuring that students perform the assessment to the best of their abilities might exist beside having the assessment graded. It is believed that having the assessment be multiple choice would eliminate any biases that might come about through interpreting answers, grading consistently, and analyzing data quickly without the use of funds to pay a grader. Therefore, it might be best to stick with multiple choice questions that are non-graded. What the SAC can do instead is figure out a good threshold based on a distribution curve. If the average of all student scores meet a specific threshold, we can consider their learning “significant” and would thus result in a successful instructional framework for this quantitative assessment.

According to PHY 201’s assessment last year, students show a significant increase in scores involving unit analysis, but a significant low starting score in interpretation of parameters and magnitude in graphs. We propose that hand-on-labs might be a significant factor in this, since hands-on labs give students a tangible way of looking at the different parameters of a graph (for example, force versus speed for some kinematic labs). It is in our hopes that going back to face-to-face labs would greatly increase graphical competency dealing with hands-on measuring and graphing, especially with knowing what graphics are telling them.

SECTION 4: ADDITIONAL ACHIEVEMENTS, CHALLENGES or OPPORTUNITIES

4A. Is there anything further you would like to share about your program's achievements at this time?

Publications:

1. Dittrich, W. A., "Drop Tower Physics II" accepted for publication in 2021 (*The Physics Teacher)*
2. Dittrich, W. A., "Hair Ice: A Multidisciplinary Science" accepted for publication in 2021 (*The Physics Teacher)*
3. Mamola, Karl C. and Dittrich, W. A., "Energy loss and jerk on the Loop-the-Loop" , American Journal of Physics 89, 583 (2021); https://doi.org/10.1119/10.0003877
4. Minkin L. & Zable A. C., "From Balancing a Stick to Tightrope Walking: How Added Mass Influences the Act of Balancing", accepted for publication on July 26, 2021 *(The Physics Teacher).*

Research Activity:

- Toby Dittrich traveled to Southern Chile in December 2020 to perform the Modern Eddington Experiment, with an interview broadcast worldwide on BBC World News (https://www.youtube.com/watch?v=BYtX---eVmw). Funded by the NASA Space Grant.
- Travelled in August to El Salto, Mexico and completed arrangements for research during the 2024 solar eclipse with the Technological Institute of El Salto for hosting our research teams with joint educational lectures and logistical support for our equipment and lodging. Funded by the NASA Space Grant.

Conferences:

- Toby Dittrich was heavily involved in activities at both the Winter and Summer AAPT National Meetings in 2021:
    - Moderated the Main Plenary Lecture, "Current Research on the Hubble Constant, by the world famous female physicist Dr. Wendy Freedman, AAPT Winter Meeting, Jan 2021.
    - Moderated the Invited Lecture session, "Back to the Moon and on to Mars", featured Program Managers from the Artemis and Space Launch System (SLS) Rocket programs, AAPT Winter Meeting, Jan 2021.
    - Attended and Moderated the Invited Session, "Current Research in Black Holes", which featured leading physicists in black hole research and gravitational wave detection, at the AAPT Summer Meeting, July 2021.

AAPT Leadership:

- Toby Dittrich was very active with the American Association of Physics Teachers at both the national and local level:
    - Nominated to the Physics in Two Year Colleges Committee for AAPT
    - Nominated to the Committee on Space Physics and Astronomy for AAPT

- Nominated to the Meetings Planning Committee for AAPT
- Elected to be Representative for Oregon Chapter of the AAPT

Grants:
Toby Dittrich:

- Applied for a pending Oregon Space Grant Faculty Research Award ($140k) for funding research during the 2024 total solar eclipse by performing the Modern Eddington

Lee Collins:

- EXITO mentor for PCC student: Ryne Shelton.
- Faculty Advisor for Ryne Shelton, NASA STARR Project grant: studied the SMAP satellite that measures and maps Earth's soil moisture.

4B. Are there any challenges not described above that you would like to note here?

Similar to 2019-2020, student academic integrity misconduct has remained the most concerning challenge and concern for the Physics SAC. This year, several physics faculty worked more closely with the Office of Student Conduct and CARE and submitted multiple academic misconduct reports on numerous students enrolled in physics courses. In some cases, the same student was reported multiple times. The primary reasons for filing the academic misconduct reports were plagiarism and the use of internet sites, such as Chegg.com, to upload or copy exam solutions.

After numerous discussions addressing this challenge, the following measures were proposed to help reduce student cheating in their remote physics courses:

1. Instructors were encouraged to start the term with an open and honest conversation with their students about academic integrity.
2. The Physics SAC discussed and identified ways to write better exam questions that are easily identified on cheating websites.
3. Physics SAC members were shown how to use the Office of Student Conduct and CARE when a student is suspected of cheating in their class.
4. In-person/on-campus class exams for remote physics classes. *The Physics SAC's official position is that it is not unreasonable to require students to take a couple scheduled class exams on campus each term and that there is plenty of classroom space available for instructors to schedule an appropriate room for this purpose.*

Unfortunately, the SAC has yet to be allowed to schedule on-campus exams for physics classes so do not know how effective this measure would be to lower student cheating. However, the implementation of the other three measures appears to have produced promising results in some of the physics courses offered during the Fall of 2021, as observed by the noticeably fewer number of academic misconduct reports they have had to submit compared to the previous couple of terms. We are hoping to see this trend continue and increase this year. Although the Physics SAC will need to obtain more data, from more physics instructors and

across more classes, to convincingly ascertain whether a widespread decrease in cheating has actually occurred, we are proud of the efforts undertaken to solve this formidable challenge.

4C. Do you see any opportunities in the near or long term that you would like to share?

The rapid transformation to the remote teaching modality has had a profound effect on how physics courses are structured and taught remotely but has also changed the way many the faculty measure and nurture student learning success. The following is a list of some of the positive outcomes as a result of going remote...

- Widespread pre-recording topic videos for students
- Widespread video recording of class sessions for students to review later
- Improved and increased use of video technology for student communication with their class peers
- Increases student accessibility to instructor office hours and study sessions with peers through communication platforms such as Zoom, Discord, Google Meet, etc.
- Improved accessibility to classes due to greater flexibility in class scheduling, including decreased commuting and travel time between campuses
- Ability to upload actual instructor notes written during class sessions for student access
- Expanded use of effective technology to support student learning

Going forward as PCC transitions back to on-campus classes, many of the above can be further developed and/or improved.

The Physics SAC has identified several opportunities to be explored that could achieve lasting positive impacts for our students and student learning:

1. Continue to refine remote physics courses for future terms so we can be confident that student learning in remote physics courses is comparable to in-person classes.
2. Establish a process and mechanism for scheduling on-campus exams for remote physics courses
3. Develop ways to leverage the student usage of “cheater” websites, such as Chegg, in positive ways to improve the student learning experience and increase student learning outcomes.
4. Identify and/or develop effective online physics labs that can be comparable to on-campus equivalents.