

Part 2: Outcomes

2.1 Overview of Outcomes

Discuss how both program learning outcomes (PLOs) and student learning outcomes (SLOs) are reviewed and revised in the program

Questions for Analysis:

- How does the program review and revise PLOs and SLOs to ensure alignment, academic rigor, integrity, relevance, and currency?
- What is the culture of assessment within the program?
- How are adjunct faculty involved in the assessment discussion?
- How extensive is the dialogue about PLOs and SLOs in the department?

2.2 Institutional Learning Outcomes

Describe how the program helps students attain one more of the Institutional Learning Outcomes (ILOs). [Link to ILOs](#). (Note: Only include SLOs that directly map to specific ILOs. Not every SLO must map to an ILO.)

Matrix of Student Learning Outcomes and Institutional Learning Outcomes Alignment

Course	SLO	ILO A Communication	ILO B Information Competency	ILO C Critical Thinking	ILO D Citizenship
ABCD C101	SLO 1		X		
ABCD C204	SLO 5	X			

Questions for Analysis:

- How do the SLOs relate to the ILOs?
- Based on the success of the SLOs, how well is the program meeting the associated ILO?
- What, if any, changes were made to align the mapping of SLOs to ILOs?

2.3 Course Student Learning Outcomes (SLOs)

Provide a list of every SLO for each course in the program in Part 5 Supporting Documentation.

For each SLO, use the following table to indicate the assessment history of every SLO in the program. If an SLO has been assessed more than 3 times, indicate only the last 3 times it was assessed.

SLO Assessment 5-Year History

Course	SLO #	Target	Semester	Met?	Semester	Met?	Semester	Met?
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ABCD C101	SLO 1	75%	FA18	No	SP19	Yes	FA19	Yes
	SLO 2	75%	FA18	Yes	FA19	Yes		
	SLO 3	75%	FA18	Yes	FA19	Yes		
ABCD C201	SLO 1	85%	SP19	Yes	SP20	Yes		
	SLO 2	85%	SP19	Yes	SP20	Yes		
	SLO 3	85%	SP19	Yes	SP20	No	SP21	Yes

Questions for Analysis:

- Since the last Program Review, what is the student performance in achieving the stated SLOs at the course level? Refer to the AUPs and assessment data.
- Overall, are the outcomes and assessments providing valuable and relevant feedback on students' ability to accomplish SLOs and their overall success in the courses?
- What, if any, adjustments, modifications, or changes to SLOs or to assessments need to be made?

2.4 Program Learning Outcomes (PLOs)

2.4.1 List of Program Learning Outcomes

Provide a current list of the PLOs.

2.4.2 Course Matrix

Use the following accessible table to provide the program matrix. Delete or add columns or rows, as needed. For additional certificates, copy and paste this table along with the caption. Use table headings to differentiate the matrices for different awards.

Matrix of Courses and Program Learning Outcomes Alignment

Course	PLO 1	PLO 2	PLO 3	PLO 4	PLO 5
ABCD C101	SLO #			SLO #	SLO #
ABCD C102			SLO #		

2.4.3 Assessment History

For each program learning outcome, use the following tables to provide the PLO language target level of performance, assessment method, date of assessment and recent assessment results. Delete the sample

information and add your information. Copy and paste the table along with the caption for each PLOs. Your assessment should be on the current PLOs.

PLO 1 Assessment Results

PLO 1:	
Target:	75%
Assessment Method:	Students successfully meet SLO 3 from ABC 101
Assessment Date:	Fall 2021
Recent Results:	87%

PLO 2 Assessment Results

PLO 2:	
Target:	
Assessment Method:	
Assessment Date:	
Recent Results:	

PLO 3 Assessment Results

PLO 3:	
Target:	
Assessment Method:	
Assessment Date:	
Recent Results:	

PLO 4 Assessment Results

PLO 4:	
Target:	
Assessment Method:	
Assessment Date:	
Recent Results:	

PLO 5 Assessment Results

PLO 5:	
Target:	
Assessment Method:	
Assessment Date:	
Recent Results:	

PLO Assessment History Summary

PLO #	Target	Semester	Met?	Semester	Met?	Semester	Met?
PLO 1	85%	FA 21	No	SP 22	Yes		
PLO 2							
PLO 3							
PLO 4							
PLO 5							

2.4.4 Evaluation of Program Learning Outcomes

Questions for Analysis:

- **Regarding the Appropriateness of PLOs:**
 - Are students prepared to transfer or enter the workforce with the knowledge and skills identified in the PLOs? How do you know? Do the PLOs sufficiently capture the key knowledge and skills expected of students exiting the program? Does the successful completion by students of the set of courses required for the program enable them to fulfill the program objectives and meet the program objectives?
 - Are the PLOs realistic, achievable, and measurable?
 - Is the program well designed so the courses complement each other? Does each class have a specific role to play in helping students achieve the PLOs? Is unnecessary duplication of knowledge and/or skills avoided? Do the course offerings provide a clear path to achieving the program learning outcomes?
 - How has the department structured the relationship between SLOs and competency levels for degrees, certificates, programs, and courses?
- **Regarding Student Achievement of PLOs:**
 - For each PLO where the target was not met, identify what the department determined was the reason for the gap, describe the intervention applied to improve the outcome, when the outcome was reassessed, and the reassessment's result.
 - Overall, how well are students achieving the stated learning outcomes?
 - What significant patterns exist in learning outcomes?
 - Have the right assessment artifacts been chosen to measure the PLOs?
- **Implications:**

- What changes, if any, to the curriculum or instruction are recommended or made even if the targets have been met?
- If changes, adjustments, or modifications are being made to the PLOs, include the expected new PLO language. What other changes will result? How will the SLO to PLO mapping change?

2.5 Planning

2.5.1 Planned Assessment Cycles for PLOs and SLOs

Note:

- At a minimum, PLOs must be assessed in Year 4, which is the year prior to the next Program Review being due.
- It is recommended that SLOs be assessed in Years 1 and 2. If SLO targets are not met, there are still many opportunities in Years 2 and 3 to initiate improvement strategies and reassess. (Make sure you document your strategies!)
- There is the institutional expectation that if outcomes are not met, improvements are made, and the outcome is reassessed as soon as possible.
- Year 5 of the Program Review cycle is when the Program Review is written. There will not be assessment in Year 5.
- Make sure you discuss the assessment schedule with program faculty and get their buy in. This assessment schedule is what the Outcomes Assessment Committee will expect the program to follow over the next five years. Set a realistic assessment schedule. Additional assessments can always be added later.

Use the following table to indicate when each PLO and SLO will be assessed in the next Program Review cycle. Delete the sample data and add your data. Add rows as needed to accommodate all PLOs and SLOs for the program. In the schedule, use the PLOs and SLOs you are planning to use. That is, if you are modifying the PLOs, use the expected new PLOs in the schedule rather than the current PLOs. We recognize that these PLOs may change until the program goes through CIC. Avoid planning to plan.

PLO Assessment Cycle

	FA 24	SP 25	FA 25	SP 26	FA 26	SP 27	FA 27	SP 28	FA 28	SP 29
PLO 1								X		
PLO 2								X		
PLO 3								X		
PLO 4								X		
PLO 4								X		

SLO Assessment Cycle

Course	SLO	FA 24	SP 25	FA 25	SP 26	FA 26	SP 27	FA 27	SP 28	FA 28	SP 29
ABC C101	SLO 1	X									
	SLO 2	X									



	2015-16	2016-17	2017-18	2018-19	2019-20
Math Associate of Science Degree	6	9	8	11	15
Percent Change	--	50%	-11.1%	37%	36.4%

The number of students completing the program has more than doubled since 2016. Still, this is a small number of completers if one considers the number of students who have declared math as their major in the top table. There could be several reasons for this. One example is that many students in the program are students who plan on transferring to obtain a 4-year engineering degree. The college does not offer engineering as a degree any longer and these students must declare a major while at Cerro Coso. Since engineering students require a lot of lower division math prerequisites, many of these students could be declaring math as a major but wind up transferring to engineering programs without formally completing the math degree requirements at our college. There could be other majors where this is happening as well such as Physics. Some students may declare the math major, then transfer without requesting the degree (even if they have completed all the degree—major and gen ed—requirements). Another possible explanation is that students are not required to have a degree to transfer to a four-year institution, and Cerro Coso does not automatically award degrees. Students must submit a petition to graduate. Counselors have in the past had to encourage some students to apply for our degree because they see the associate degree as pointless when they’re going on to get a BS. Finally, some students complete university major prep (such as the math major requirements) without completing all of the gen ed. courses that are required for an associate degree. UCs and CSUs will accept students who complete the major prep and minimum admission requirements; completion of CSU Cert or IGETC is not required for admission.

All of the courses in the degree can be taken online, so it should not be a geographical problem. The department will investigate where students are stopping out of the program and attempt to better track student progress through the program to determine what measures can be implemented to increase the proportion of completers.

4.3 – Program Achievement of Program Learning Outcomes

PLO 1 Assessment Results

PLO 1	<i>Use the Cartesian, polar, cylindrical, and spherical coordinate systems effectively</i>
Target:	70%
Assessment Method:	Exams in MATH C151 and MATH C152,
Assessment Date:	FA 2018
Recent Results:	78.4%





PLO 2 Assessment Results

PLO 2	<i>Use scalar and vector products in applications.</i>
Target:	70%
Assessment Method:	Exams in MATH C251
Assessment Date:	FA 2018
Recent Results:	71.2%

PLO 3 Assessment Results

PLO 3	<i>Use vector-valued functions to describe motion in space.</i>
Target:	70%
Assessment Method:	Exams in MATH C251
Assessment Date:	SP 2019
Recent Results:	40.9% Met at 70% or higher and 81.9% somewhat met (65% or higher)

PLO 4 Assessment Results

PLO 4	<i>Extend the concepts of derivatives, differentials, and integrals to include multiple independent variables</i>
Target:	70%
Assessment Method:	Exams in MATH C 152 and MATH C251
Assessment Date:	FA 2018
Recent Results:	84.0%

PLO 5 Assessment Results

PLO 5	<i>Solve simple differential equations of the first and second order</i>
Target:	70%
Assessment Method:	Exams in MATH C255
Assessment Date:	FA 2018
Recent Results:	69.4% met. More than 70% somewhat met (65% or higher)

PLO 6	<i>Analyze and model the behaviors of physical phenomena by applying advanced calculus concepts</i>
Target:	70%
Assessment Method:	Exams in MATHC152, MATH C255, and MATH C257
Assessment Date:	FA 2018
Recent Results:	79.6%



PLO 7	<i>Apply broad mathematical concepts to practical applications</i>
Target:	70%
Assessment Method:	Exams in CSCI C251, MATH C121, MATH C255, and MATH C257
Assessment Date:	FA 2018
Recent Results:	73.2%

PLO Assessment History Summary

SLO #	Target	Semester	Met?	Semester	Met?	Semester	Met?
PLO 1	70%	FA18	Yes				
PLO 2	70%	FA18	Yes				
PLO 3	70%	SP19	No	SP20	Yes		
PLO 4	70%	SP17	Yes				
PLO 5	70%	FA18	No	FA 19	Yes		
PLO 6	70%	FA 18	Yes				
PLO 7	70%	FA18	Yes				

Since the beginning of the program, the PLOs have been reviewed only during the assessment period when SLO results are mapped to the program outcomes. There have not been any revisions to the PLOs as they directly reflect the skills associated with the SLOs. The SLOs in turn are kept current and relevant by aligning with the state C-ID descriptors during each mandatory course revision. Since the last program review, MATH C121, MATH C152, and MATH C251 have received C-ID approval from the state. MATH C151 is still pending.

There has been no discussion in the department to disaggregate the outcome data. One reason for this is that there would be small numbers of students in many of the aggregate groups which would compromise the validity of conclusions drawn from the data.

More importantly, the method used to assess the PLOs is direct assessment of two or three SLOs from one or more courses in the program and then using the results of those SLO assessments to determine whether the related PLO has been met. If the cumulative SLO scores met the 70% target, then it was determined that the PLO corresponding to the SLO had been met as well. SLOs are only formally assessed one semester during the program review cycle unless they do not meet the 70% target in which case they are reassessed after a brief department discussion. The entire assessment procedure has been a learning process for the department over the past 5 years but progress has been made as faculty become more aware of how to use eLumen and the reporting procedures.

4.3.a - Gaps and Improvements Made

Program Learning Outcome number 3, “use vector-valued functions to describe motion in space” did not meet the 70% target when it was first assessed by the instructor with SLOs from MATH C251 in spring of 2019. The same instructor used practice exams to better prepare students for the exams in



the spring of 2020 and the target was met. PLO 5, “Solve simple differential equations of the first and second order,” also did not meet the target in the first assessment but was only 0.6% shy of the target in the reassessment. The adjunct instructor who taught the class that maps to PLO 5 both in the initial assessment and reassessment no longer teaches at the college so it is not known what intervention was used. However, the instructor was made aware of the need to reassess the PLOs at the beginning of the semester which may have allowed more time to prepare students. All other PLOs had their targets met or exceeded. For SLOs that did not meet the 70% target initially, there was little department discussion of strategies to improve scores in between the first assessment and the reassessment. In fact, the only discussion about it at department meetings was limited to discussion of how close the score was from the target and the fact that the SLO needed to be reassessed and the timeline for doing so. As a side note, the item of “the instructor presents material in a variety of ways” has always been one of the more challenging items for math faculty in instructor evaluations. Although the math faculty make every attempt to try new ways of presenting material to engage students and increase success, it must be realized that the number of ways to present advanced math topics is limited. This is especially true for the higher-level math courses in the program. If a particular SLO has missed the target, quite often the most effective strategy the instructor can employ in the reassessment semester is to emphasize and spend more time teaching the topic. As the understanding of the importance and procedure in which SLOs are to be assessed and reassessed grows amongst the math faculty with time, it is hoped that more discussion about effective teaching methods will increase within the department.

4.3.b - Summary of Program Learning Outcome Achievement

Overall, students are meeting the program learning outcomes.

Assessing the PLOs by mapping directly from certain aligning SLOs has two possible flaws. One shortcoming is that it is difficult to associate to any particular student, or group of students, a designation of having met the PLO target since any particular SLO could have been assessed at any point in the student’s pathway. The second concern is that although the average score of the SLOs pertaining to a PLO met the target, a few SLO scores were below the target. There has not been department discussion about this at the time of this writing. The department will address this in future department meetings.

The extent of dialogue about learning outcomes in the department is somewhat minimal at this point. Although the department does have discussions about math skill deficiencies of students especially in regards to prerequisite courses, these discussions are usually very informal and there is not enough constructive discussion about better ways to provide remediation. At department meetings faculty are reminded to follow the course outlines of record (CORs) in designing their courses and list the SLOs on course syllabuses. Adjuncts are encouraged to attend department meetings and contribute to the conversation. However, most adjunct instructors are not able to make the department meetings due to



other commitments but they can still read through the minutes of the meetings posted in a department canvas shell.

The PLOs have not been regularly reviewed nor revised since they were written. However, they do accurately and broadly reflect the transfer-level skills required by the Cal State University (CSU) and University of California (UC) colleges. Even though the PLOs for the most part have met their targets, over the last 5 years, the courses have been modeled after the state curriculum guidelines to obtain C-ID approval. As part of this process, the number of units in the Calculus courses was lowered from 5 units to 4 units to better align with C-ID descriptors. In doing this, the number of SLOs in the classes were reduced and written to be broader in scope. These new SLOs still align with the PLOs which remain relevant to the AST Degree.

4.4 - Achievement of Course Student Learning Outcomes

Course	SLO #	Target	Semester	Met?	Semester	Met?	Semester	Met?
MATH C121	SLO 1	70%	SP20	No	FA20	Yes		
	SLO 2	70%	SP20	Yes				
	SLO 3	70%	SP20	No	FA20	Yes		
	SLO 4	70%	SP20	Yes				

Course	SLO #	Target	Semester	Met?	Semester	Met?	Semester	Met?
MATH C121H	SLO 1	70%	SP20	Yes	FA20	Yes		
	SLO 2	70%	SP20	Yes				
	SLO 3	70%	SP20	Yes	FA20	Yes		
	SLO 4	70%	SP20	Yes				
	SLO 5	70%	FA18	Yes				

Course	SLO #	Target	Semester	Met?	Semester	Met?	Semester	Met?
MATH C151	SLO 1	70%	FA18	Yes				
	SLO 2	70%	FA18	Yes				
	SLO 3	70%	FA18	Yes				
	SLO 4	70%	FA18	Yes				

Course	SLO #	Target	Semester	Met?	Semester	Met?	Semester	Met?
MATH C152	SLO 1	70%	FA18	Yes				
	SLO 2	70%	FA18	Yes				
	SLO 3	70%	FA18	Yes				



MATHEMATICS

Course	SLO #	Target	Semester	Met?	Semester	Met?	Semester	Met?
MATH C251	SLO 1	70%	SP19	Yes				
	SLO 2	70%	SP19	No	SP20	Yes		
	SLO 3	70%	SP19	Yes				
	SLO 4	70%	SP19	Yes				
	SLO 5	70%	SP19	No	SP20	Yes		

Course	SLO #	Target	Semester	Met?	Semester	Met?	Semester	Met?
MATH C255	SLO 1	70%	FA18	Yes				
	SLO 2	70%	FA18	Yes				
	SLO 3	70%	FA18	Yes				
	SLO 4	70%	FA18	Yes				
	SLO 5	70%	FA18	Yes				
	SLO 6	70%	FA18	Yes				
	SLO 7	70%	FA18	Yes				
	SLO 8	70%	FA18	Yes				
	SLO 9	70%	FA18	Yes				

Course	SLO #	Target	Semester	Met?	Semester	Met?	Semester	Met?
MATH C257	SLO 1	70%	FA18	Yes				
	SLO 2	70%	FA18	Yes				

Course	SLO #	Target	Semester	Met?	Semester	Met?	Semester	Met?
IT C251	SLO 1	70%	SP20	Yes				
	SLO 2	70%	SP20	Yes				
	SLO 3	70%	SP20	Yes				

Course	SLO #	Target	Semester	Met?	Semester	Met?	Semester	Met?
CSCI C252*	SLO 1	70%		NA				
	SLO 2	70%		NA				
	SLO 3	70%		NA				
	SLO 4	70%		NA				
	SLO 5	70%		NA				

Course	SLO #	Target	Semester	Met?	Semester	Met?	Semester	Met?
CSCI C265*	SLO 1	70%		NA				





MATHEMATICS

	SLO 2	70%		NA				
	SLO 3	70%		NA				
	SLO 4	70%		NA				
	SLO 5	70%		NA				
	SLO 6	70%		NA				

Course	SLO #	Target	Semester	Met?	Semester	Met?	Semester	Met?
PHYS C111	SLO 1	70%	SP20	No	SP21	Yes		
	SLO 2	70%	SP20	Yes				
	SLO 3	70%	SP20	Yes				
	SLO 4	70%	SP20	Yes				
	SLO 5	70%	SP20	Yes				

* These courses are no longer being offered which is why there are no data.

4.4.a - Gaps and Improvements Made

All of the math courses in the program eventually met the 70% targets as did the IT C251 computer science course. In MATH C251, SLO 2 and SLO 5 did not meet the target the first time they were assessed in spring 2019. These SLOs are as follows:

- 2. Use vectors and vector functions to model and solve problems by applying vector addition, scalar multiplication, the dot product, the cross product and the calculus of vector functions.
- 5. Use differentiation for vector-valued functions to compute tangent lines.

After determining that the students were not sufficiently prepared for the exams as being the main reason that these targets were missed, the instructor and department chair discussed ways in which the students could be better prepared. The following year the instructor placed more emphasis on practice exams and held regular tutoring sessions twice weekly. The result was that the target was met.

In MATH C121, two of the SLOs fell short of the target .They were

- SLO 1: Apply appropriate inferential analyses to real situations in order to draw conclusions about a population or several populations and
- SLO 3: Construct and interpret hypothesis tests and confidence intervals.



Both SLOs were reassessed the following semester (Fall 2020) in a synchronous online delivery mode. Both SLOs met the target. One possible reason for the SLOs not meeting the target the first time when they were taught online is that both SLOs are covered in the second half of the course. Topics like hypothesis testing, building confidence intervals and interpreting the results of tests require more practice to fully master the procedures. The instructors teaching MATH C121 online in the fall of 2021 will discuss covering the beginning material in less time so that more time can be left to master the aforementioned techniques.

Elective courses in the program namely, CSCI C252 and CSCI C265 are no longer being taught due to not having someone available and qualified to teach these courses. The department will be seeking other options for electives in the math program.

4.4.b - Summary of Student Learning Outcome Achievement

The department feels that the students are meeting the stated student learning outcomes at the course level. In the few instances when the outcomes fell short of the target, targets were met upon reassessment. Any SLO scoring below 70% needs to be investigated. The department meets twice a semester and any SLO scoring below 70% is discussed and improvements are planned. Early in this assessment cycle, adjunct instructors were involved with assessing SLOs for courses within the program. However, adjunct instructors were not always eager or able to attend department meetings to provide input for strategies to increase success even though they were strongly encouraged to attend department meetings. Even when faculty, whether adjunct or full-time, are not able to attend a department meeting, follow up by email exchange with the faculty member and the department chair is essential. In the case of some adjunct instructors, this dialog with fellow department members or email exchange serves as the major source of communication about SLOs and assessment. Within the last year, the department has converted all of its math classes in the degree to be taught by full-time faculty.

The primary manner in which SLOs are regularly reviewed is during mandatory cyclic reviews of course outlines of record. When CORs are reviewed every cycle so are the SLOs which ensures alignment, academic rigor, integrity, relevance, and currency of the SLOs over time. Since the last program review, the SLOs in all of the Calculus courses were revised. For MATH C151, MATH C152, and MATH C251, when the number of units was changed from 5 to 4 in order to better align with the C-ID descriptors, some content was moved to the subsequent course requiring that the SLOs be updated. In all of the Calculus courses, the old SLOs were overly specific and were a better fit as course objectives. The new SLOs are broader in scope and fewer in number in order to streamline the assessment process.

All of the math courses in the program align with the General Education Program Learning Outcome 4 - Language and Rationality. The outcome in this category that applies to math courses is "use a complex symbol system to solve problems." This overarching outcome easily encompasses many of the MATH



PLOs. Finally, students who complete the Math AS-T will be able to think critically and apply reasoning which is in alignment with one of the Institutional learning outcomes of the college.

4.5 - Assessment Schedule for Next Program Review Cycle

PLO Assessment Cycle

	FA 2021	SP 2022	FA 2022	SP 2023	FA 2023	SP 2024	FA 2024	SP 2025
PLO 1							X	
PLO 2							X	
PLO 3							X	
PLO 4							X	
PLO 5							X	
PLO 6							X	
PLO 7							X	

SLO Assessment Cycle

	FA 2021	SP 2022	FA 2022	SP 2023	FA 2023	SP 2024	FA 2024	SP 2025
Math C121								
SLO 1			X					
SLO 2			X					
SLO 3			X					
SLO 4			X					
Math C121H								
SLO 5	X							
Math C151								
SLO 1			X					
SLO 2			X					
SLO 3			X					
SLO 4			X					
Math C152								
SLO 1		X						
SLO 2		X						
SLO 3		X						
Math C251								
SLO 1			X					
SLO 2			X					
SLO 3			X					
SLO 4			X					
SLO 5			X					