Assessment: Assessment Unit Four Column

Fall 2018

El Camino: PLOs (MATH) - Developmental Math

PLOs	*Assessment Method Description*	*Results*	*Actions*
PLO #2 Solving Equations and Manipulating Expressions - A student completing Pre-Collegiate Mathematics will demonstrate the ability to identify and correctly implement techniques to symbolically solve equations and manipulate expressions. **PLO Status:** Active **PLO Assessment Cycle:** 2014-15 (Fall 2014), 2018-19 (Fall 2018) **Input Date:** 07/10/2013	**Exam/Test/Quiz -** The program-level assessment is a compilation of the course-level assessments. Each course used a quiz or embedded problem(s) appropriate to the course content to assess PLO #2. **Standard and Rubric:** The expectation is that 70% will score a 2 (satisfactory) or 3 (excellent). The scale is 1 - unsatisfactory, little or no understanding; 2 - satisfactory, good understanding; 3 - excellent, excellent understanding.	**Semester of Current Assessment:** 2014-15 (Fall 2014) **Standard Met:** Standard Not Met There were 3217 students in eight courses were assessed. Of those 66% scored satisfactory or excellent, which does not meet the target of 70%. It is interesting to note that 6 of the 8 courses reported the 70% or more students passed the SLO. However, the two courses that did not, math 40 and math 80, represent a much greater portion of the students (38%). Also, it was noted that in math 40 there were two distinct skills tested (factoring and solving quadratic equations by factoring). (03/24/2015) **Faculty Assessment Leader:** Susan Taylor **Faculty Contributing to Assessment:** Art Martinez, Megan Granich, Anna Hockman, Susie Tummers, Susan Taylor, Ambika Silva, Eddie Barajas **Courses Associated with PLO Assessment:** Math 12, Math 23, Math 37, Math 40, Math 60, Math 67, Math 73, Math 80	**Action:** We will survey the instructors about their use of the resources. (02/01/2016) **Action Category:** SLO/PLO Assessment Process **Follow-Up:** This action has not been completed due to inadequate resources. (11/09/2017) **Action:** We will create a library of resources for each course and make the instructors aware of it. (02/01/2016) **Action Category:** Teaching Strategies **Follow-Up:** This action has been only partially completed due to inadequate resources. (11/09/2017) **Action:** We will distribute the results of each SLO assessment to each instructor of the course. (02/01/2016) **Action Category:** SLO/PLO Assessment Process **Follow-Up:** This action has been only partially completed due to inadequate resources.

PLOs	Assessment Method Description	Results	Actions
			(11/09/2017)
	Exam/Test/Quiz - A review of Student Learning Outcomes (SLO) # 2 for Spring 2018 in comparison to 2014 for all developmental math courses (Math 12, 23, 37, 40, 67, 73, 80). **Standard and Rubric:** Rubric varied from course to course, but 66% was generally considered a satisfactory outcome whether dealing with individual problems with a 3 point rubric, or multiple problems were two-thirds of the problems were answered correctly.	**Semester of Current Assessment:** 2018-19 (Fall 2018) **Standard Met:** Standard Met A review of the Student Learning Outcomes success rates for 2018 in comparison to 2014. A satisfactory SLO success rate varied between 60% - 70% depending on the course, but was often set at a two-thirds level (66%) mark. (09/13/2018) **Faculty Assessment Leader:** Art Martinez **Faculty Contributing to Assessment:** Alice Martinez **Courses Associated with PLO Assessment:** Math 12, 23, 37, 40, 67, 73, 80	**Action:** The PLO report was shared with committee D on 9/14/2018. Two issues of concern discovered in the PLO was shared for further discussion. (09/13/2018) **Action Category:** SLO/PLO Assessment Process **Follow-Up:** PLO report was shared with committee D. (09/13/2018)
		Semester of Current Assessment: 2017-18 (Spring 2018) **Standard Met:** Standard Met Program Learning Outcome 2 focused on the correct identification, implementation, solution of algebraic equations, and simplification of expressions. The developmental math program is composed of 7 courses: Arithmetic (Math 12), Pre-Algebra (Math 23), Elementary Algebra (Math 40), Intermediate Algebra (Math 73/80), Basic Accelerated Math (Math 37), and General Education Algebra (Math 80). These courses evaluated a student learning outcomes (SLO) on a variety of topics. Students were tested on order of operations, simplifying algebraic expressions, solving algebraic equations, factoring and solving trinomial polynomials, solving rational equations, or solving exponential growth functions which perfectly aligns with program learning outcome #2. A total of 3,344 developmental math students were assessed on solving equations and manipulating expressions in 2014, and 2,147 developmental math students in 2018. A great majority of these courses met expectations, though expectations varied from course to course. The student learning outcomes (SLO), for some courses, was composed of a variety of problems while other courses used only a single question. When a single problem was used in an SLO, a three-point rubric was used where 3 represented a perfect score. A satisfactory SLO constituted a score of 2 or greater out of a maximum score of 3. In the case where	

PLOs	Assessment Method Description	Results	Actions
		multiple problems were assigned, correctly answering two-thirds of the questions was a satisfactory outcome; 66% was often considered a satisfactory completion goal. A majority of the courses in the developmental math program achieved satisfactory results in the student learning pertaining to solving equations and manipulating expressions. There are two points of interest when viewing the summary of results table below: (1) In Math 40 for the Spring of 2014, only 62% of students met the established expectation. This is arguably less than satisfactory, but in the Spring of 2018, 72% of students met the established expectation for the same student learning outcome. This shows a 10% improvement in student competency in solving equations and expressions. This was an encouraging outcome. (2) In Math 80, for the Spring of 2014, only 45% met the established expectation for the same student learning outcome. This result increased to 55% in the Spring of 2018. Both results are less than satisfactory and highlights an area of weakness and concern in the developmental math program (please see Figure 1 below). Some instructors expressed concern that the two default text books in Math 80 prepared students in different ways and that the questions in the student learning outcomes may have favored one textbook over the other. The questions for this SLO were word problems, and one of the text books did not have word problems to adequately prepared students to answer these assessment questions. This tension in instructional methodologies (procedural fluency vs contextualization of math instruction) needs to addressed by the department. Either the department needs to determine a single comprehensive approach to intermediate algebra, or the student learning outcomes needs to assess for both procedural fluency and contextualized application. The overall average of results, for both 2014 and 2018, was 68% which is above the common target rate of two-thirds success rate. These results are positive with room for growth. Course and Assessment Period Topic of Assessment Number of	

PLOs	Assessment Method Description	Results	Actions
		Students Met Expectation (%)	
		MATH 12 - 2013-14 (Spring 2014) (1 question)	Order of Operations 342 69%
		MATH 12 - 2017-18 (Spring 2018) (3 questions)	Order of Operations 324 69%
		MATH 23 - 2013-14 (Spring 2014) Equation or Expression (1 question)	Simplify/Solve and 605 79%
		MATH 23 - 2017-18 (Spring 2018) Equation or Expression (1 question)	Simplify/Solve and 351 76%
		MATH 37 - 2013-14 (Spring 2014) Equations (9 questions)	Solve Algebraic 137 73%
		MATH 37 - 2017-18 (Spring 2018) Equations (2 questions)	Solve Algebraic 101 69%
		MATH 40 - 2013-14 (Spring 2014) Solving Trinomials (1 question)	Factoring and 812 62%.
		MATH 40 - 2017-18 (Spring 2018) Equation or Expression(1 question)	Simplify/Solve and 511 72%
		MATH 67 - 2013-14 (Spring 2014) Equations (multiple questions)	Solve Algebraic 89 71%
		MATH 67 - 2017-18 (Spring 2018)	NA NA NA
		MATH 73 - 2013-14 (Spring 2014) Equation (1 question)	Solve a Rational 865 70%
		MATH 73 - 2017-18 (Spring 2018) Inequalities and Linear systems (1 questions)	Equations, 362 67%
		MATH 80 - 2013-14 (Spring 2014) Growth Functions (3 questions)	Solve Exponential 494 45%
		MATH 80 - 2017-18 (Spring 2018)	Solve Exponential

PLOs	Assessment Method Description	Results	Actions
		Growth Functions (2 questions) 55%	498
		(09/13/2018) **Faculty Assessment Leader:** Art Martinez **Faculty Contributing to Assessment:** Alice Martinez **Courses Associated with PLO Assessment:** Math 12, 23, 37, 40, 67, 73, 80	

Assessment: Assessment Unit Four Column

Fall 2018

El Camino: PLOs (MATH) - Math (Math and Science Majors)

PLOs	*Assessment Method Description*	*Results*	*Actions*
PLO #1 Understanding Concepts - Students will explain and demonstrate mathematical concepts relevant to the course content. **PLO Status:** Active **PLO Assessment Cycle:** 2014-15 (Fall 2014), 2018-19 (Fall 2018) **Input Date:** 05/19/2014	**Exam/Test/Quiz -** For our CM1 courses (Mathematics for STEM Majors), we utilize a variety of test / quiz problems assessing student understanding of important concepts essential for being successful not only in the current course but in their future STEM math and science coursework to come. Math 170 - We analyze the basic trigonometric functions and apply them to a real world situation. Math 180 - Using the rational roots theorem, an important concept to pre-calculus and future calculus coursework, to find the roots of a polynomial function. Math 190 - We use the limit definition of the derivative to find the slope of the tangent line to a curve at a given point. Complete understanding of this concept is essential to STEM coursework. Math 191 - Students are required to	**Semester of Current Assessment:** 2014-15 (Fall 2014) **Standard Met:** Standard Met Across all the CM1 sections for fall 2014, we assessed 1206 students in the SLO #1 (Understanding Concepts). We have the following results: 53.8% of students (649 students) scored a '3' on the SLO assessment - demonstrating complete understanding. 24.7% of students (298 students) scored a '2' on the SLO assessment - demonstrating most understanding. 13.7% of students (165 students) scored a '1' on the SLO assessment - demonstrating some understanding. 7.8% (94 students) scored a '0' on the SLO assessment - demonstrating no understanding. Overall performance is quite strong, showing a 78.5% of STEM students being assessed in this large sample demonstrating a '2' or '3' on the SLO assessment - thus we attain our goal of at least 70% of students demonstrating most to complete understanding of the concepts being assessed this cycle. ANALYSIS: Overall we are very pleased with the results - demonstrating that we have met our standard for this PLO. We continue to use instructor feedback on their student performance to continue to raise our success rates and help	**Action:** 2/3/2015 - Overall, students did quite well with the course level SLO assessments and overall we achieved our goal of at least 70% success rate. For the next assessment of this PLO, we hope to continue to assess these important concepts but utilize different problems / scenarios to further challenge and push our students to excel in their understanding of the course material. By adjusting the variety of mathematical functions being assessed and increasing the rigor of application problems to assess the concepts, we can further assess our student's understanding of mathematical concepts. (For example, instead of using polynomial functions to assess understanding of the concept of the limit definition of the derivative, utilizing a root or reciprocal function can assess the same concept but require more sophisticated techniques to reach the correct solution.)

PLOs	Assessment Method Description	Results	Actions
	apply sequence and series convergence theory. Math 210 - Students were assessed on their understanding of basic concepts of logic statements. They are asked to apply the following logic properties: Reflexive, Symmetric, Transitive, and Antisymmetric. Math 220 - Students were assessed on their understanding of partial derivatives of multivariate functions. The concept of partial derivatives is essential to success in college calculus and other college level STEM coursework. Math 270 - For the linear algebra / differential equations class, students were asked to demonstrate understanding of the basis of a vector space - an essential concept for advanced mathematics at the college level. **Standard and Rubric:** Across the CM1 courses, we establish a goal of at least 70% of our students enrolled in the STEM mathematics coursework to score a '2' or a '3' on the SLO assessments. This would mean at least 70% of our students will attain most to complete understanding of the important concepts. We utilize the following general rubric across the SLO assessments: 3 (complete understanding) -	students be successful. Many instructors found utilizing a variety of teaching techniques to be helpful in reaching students that respond better to different learning styles - including collaborative group work, interactive demonstrations, and utilizing technology in the classroom (such as software, Mathematica, graphing calculators, online homework, etc...) to further illustrate challenging math concepts and engage our diverse student population. We find it helpful to establish real world applications of the concepts being studied to further demonstrate to students that their success in STEM career fields can be bolstered with strong mathematics understanding. (02/03/2015) **Faculty Assessment Leader:** Zachary Marks **Courses Associated with PLO Assessment:** Math 170, Math 180, Math 190, Math 191, Math 210, Math 220, Math 270	(02/01/2018) **Action Category:** SLO/PLO Assessment Process **Follow-Up:** Instructor feedback indicates that we are always in progress evaluating student understanding of important mathematical concepts. A sample of math 190 instructors from Spring 2017 report that while students seem to grasp limits of polynomial and rational functions fairly well, limits of trigonometric functions or logarithmic functions still present difficulties. We continue to look at the structure and instructor feedback for the 170 classes for insight. (03/07/2018)

PLOs	Assessment Method Description	Results	Actions
	Students demonstrate mastery of the concept being assessed. This may include demonstrating flawless algebraic and calculus mechanics, problem solving strategy, and/or providing a solid proof / logical justification. 2 (most understanding) - Students demonstrate a strong understanding of the concept being assessed. Perhaps minor errors arise in algebraic or calculus mechanics and/or problem solving strategy. Steps in proof / problem solving procedure may have minor errors. 1 (some understanding) - While the student may exhibit some understanding of the concept being assessed, errors in problem solving procedure and/or logic may be present. 0 (no understanding) - Student demonstrates little to no understanding of the concept being assessed. **Exam/Test/Quiz -** During the spring 2015 semester, SLO #1, application problems, was assessed for 8 development mathematics classes: Math 12, 23, 37, 40, 60, 67, 73, and 80. A variety of application problems were used across these courses in the form of word problems, data, and diagrams, and in the context of real-world applications. Math 12 (Basic Arithmetic Skills):		

PLOs	Assessment Method Description	Results	Actions
	Calculate the subtotal, tax, and change from a given purchase at a restaurant. Math 23 (Pre-Algebra): Find the perimeter of a rectangle with one side missing. Math 37 (Basic Accelerated Mathematics): Complete five computer-based application problems. Math 40 (Elementary Algebra): Set up and solve a linear system of equations related to the cost of cell phone plans. Math 60 (Elementary Geometry): Sketch a trapezoid with certain characteristics, labels parts of it, and find the measure of its angles. Math 67 (General Education Algebra): Answer a series of questions related to cost functions, graphs, and data. Math 73 (Intermediate Algebra for General Education): Compare two different gym memberships by forming and solving relevant equations. Math 80 (Intermediate Algebra for Science, Technology, Engineering, and Mathematics): Form a quadratic revenue function for the sale of toys and use it to find the maximum revenue.		

PLOs	Assessment Method Description	Results	Actions
	Standard and Rubric: Most of the developmental math classes used a similar 3-point rubric of: 3: The student's answers are correct and the student demonstrates complete understanding of the material. 2: The student's answers are mostly correct, with a few small errors, and the student demonstrates a reasonable understanding of the material. 1: The student has few, if any, answers correct and demonstrates minimal understanding of the material. 0: The student has no answers correct or has left the questions blank, and shows no understanding of the material. However, Math 23 and Math 37 utilized as 5-point scale, which is a more refined version of the above. The goals, in terms of percentage and score, for each course are as follows: Math 12 (70% with a 2 or 3), Math 23 (70% with a 4 or 5), Math 37 (80% with a 3, 4, or 5), Math 40 (60% with a 2 or 3), Math 67 (75% with a 2 or 3), Math 73 (70% with a 2 or 3), Math 80 (60% with a 2 or 3). The overall goal was a 70% across all of developmental mathematics. Success would mean that at least		

PLOs	Assessment Method Description	Results	Actions
	70% of the students had a reasonable understanding of the concepts related to application problems.		
	Exam/Test/Quiz - In our CM1 courses (Mathematics for STEM Majors), we used various test / quiz problems to assess student understanding of concepts in their current courses that are important parts of the foundations for their future math courses. Math 170 - We asked students to use right triangle trigonometry on an application problem. Math 180 - We asked students to use the Rational Roots Theorem to find the roots of a polynomial. Math 190 - We asked students to find the displacement of a particle when given the velocity function or find the derivative and tangent line to a function at a given point. Math 191 - We asked students to determine the convergence of a sequence or series. Math 210 - We asked students to determine the differences between quantifications involving truth values and predicates. Math 220 - We asked students to find partial derivatives. Math 270 - We asked students to	**Semester of Current Assessment:** 2018-19 (Fall 2018) **Standard Met:** Standard Met Across all the CM1 sections for fall 2018, we assessed 1217 students in the SLO #1 (Understanding Concepts). We have the following results: 53% of students (647 students) scored a 3 on the SLO assessment - demonstrating complete understanding. 24% of students (288 students) scored a 2 on the SLO assessment - demonstrating most understanding. 16% of students (192 students) scored a 1 on the SLO assessment - demonstrating some understanding. 7% (90 students) scored a 0 on the SLO assessment - demonstrating no understanding. Since 77% of STEM students who were assessed obtained a score of 2 or 3, we surpassed our goal of at least 70% of students demonstrating most to complete understanding of the concepts being assessed this cycle. ANALYSIS: The last time PLO 1 was assessed, 78.5% of the STEM students who were assessed obtained a score of 2 or 3. This time, we were close to that percentage. So our students are showing a steady understanding of the concepts in PLO 1. We are pleased with these results, and we hope to continue to ensure that students learn the concepts in PLO 1 well. Instructors found that it was useful to have a lot of repetition of the same types of problems in order to help students retain the concepts that were taught. Moreover, instructors found that spreading out the practice over multiple days and classes helped with the retention of the	**Action:** We believe that we should explain concepts and problems in various ways, so that students can see ideas from different perspectives. This will help students gain a deeper understanding of the concepts. (04/26/2020) **Action Category:** Teaching Strategies

PLOs	Assessment Method Description	Results	Actions
	find the dimension or basis of a vector space. **Standard and Rubric:** Across the CM1 courses, we establish a goal of at least 70% of our students enrolled in the STEM mathematics coursework to score a '2' or a '3' on the SLO assessments. This would mean at least 70% of our students will attain most to complete understanding of the important concepts. We utilize the following general rubric across the SLO assessments: 3 (complete understanding) - Students demonstrate mastery of the concept being assessed. This may include demonstrating flawless algebraic and calculus mechanics, problem solving strategy, and/or providing a solid proof / logical justification. 2 (most understanding) - Students demonstrate a strong understanding of the concept being assessed. Perhaps minor errors arise in algebraic or calculus mechanics and/or problem solving strategy. Steps in proof / problem solving procedure may have minor errors. 1 (some understanding) - While the student may exhibit some understanding of the concept being assessed, errors in problem solving procedure and/or logic may be present.	material that was taught earlier. In the future, instructors believe that taking more time to make sure that students understand the definitions involved with each concept will increase the SLO results. Groupwork and more classwork may be great ways for students to explore the definitions and concepts and gain a more in depth understanding of the material. Instructors also believe that explaining concepts in different ways and showing different ways of doing problems is helpful since the students can see the problem from more perspectives. (04/21/2019) **Faculty Assessment Leader:** Jasmine Ng **Faculty Contributing to Assessment:** Oscar Villareal, Dominic Fanelli, Mike Bateman, Paul Yun, Diaa Eldinaf, Ashod Minasian, Susan Taylor	

PLOs	Assessment Method Description	Results	Actions
	0 (no understanding) - Student demonstrates little to no understanding of the concept being assessed.		