Assessment: Course Four Column

Spring/Summer 2018

El Camino: Course SLOs (MATH) - Math (GE and Non-Science Majors)

ECC: MATH 120:Nature of Mathematics

Course SLOs	*Assessment Method Description*	*Results*	*Actions*
SLO #4 Solve Application Problems - Solve application problems using basic counting principles, permutations, combinations, probability, expected value and frequency distribution. **Course SLO Status:** Active **Course SLO Assessment Cycle:** 2014-15 (Spring 2015), 2017-18 (Spring 2018) **Input Date:** 11/21/2013	**Exam/Test/Quiz -** Probability (Combinations/Permutations): Sample question attached. **Standard and Target for Success:** Based on the rubric below, it is expected that 60% of the students will score a 2 or higher on this assessment. Rubric: 0 – No Understanding (This means the student uses concepts other than combinations/permutations/counting rule or leaves it blank). 1 – Some Understanding (This means the student uses combinations instead of permutations or counting rule) 2 – Most Understanding (This means they use permutations or counting rule, but make a basic computational error).	**Semester and Year Assessment Conducted:** 2014-15 (Spring 2015) **Standard Met? :** Standard Met 5 of the 6 sections of Math 120 (0578, 0580, 0582, 0590, 0586) participated in this SLO. Sections 0584 (Instructor A. El-Abyad) did not participate. Here are the results: * 110 students were assessed. * 76 students (69.1%) scored a "3", 8 students (7.2%) scored a "2", 18 students (16.4%) scored a "1" and 8 students (7.3%) scored a "0" * The overall passing rate (scoring a "2" or "3") was 84/110 = 76.3%. This exceeds the target set (60%) for this particular SLO. Since the passing rate for this SLO far exceeded the expectations, instructors were asked to list any teaching methods used that contributed to the success. Here are their comments: 1. I gave numerous examples of the differences between when to use combinations vs. when to use permutations.	**Action:** Raise the success target for this assessment from 60% to 70%. This can be accomplished by giving students problems to work on in groups in which combinations and permutations are mixed together. (04/06/2016) **Action Category:** SLO/PLO Assessment Process **Follow-Up:** Based on the actions working in groups on activities, instructors noticed the students improve on differentiating permutation problems from combination problems. Also, having students come up with permutation and combination problems assured that they understood the difference between the two concepts. (09/21/2016)

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	3 – Complete Understanding (This means the student uses permutations or counting rule and correctly computes the numerical solution). **Related Documents:** Math 120 SLO Question Spring 2015	(order matter vs. not matter). Gave numerous HW problems as well as a group work exercise where they had to determine whether problems required combinations or permutations. 2. I use an in class activity to develop the permutation and combination formulas that begin with listing the possible results. I use winning a foot race with different runners and different awards, followed by foot races with top runners advancing to next race. This activity was completed about a week before I gave the SLO as a stand alone problem. 3. I expected 80% of the students to get a 2 or a 3. I will have more in-class problem sessions, and adopt chapter tests, instead of exams covering more than one chapter. 4. The instructor for section 0590 noted that since the success rate for their class was not as high as they had hoped (57%), they would (in the future) provide more "math worksheets". They also noted that they expected to have better results because they "provided study sessions before the class". (04/06/2015) **Faculty Assessment Leader:** Megan Granich **Faculty Contributing to Assessment:** M. Granich, R. Reece, A. Esmaeili, D. Strivewell	
	Exam/Test/Quiz - Sample test problem: Suppose there are 15 students in a student club. They need to choose 4 members to go to a conference. In how many different ways can they choose the 4 members to go to this conference? **Standard and Target for Success:** We set a standard of 70% of students being successful (that is, 70% of students scoring a 2 or 3) on	**Semester and Year Assessment Conducted:** 2017-18 (Spring 2018) **Standard Met? :** Standard Met A total of 85 students were assessed across 5 sections: Score of 0 - 7 (8.2%) Score of 1 - 16 (18.8%) Score of 2 - 10 (11.8%) Score of 3 - 52 (61.2%) We had 73% of students score a 2 or 3 - thus meeting our standard for success on this assessment.	**Action:** Since we saw a solid success rate on this topic, we would like to assess a similar problem (maybe of slightly higher difficulty) on the next assessment. This problem uses combinations to solve it - so perhaps a problem using permutations next time. (09/07/2019) **Action Category:** SLO/PLO Assessment Process **Follow-Up:** We continue to assess students on their understanding

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	the assessment. Scoring rubric: 0 - No understanding Left problem blank or wrote unrelated math 1 - Some understanding Used an incorrect counting method such as permutations 2 - Most understanding Used combinations or another appropriate counting rule but made a basic computational error 3 - Complete understanding Used combinations or another appropriate counting rule and correctly computed the numeric answer	Instructor analysis: General analysis: Overall instructors found the students were successful at solving this combinatorics problem. By assigning homework problems, regular quizzes and group work, instructors commented on students having a pretty strong understanding of the concepts of combinations and permutations. Specific instructor comments: Rusty Reese: Those who attended passed, those who did not attend didn't pass. In class activities with counting principles seemed to help. Rich Wong: Yes, Majority number of students understood combinations & permutations Repeat over and over again the concepts Hopefully not too many students absent Emmanuel Ndoumna: No. 57% of students demonstrated complete understanding; I expected at least 70 %. But overall, 76% were able to identify the problem as a combination – I am encouraged. I gave them worksheets on the difference between the counting techniques; fundamental principle of counting, permutation, and combination. When to use each of them. I had them use the formulas and calculator function to evaluate permutation and combination. Since slos, to my understanding are skills, knowledge students will demonstrate as results of their participation (not necessarily completed) in a course, I will consider giving slo topic as pop quiz every week after I have introduced the topic. BEYENE BAYSSA: Yes, they met my expectation because 9/12 = 0.75 = 75%	of permutations and combinations (in particular, emphasize the differences between the two methods). Reading comprehension is key - making sure students can determine when the order of selection makes a difference in the event's outcome. One instructor commented that a quick quiz on the topic revealed a 75% success rate. (10/14/2019)

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		has most understanding or complete understanding. Illustrating the concept in detail by giving several examples, exercises and solving several applications Encouraging students to work in group in class Encouraging students to participate in class discussion Motivating students to do their best and appreciating their effort Clearly introducing the concept by giving real life problems Defining concepts Giving several class exercise and group work Encouraging students to use available resources such as tutorial, relevant websites and computer systems Giving worksheets on this particular topic Encouraging to do their Homework and discussing with students in class. (09/07/2018) **Faculty Assessment Leader:** Z Marks **Faculty Contributing to Assessment:** R. Reese, R. Wong, E. Ndoumna, B. Bayssa	

ECC: MATH 130:College Algebra

Course SLOs	*Assessment Method Description*	*Results*	*Actions*
SLO #4 Solve Application Problems - Solve college algebra level application problems and use technology. **Course SLO Status:** Active **Course SLO Assessment Cycle:** 2014-15 (Spring 2015), 2017-18 (Spring 2018) **Input Date:** 11/21/2013	**Exam/Test/Quiz -** The following problem was included on an exam and used as the assessment instrument for SLO #4: The fox population grows exponentially, with a growth rate of 7% per year. In 2010, the fox population was 28000. (a) Construct a function that models the fox population growth after the year 2010. (b) Use the function to estimate the fox population in the year 2023 and round the final answer to the nearest fox. The grading rubric was as follows: If a student left the problem blank or wrote irrelevant math, the student earned a score of 0. If the student identified n0 and r and wrote the exponential growth formula, the student earned a score of 1. Scores of 0 and 1 correspond to students being unsuccessful at mastering this SLO. If, in addition to identifying n0, the initial population and r, the exponential growth rate and writing the formula, the student constructed the function, the student earned a score of 2. If, in addition to the previous, the student plugged into the function, obtained an answer, and rounded correctly, the student earned the maximum score of 3. Scores of 2 and 3 correspond to	**Semester and Year Assessment Conducted:** 2014-15 (Spring 2015) **Standard Met? :** Standard Met Students from all 14 sections of Math 130 that were offered at the El Camino campus were assessed. From the total number of 288 students, 26 (9%) scored 0, 37 (13%) scored 1, 72 (25%) scored 2, and 153 (53%) scored 3. Since scores of 0 and 1 correspond to students being unsuccessful, there were 63 (22%) who did not master the skills for this SLO. Since scores of 2 and 3 correspond to students being successful, there were 225 (78%) who did master the skills for this SLO. A 78% success rate is quite good for students at the College Algebra level. This would mean The target of a 70% success rate was met and exceeded. The next time that students are assessed for this SLO, the problem could be modified and made more challenging. For example, students could also be asked to determine the year when the fox population reaches a specified number. (08/26/2015) **Faculty Assessment Leader:** Milan Georgevich **Faculty Contributing to Assessment:** Huang, Khorram, Epstein, Stillson, Dovner, Georgevich, Z. Dammena, Ornelas, Hoang, Heng, and Abdelwahab	**Action:** Math 130 instructors will be sent the SLO report and encouraged to have students solve and discuss application problems with a partner during class time. (10/01/2015) **Action Category:** Teaching Strategies **Follow-Up:** Message was sent to Math 130 instructors about the SLO action of having students work problems in class in pairs. (05/25/2016)

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	students being successful at mastering the SLO. **Standard and Target for Success:** The target for success was that 70% of the students score 2 or 3. **Exam/Test/Quiz -** Sample test problem: Suppose that the population of a small town is decaying continuously with a decay rate of 5% per year. Assume that in 2015 the population was 30000. a) Write down a function P(t) that models the population of this town t years after 2015. b) Rounding to nearest year, in what year does your model predict the population of the city will be 8500? **Standard and Target for Success:** We set a goal of a 70% success rate on this SLO (that is, 70% of students score a 2 or 3 on the assessment). Scoring Rubric: Score of 0 (No understanding) - Left problem blank or wrote unrelated math. Score of 1 (Some understanding) - Correct set up the model P(t) for part (a) but was unable to start solving in part (b).	**Semester and Year Assessment Conducted:** 2017-18 (Spring 2018) **Standard Met? :** Standard Not Met A total of 140 students were assessed across 7 sections: Score of 0 - 29 (20.7%) Score of 1 - 35 (25%) Score of 2 - 28 (20%) Score of 3 - 48 (34.3%) Total: 140 We see that 54.3% of students achieved a score of 2 or 3. This is under our goal for success. Assessment analysis: Overall assessment: Many faculty found the assessment results pretty lackluster. Students definitely seem to struggle with the application problems and we definitely see that in the results. Many considered reworking some of their course material around training students to solve word problems more tactfully. Some instructors commented on the algebra of logs and exponentials being solid however the set up of an appropriate mathematical model was were students reached difficulties. Timothy Ferguson: A little lower. I was hoping for 70% to score a 2 or 3. Practice problems in the homework I didn't see the mid-semester reminder so I had to ask the question on the Final. Asking the question at the time we were covering the material would have helped.	**Action:** Due to the lower success rate on this assessment, we would like to try assessing a similar application problem after instructors have perhaps coordinated some activities with students emphasizing word problem solving strategies. (09/07/2019) **Action Category:** SLO/PLO Assessment Process **Follow-Up:** Instructors commented that students still find constructing an appropriate model to be a challenging task. A recent instructor commented seeing a 60% success rate on a short quiz involving constructing a half-life model for radioactive decay. We will continue to talk about ways to improve student comprehension of the topic. (10/14/2019)

Course SLOs	Assessment Method Description	Results	Actions
	Score of 2 (Most understanding) - Correctly set up the model P(t) for part (a), used a logarithm to start solving in part (b) but made a computational error or got stuck after the logarithm. Score of 3 (Complete understanding) - Correctly set up the model P(t) for part (a), and used a logarithm to correctly solve part (b) including phrasing their answer not as just a t value but as an actual year.	Oscar Villareal: I fell the student's performance was lackluster. The number of students in the 0-1 range was a big minority: 8/17. Almost half. I feel slow in-depth look at one application is useful. Looking at a small set of problems from a couple of angles helps. This material was covered late in the semester and the students are struggling at this point. Perhaps covering this earlier on would help. Juan Martinez: Yes, the student outcomes met my expectations for the SLO. Most students did well or at least received what I would call a passing score. I think the teaching method that worked best, was to give an example, and then use question/response method in the class. I think I might consider improving this portion of the topic by spending more time discussing it in class. Diaa Eldanaf: Yes, my students met my expectations since more than 73% of them had most or complete understanding. Solving exponential and logarithmic equations first then a lot of word problems in class and on homework. Students who did not do well on this question still had trouble using the log notation. So they would consider the argument of the function as a coefficient. In the future, I will spend more time and discussion to review more basic log notation and log rules. Christina Watson: No. The majority couldn't set up the equation. That being said, after I gave them the formula, they all filled it in correctly, got the model and solved part b with no problem. ALL 16 students. Clearly my teaching of logarithms and solving logs is not an issue. But my strategies for setting up the model are completely ineffective.	

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		Spend more time on the parts of the formula. Spend more time on basic definitions. Spend more time on 4.6 (09/07/2018) **Faculty Assessment Leader:** M Mata **Faculty Contributing to Assessment:** L. Wapner, R. Bauman, O. Villareal, D. Eldanaf, T. Ferguson, J. Martinez, C. Watson	

ECC: MATH 140:Finite Mathematics for Business and Social Sciences

Course SLOs	*Assessment Method Description*	*Results*	*Actions*
SLO #4 Use of Finite Mathematics Techniques - Solve application problems using finite mathematics techniques. **Course SLO Status:** Active **Course SLO Assessment Cycle:** 2014-15 (Spring 2015), 2017-18 (Spring 2018) **Input Date:** 11/21/2013	**Exam/Test/Quiz -** Students were asked to solve an application problem using a Venn Diagram and the addition principle for counting. The question is below. A food store surveyed 50 of its shoppers as to whether they had purchased bacon or steak during the past week. The results were 30 had purchased bacon, 20 had purchased steak, and 8 had purchased both bacon and steak. a. Draw and label a Venn Diagram to numerically represent this survey. Use the Venn Diagram constructed to answer parts b and c. b. How many of these shoppers bought bacon, but not steak? c. How many of these shoppers bought neither of these two meats? Use the Addition Principle for Counting to answer part d. d. How many of these shoppers bought bacon or steak? This question will be graded according to the following rubric 0 –No understanding: Student cannot set up the Venn Diagram correctly. 1 –Some understanding Student can correctly set up the Venn Diagram but cannot answer any of the questions. 2 –Most understanding Student can correctly set up the Venn Diagram and can answer 2 of the 3 questions	**Semester and Year Assessment Conducted:** 2014-15 (Spring 2015) **Standard Met? :** Standard Met One section of Math 140 was offered and 15 students completed the assessment. Eleven students or 73% scored a 3, three students or 20% scored a 2, no student scored a 1 and one student or 7% scored a 0. The standard was met since 93% of the class scored a 2 or a 3 on this assessment. The student who scored a 0 was unable to set up the Venn Diagram and therefore was unable to answer the questions that followed. Of the three students who scored a two, one of them used the addition principle correctly but made a mistake in the calculation and the other two students were unable to use the addition principle to answer the question. (06/24/2015) **Faculty Assessment Leader:** Reza Mirbeik **Faculty Contributing to Assessment:** Susanne Bucher	**Action:** Since the success rate was high the next time this SLO is assessed the question should pertain to other finite mathematical techniques such as Markov Chains or Game Theory. (02/18/2019) **Action Category:** SLO/PLO Assessment Process **Follow-Up:** We will be re-assessing this in Fall 2016 after we have students work on problems in pairs. (08/20/2016)

Course SLOs	Assessment Method Description	Results	Actions
	correctly. 3- Complete understanding Student can correctly set up the Venn Diagram and can answer all of the questions correctly. **Standard and Target for Success:** It is expected that 75% of the students will score a 2 or a 3 on this assessment. **Related Documents:** Math 140 SLO 4 Results Spring 2015.docx		
	Exam/Test/Quiz - Sample test problem: Suppose that a professor surveyed 100 of their students in a large lecture about their class. 70 of the students said that they found the exams too hard and 60 of the students said that they found the homework too hard and 50 of the students said they found both the exams and the homework too hard. (a) Draw and label a Venn Diagram to represent the results of this survey. (b) How many students thought that the exams were too hard but did not think the homework was too hard? (c) How many students thought that the homework was too hard but did not think the exams were too hard? (d) How many students thought the exams or the homework were too hard? **Standard and Target for Success:** We set a goal of 70% of students	**Semester and Year Assessment Conducted:** 2017-18 (Spring 2018) **Standard Met? :** Standard Met A total of 8 students were assessed in the 1 section of Math 140: 2 students (25%) scored a 3 4 students (50%) scored a 2 3 students (37.5%) scored a 1 1 student (12.5%) scored a 0 The standard for success was met (at 6 of the 8 earning students (75%) a 2 or 3. The instructor commented that the students seemed to do well. Working on homework problems of similar type seemed to solidify their understanding of using the venn diagram to solve these types of problems. J Evensizer: The students did ok. The students this semester were, for the most part, quite weak in their mathematical and analytical skills. They did understand Venn Diagrams fairly well though. We worked several problems of this sort in class and some of them were much more complicated, requiring 3 or more circles in the Venn Diagram (rather than just two).	**Action:** For another assessment we will use a different application problem focusing on a different topic in finite math such as counting rules or probability. (09/07/2019) **Action Category:** SLO/PLO Assessment Process **Follow-Up:** Instructors commented that the method of using a Venn Diagram seems to be one that students are pretty comfortable with. Looking at recent test results, assessing a tree-diagram method can cause more problems. We believe this method will be tested at the next SLO assessment to compare results. (10/14/2019)

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	earning a score of 2 or 3 on the assessment. Scoring rubric: 0 - No understanding Left problem blank or wrote unrelated math 1 - Correctly set up and labeled a Venn Diagram and was able to answer one of (b)-(d) correctly. 2 - Correctly set up and labeled a Venn Diagram and was able to answer two of (b)-(d) correctly. 3 - Correctly set up and labeled a Venn Diagram and were able to answer all of (b)-(d) correctly.	(09/07/2018) **Faculty Assessment Leader:** Z Marks **Faculty Contributing to Assessment:** J Evensizer	

ECC: MATH 150:Elementary Statistics with Probability

Course SLOs	*Assessment Method Description*	*Results*	*Actions*
SLO #4 Confidence Intervals and Hypothesis Testing - Compute the confidence intervals and conduct hypothesis testing for a variety of parameters, and perform non-parametric hypothesis testing. **Course SLO Status:** Active **Course SLO Assessment Cycle:** 2014-15 (Spring 2015), 2017-18 (Spring 2018) **Input Date:** 11/21/2013	**Exam/Test/Quiz -** With a previous contractor, the mean time to repair a pothole was 3.2 days. A city councilman thinks that the new contractor's mean time to repair a pothole is higher than 3.2 days. He randomly selects a sample of 12 pothole service calls and obtains the following times to repair (in days): 6.2 4.3 7.1 2.9 5.4 3.7 5.5 0.7 7.5 5.6 2.6 1.7 Is there enough evidence to support the councilman's claim? (Use a=0.05 level of significance). Show all the steps of an appropriate hypothesis test. Assume all conditions are satisfied for your chosen hypothesis test. **Standard and Target for Success:** Our goal this semester is that 70% of these students will score a 2 or a 3 on this SLO using the following rubric: Students will receive a score of 0 - 3 based on how many of the following three things they include in their answer: • Recognizes and correctly sets up a Hypothesis test including: Stating null & alternative hypothesis & rejecting/failing to reject null hypothesis	**Semester and Year Assessment Conducted:** 2014-15 (Spring 2015) **Standard Met? :** Standard Met There were 26 sections assessing this SLO during Spring 2015. A total of 654 students participated in this SLO assessment. The distribution of scores is as follows: 8.0% earning score of 0 (52 students), 15.9% earning score of 1 (104 students), 25.5% earning score of 2 (167 students), 50.6% earning score of 3 (331 students). The overall success rate is 76.1% (498 students earning a score of 2 or 3). We successfully achieved out target percentage for success. Sec 0674 This course is a one day a week four hour course. I believe that attracts more disciplined students in general. Also at this point many of the students that had little to no understanding have stopped coming to the class. Like the other section p-value and conclusion seem to be the hardest topics for students. I will more emphasis on those two topics in the future starting in section 8-2. Sec 0660 9 out of 21 students had most or complete understanding. Many students struggle with the concept of p-value. In future classes I will emphasize that it is the probability of the test statistic if the Null hypothesis is true. The lower the probability the less likely that Null hypothesis is true. Sec 0670 I used traditional lecture with assigned homework to prepare them. Sec 0722 and 0730	**Action:** Overall, the students who participated in this SLO assessment showed that they understood hypothesis testing methods fairly well by reaching and surpassing our targeted success rate (70%). However, as some professors noted in their comments, there are many steps in completing a hypothesis test problem. Many students become confused with the process easily, so we would like to work on providing a clear list of items that we would like the student to include when showing work for each hypothesis test problem. In turn, this list will serve as a guide to the student on the step-by-step process of answering a hypothesis test problem. This will hopefully raise the percentage of students scoring 2 or above in the next assessment for this SLO. (09/01/2016) **Action Category:** SLO/PLO Assessment Process **Follow-Up:** We will send a reminder email to all sections of Math 150 this semester to remind the instructors to provide a clear list of items that they would like their students to include when showing work for each hypothesis test problem to increase student success. (08/26/2016)

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	• Finds the correct test statistic • Writes a conclusion with the correct decision and that references the original questions (contractor's time) Score of 3: Does everything correctly (minor errors are accepted) Score of 2: Completes TWO of the key concepts correctly Score of 1: Completes ONE of the key concepts correctly Score of 0: Completes NONE of the key concepts correctly or leaves the problem blank **Additional Information:** The question that we used to assess this SLO is a typical example of a medium difficulty problem for hypothesis tests.	It seems like the majority students in both of my classes have mastered the expectation on this SLO. I deliver my instructions using "" flip the classroom"" method. I record video lessons for students to watch at home. The next class session, I spend about 15 - 20 minutes reviewing the lesson and answering student questions. Students then spend the remainder time in class completing their homework with their peers. I walk around the classroom guiding them, assisting them and leading them toward their understanding of the concept. This is the second semester that I have tried ""flip the classroom"" method and I think it works! I have noticed a dramatic increase in student understanding and achievement. ""Flip the classroom"" allows students the flexibility to learn at their own pace. If needed to, they can re-watch the video lesson a second time, and a third time to review and to deepen their understanding. Sec 0706 My expectations are not met. I spent a lot of time on lecturing, reviewing and doing group activities on hypothesis testing. Even after the review and providing them formula sheet to use on the exam, I am disappointed about the scores. Some students got the answers from the calculator and didn't write the test statistic. In future, I am planning to give a table with spaces for Null and Alternate Hypothesis, Test Statistic, Critical and /or P-value and Conclusion. I am not sure how my results compare to other Math 150 students results. Please update me with the final report and better techniques that other instructors used for their class. Sec 0708 Most of the students did well on this SLO. 20/27 or 74% earned a score of 2 or 3. This question was given on the test after hypothesis tests and confidence intervals were	

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		first introduced. Some students left out one or two of the key concepts, and needed a little more time to master the material. Since the next topics – Chi-Squared GOF, and ANOVA, etc. used hypothesis tests, almost all of the students were able to master the concepts involved in hypothesis tests. Continuing to practice the topic at the end of the semester made my students 95% confident with hypothesis testing. Sec 4832 and Sec 4831 "Spend more time on doing examples! For hypothesis testing I use an acronym PHANTOMS For Hypothesis Testing, follow PHANTOMS: P – parameters (is it a mean, proportion, SD or Variance?) H - hypotheses A - assumptions N - name your test (Calculator Function) T - find your test statistic O - obtain your p-value M - make a decision (reject or fail to reject) S - state a conclusion in the context of the problem" Sec 0676 Overall I was pleased with the results. With 21/31 students at some or complete understanding, my expectations were met. Using a series of in-class handouts emphasizing the key steps to testing statistical hypotheses – I believe students were able to grasp this difficult concept with more ease than simply reading over the textbook (which many students find pretty confusing and lacking in details). Using some relevant examples (such as political campaigns on current issues) I believe also helps piques student interest and keeps them engaged in the material. Some areas the students could use improvement include wording their conclusions correctly and realizing that this process does not verify or prove anything for certain. Another common mistake involved a handful of students using the z (standard normal) distribution instead of the t-distribution. To alleviate this, I will continue to emphasize	

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		the importance of noticing a small sample size and the typical lack of a population standard deviation in practice will usually require the use of the t-distribution. Sec 0716 Although there is work to done, I think overall, students got the general idea of hypothesis solving. Using both the traditional and P value method seemed a bit confusing to them. I decided to focus more on the P value method and work on the traditional method later. I presented the material and let them work on few problems. I spent enough time on each step. I actually presented the material by steps. I treated the steps as individual lessons on their own. Sec 0694 The students met the objectives very well. I evaluated their understanding with the following criteria: writing the correct hypotheses, finding the correct test statistic and P-value, writing the correct conclusion to the hypothesis test in context of the situation. My teaching method including breaking down hypothesis testing into a step-by-step process which I followed for each test: 1. State hypotheses 2. Verify preliminary conditions 3. Calculate the appropriate test statistic 4. Determine the correct P-value or critical value 5. State a conclusion in context I presented the process and several examples during class time. I also administered two quizzes on hypothesis tests: one was in-class and one was take-home. For each quiz, I posted my solution key. I explained to students that the exam questions will require they follow the same step-by-step process as the quizzes. Of the 11 students who did not get all 3 objectives, most wrote an incorrect conclusion to the results they calculated.	

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		A few students performed the incorrect test or otherwise received an incorrect test statistic or P-value possibly due to data entry error. Sec 0686 The students have met my expectations. When grading the assessment question, I used the SLO rubric and question provided, however, I also looked at the overall performance of each student on Exam4. Exam 4 was on finding Confidence Intervals and performing Hypothesis Tests. Of the 29 students who took the test, 19 passed the test with a 70% or higher, 8 scored between 69% and 55% and the remaining 2 students scored less than 50%. What I have found to help on these types of problems is the format and structure I expect my students to provide on their exam. Confidence Interval Problems Students are expected to provide the following FIVE parts a) The best point estimate for the parameter in question b) The graph with labels and command used to find the CRITICAL VALUE c) The formula written out with the substitution of the sample statistics and critical value. d) The answer… the confidence interval found and the command they used in calc. e) A complete sentence explaining the meaning of the confidence interval they have found. Sec 0690 and 0710 Overall, I am happy with the result. When I teach hypothesis testing, I use a 5-step procedure to guide students. I focus on asking students questions like “which population parameter are you testing and how do you know?”, “which test statistic would you use and why?”, and “what does it mean to reject H0 or fail to reject H0 in the context of the problem?”. I train my students to ask the same questions to themselves when they are conducting a hypothesis testing and I believe that helped my students	

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		tremendously. Having students to more problems using activities are great, but if students do not understand “why” in each step of hypothesis testing, they will keep making the same mistakes over and over again. Some students still do not have the skill to write final conclusions correctly. This will be my objective for the next semester. Sec 0704 My students met my expectation! I made sure that the students had done enough homework assignments and also had good understanding of concepts. Sec 0666 58% percent of my students passed the assessment with a 2 or 3, I am unsatisfied with these results. The next time I teach stats, we will spend less lecture time on the first 3 chapters of the book and move faster to the last 8 chapters where students really struggle. Sec 0664 43% percent of my students passed the assessment with a 2 or 3, I am unsatisfied with these results. The next time I teach stats, we will spend less lecture time on the first 3 chapters of the book and move faster to the last 8 chapters where students really struggle. Sec 0680 and 0700 Overall, the students were able to identify that the question was a hypothesis test for a single mean. The students were very adept at the calculating the test statistic but some did struggle to relate their conclusion back to the original problem. I was very pleased to see that the majority of my students drew a quick sketch of a t-distribution to help with making sure they calculated the correct P-value. I think my approach of breaking down hypothesis tests into multiple pieces was effective in terms of student learning. In terms	

Course SLOs	Assessment Method Description	Results	Actions
		of getting students to state their conclusions more clearly I plan on working in more examples that are purely word based basically removing the calculations and forcing them to focus more on appropriate conclusions. Sec 0692 Although this SLO did show a majority of the students understanding this particular topic, as the semester continued the students had particular difficulty distinguishing between different types of hypothesis tests and when to do which. However, it appeared that a lot of that came from the students deciding to stop doing HW at the end of the semester. So, I don't know if I can chalk it up to senioritis but I do have some plans for changes. I am really looking into doing a "flipped" classroom for my math 150 classes this fall. I am particularly interested because my math 73 class did so well with it this spring. I would then have more time to do problems, especially these long involved problems that statistics naturally entails. I'm looking forward to seeing the results. Sec 0670 Keep in mind that this assessment tool was not given at the end of the semester, but as a Chapter 10 Quiz, given April 23, 2015. The students had been working with the topic of Hypothesis Testing for approximately 1.5-2 weeks. The students had practiced at least two similar problems – one as a group activity, others as HW. The assessment could have been taken later, or even on the final exam (May 14, 2015). 14/20, or 70%, assessed at a 2 or better, which I am quite satisfied with. (09/03/2015) **Faculty Assessment Leader:** Jasmine Ng **Faculty Contributing to Assessment:** G. Valle, L. Wapner, C. Ngyuen, G. Manikandan, A. Hockman, A. Silva, Z. Marks, E. Ndoumna, D. Fanelli, K. Moreno, W. Chen, J. Forbes, A. Khorram, D. Yee, E. Barajas, M. Lackpour, B. Mitchell, A.	

Course SLOs	Assessment Method Description	Results	Actions
	Exam/Test/Quiz - In 2012 it was reported that 64% of adult Americans watch football regularly. You want to know if this percentage has increased. To do this you randomly sample 400 adults from across the United States. You ask all these adults, "Do you regularly watch football?" 268 of the adults respond that they do regularly watch football. Carry out at alpha = .05 a hypothesis to test your claim. Make sure to check all necessary conditions and state your conclusion in the context of this situation. **Standard and Target for Success:** We set a goal of 70% of students earning a score of 2 or 3 on the assessment. Scoring rubric: 0 - No understanding Left problem blank or wrote unrelated math 1 - Some understanding Correctly set up null and alternative hypotheses (identifying this as a test about proportions) but was unable to perform the necessary computations or was unable to make a conclusion. 2 - Most understanding Correctly set up null and alternative hypotheses, but made small mistakes in checking conditions, computing test statistic/P-value. Still	Martinez, M. Robertson **Semester and Year Assessment Conducted:** 2017-18 (Spring 2018) **Standard Met? :** Standard Not Met A total of 711 students were assessed across 32 sections of Math 150: Score of 0 - 81 (11.4%) Score of 1 - 166 (23.3%) Score of 2 - 191 (26.9%) Score of 3 - 273 (38.4%) We see that 65.3% of students scored 2 or 3 on the assessment. This is under our set standard goal of 70% success. Overall assessment: Many instructors commented that hypothesis testing is definitely one of the toughest topics on the entire Math 150 course. Not only is there new vocabulary to learn but the procedures used to solve the problems are extensive and require a lot of practice. Instructors commented on the need to continue training students to identify important context clues so they can identify which parameter is being tested and whether the test is left, right, or two-tailed. Faculty contributing: V. Avakyan, Z. Dammena, K. Numrich, K. Moreno, A. Khorram, A. Martinez, D. Yee, J. Ortiz, P. Nagpal, A. Hockman, J. Forbes, W. Chen, S. Bickford, M. Zietzew, E. Schwartz, E. Barajas, L. Gui, J. Wan, D. Ford, G. Manikandan, B. Mitchell, Z. Marks, B. Beyene, J. Jin, L. Kjeseth Instructor comments: Vage Avakyan I think they did ok. Most of them understand the concept of hypothesis testing and confidence interval and their relationship.	**Action:** For a future assessment of hypothesis testing, we test a different parameter such as a mean or comparison between two population means. (09/07/2019) **Action Category:** SLO/PLO Assessment Process **Follow-Up:** Hypothesis Testing continues to be a challenging topic for a lot of students in statistics. Many instructors have followed up with the comment that lecture needs to be designed and planned very carefully - to outline appropriate testing conditions and help students identify which parameter(s) are being tested. Combining results from a few instructors recent quizzes, we see about a 65% rate when students are asked to test a comparison between two population means. This one is definitely more involved (and might be considered for a future SLO assessment.) (10/14/2019)

Course SLOs	Assessment Method Description	Results	Actions
	correctly stated conclusion in both statistical form an in context. 3 - Complete understanding Correctly set up null and alternative hypotheses, checked all necessary conditions, correctly computed test statistic and P-value, stated conclusion both in statistical form and in context.	Considering examples from real life situations and using them to understand the hypothesis testing process. Using more group studying method and encouraging to create examples when this method can be used to make conclusion and interpret them. Jason Jin: I found that group collaboration was particularly effective with this concept because the students were able to tackle the problem together and eventually leading to doing the problem by themselves. Spending more time going over specific parts of the Hypothesis Testing section. I felt like I rushed the concept due to time constraints. Lars Kjeseth On the one hand, I was quite disappointed with my students who received a 1 using the rubric. The most common error for those receiving a 1 was setting up and drawing a sample proportion distribution, but then doing calculations for a hypothesis test for the mean. Some of these same students did quite well on a hypothesis test for the difference of means on the final exam. On the other hand, most of my students receiving a 2 did so because they failed to write any conclusion in the setting of the problem In past semesters, I have worked through all of inferential statistics for the proportion and then returned to work through all of the inferential statistics for the mean. This semester, I blended the two, trying for once to follow the order in the textbook. I believe this was a poor choice. I speculate that some of my students ended up with a more muddled picture of confidence intervals and hypothesis tests for proportions and means because I took this blended approach. I will return to my previous practice next time I teach the course. I think my primary idea for improving is to return to my previous strategy. I am also currently investigating OER course resources, particularly those that allow for greater flexibility in order. And of course, I will continue to advocate for making the course more rigorous by reducing	

Course SLOs	Assessment Method Description	Results	Actions

the number of topics. Time for greater depth of experience leads to better, more long-lasting learning.

Bayssa Beyene
Illustrating the concept in detail by giving several examples, exercises and solving several applications
Encouraging students to work in group in class
Encouraging students to participate in class discussion
Motivating students to do their best and appreciating their effort
Clearly introducing the concept by giving real life problems
Defining concepts
Giving several class exercise and group work
Encouraging students to use available resources such as tutorial, relevant websites and computer systems
Giving worksheets on this particular topic.
Encouraging to do their Homework and discussing with students in class.

Gayathri Manikandan
Overall, I was happy about the results. My morning class did better than my afternoon class. We spend lot of time going over the hypothesis testing. Used “PHANTOMS” technique to remember the things to do for any hypothesis testing. I think it helped the students to follow all the steps.

P-identify the Parameter
H: write the null and alternate Hypothesis
A: check the requirement or Assume
N: Name of the distribution or calculator function
T: Test statistic
O: Obtain P-value/Critical value
M: Make the decision
S: State the Conclusion in non-technical terms.

Diane Ford
I tell them to look for key phrases such as “claimed” or “increased” to indicate say a “>”
I will put more effort into talking about conditions for

Course SLOs	Assessment Method Description	Results	Actions
		hypothesis testing. James Wan Review the SLO topic before test. More practice. Le Gui I think students in this section DON'T meet my expectation on this SLO since the passing rate (score 2 or 3) is 67% which is below the targeting rate of 70%. There are still about 33% of students who are unsuccessful. They seem to do well on finding the test-stat value, setting up null hypothesis and wrapping up the final conclusions. They mainly struggled with setting up the alternative hypothesis, finding the critical value/p-value, labeling the test-stat value and critical value/p-value correctly on the horizontal scale, which lead them to get the wrong initial statistical conclusion, checking the conditions. I found out that it is more effective for me when I break down the whole hypothesis procedure into steps and help them to get familiar with each step through practicing. In addition, I feel that teaching students to look for the key words and what claim the question tests about will help them to set up the null and alternative hypothesis correctly. It also helps me by comparing the hypotheses with different parameters in terms of the null-hypotheses, alternative hypotheses, test-stats formulas and different distribution with different tables for finding critical values. I also notice that sometimes having students work in groups and coming to the board to solve problems seems to work well for me. This semester, most of the hypothesis test questions in the textbook provide the claim clearly therefore students lack the skill of coming up with their own claims. That also leads them to get alternative hypotheses incorrect. In future semesters, I will design more problems that students need to come up with their claims so that students are well prepared for that skill.	

Course SLOs	Assessment Method Description	Results	Actions
		Elizabeth Schwartz: Overall, I found that they met my expectations. The results of this class were very different from my other section but I didn't expects anything else. I have a large group of students who aren't doing the homework and other assignments. They will probably not be passing the class and I told them this before the "W" date but they still think that they can get a passing grade so they come to class, take notes, and take the quizzes and exams with no other time put into the class. Disregarding this group – I found that I was pleased with the results from the rest of the class. Overall they did really well. When I teach hypothesis activities I use the z, t, and chi square distribution tables for the critical values and then I have them use the formulas and the calculator test to find the test statistics. I think that combining the traditional formulas along side the graphing calculator tests is effective because the students have to understand the data in the problem to fill in the formulas correctly, but they don't have to worry about using parentheses incorrectly to get the correct answer. As I mentioned in an earlier e-mail, I misread the question and therefore had a really "off" test statistic. With that in mind, I might recommend that you put some words in front of the "x" value. Otherwise, I think that the question fits the topic very well. One proportion is the basic parameter for a hypothesis test and hypothesis testing is a vital part of the course. Michael Zietzew I gave this assessment, unannounced, about 1 week from the time they were tested on the material. I would expect that administering the problem on the test itself would've meaningfully changed these results. As far as teaching this material, I find a slow and verbose	

Course SLOs	Assessment Method Description	Results	Actions

presentation is effective. So slowly building up to the problem making sure they understand the question and the data that wat collected.

Sue Bickford
No, there are still too many students for who the vocabulary of the parts of the hypothesis test is not yet mastered so they get mixed up on how the test is to be conducted.
Send the students to the board in groups to work out a hypothesis test together. This generates a lot of discussion about what is appropriate and why. Student feedback has let me known that this is effective for students.

Junko Forbes
I will keep using the 8-step method. Written hypothesis testing homework seemed to be helpful, so I will continue doing that as well.

This is just a suggestion for a future SLO question. In addition to asking students to do a hypothesis testing question like above, I would like to ask questions that test their understanding of p-value. I want them to be able to explain what the p-value means in the context of data (example

Anna Hockman
Note: This was a difficult to grade, because score of 1 has them setting up the null and alternative hypothesis and correctly identifying it as a proportion. Some of the students could identify as a proportion and then not quite have the null and alternative correct, or they could say it was a mean, then do a test using proportions. Again, since we had recently learned the material, their understanding was not complete. I suspect it was better when they got to the final exam, since we went over several additional types of hypothesis tests.
I think one of the biggest issues for students is knowing whether the test is a mean or a proportion. This semester, I went over the types of data and that means go with

Course SLOs	Assessment Method Description	Results	Actions
		numeric data and proportions go with categorical data, right before confidence intervals and hypothesis tests. I believe that was helpful, so I will continue doing on that. They also need practice writing the null and alternative hypothesis, esp. with the notation. I can make up a worksheet to go over that in more detail. Pavan Nagpal Giving a framework of going through each element of hypothesis testing helped significantly. Many problems were practiced with this framework. There is room for improvement in writing conclusion statements. I plan on giving them problems with statistical conclusions and ask them to write conclusion in context. Juan Ortiz My students did not meet my expectations. A lot of my students had issues sitting up the hypothesis test because it dealt with percentages. Not having a basic understanding of how percentages work made it very difficult for them to make progress on the problem. The most effective method that I have found is having students work in groups and have them help each write up a hypothesis test. In the future, I will make sure that my students finish a hypothesis test in class in small groups. I plan to walk around the classroom and help them write up a prefect write up of their results. I also need to make a handout that goes over basic percentage fundamentals. David Yee: Have harder pre-requisites for the class. A lot of students come in with weak math backgrounds and weak study skills to begin with. If the students aren't prepared to work hard on a math class or they come in with very weak math skills, then nothing will improve the student learning of this topic unless we sacrifice other topics in the class to give them more time. However, that would force us to not meet the requirements of the course outline record.	

Course SLOs	Assessment Method Description	Results	Actions

Avid Khorram:
I found it really effective for students to apply their knowledge of elementary statistics in a group project. The homework assignments helped the students to have a better understanding of the concepts.
I will make sure that the students take advantages of El Camino College Tutoring. Also I will make sure more students see me during my office hours.

Kaysa Moreno:
I spend a lot of time on the format to use when performing a hypothesis test. I have my students go through the 5-step Procedure and answer questions such as describe the parameter, state the type of test, showing the work on how to compute the test value and Pvalue. I also have my students draw, shade and label the curves and will only receive full credit if they have all labels correct.
I am currently using video lecture notes to expose students to the material before we cover it in class. I would like to create my own videos for this, since every instructor has a different format they have their students follow when answering these types of questions.
In general … I believe consistency is key. I would love to see all Math 150 students performing hypothesis test using similar formats… whatever that may be.

Kristine Numrich:
The most effective teaching strategy was having students work on homework problems during class.
In the future I will provide students a Worksheet, in addition to homework problems, for this problem type.

Zekarias Dammena:
Plain lecture, and exercises from the text book
Group work.
(09/07/2018)
Faculty Assessment Leader: B Mitchell
Faculty Contributing to Assessment: V. Avakyan,Z. Dammena,K. Numrich,K. Moreno,A. Khorram,A. Martinez,D. Yee,J. Ortiz,P. Nagpal,A. Hockman,J. Forbes,W. Chen,S.

Course SLOs	Assessment Method Description	Results	Actions
		Bickford,M. Zietzew,E. Schwartz,E. Barajas,L. Gui,J. Wan,D. Ford,G. Manikandan,B. Mitchell,Z. Marks,B. Beyene,J. Jin,L. Kjeset	

ECC: Math 165:Calculus for Business and Social Sciences

Course SLOs	*Assessment Method Description*	*Results*	*Actions*
SLO #4 Solve Application Problems Using Calculus - Use single-variable and multi-variable calculus methods to solve application problems in business and economics, including marginal revenue, marginal profit and marginal cost. **Course SLO Status:** Active **Course SLO Assessment Cycle:** 2017-18 (Spring 2018) **Input Date:** 11/09/2015	**Exam/Test/Quiz -** Sample Test Question: Suppose that the demand equation for a particular product is x = 3600 - (1/3)p^2 where x is the number of units demanded and p is the price in dollars per unit. Build the revenue function R(p) and find the price that maximizes this revenue. What is the maximal revenue? **Standard and Target for Success:** Our target for success is 70% success (that is, 70% of students assessed earn a score of 2 or 3). Scoring: 0 - No understanding. Left problem blank or wrote unrelated math. 1 - Some understand. Correctly set up the revenue function R(p) but either did not recognize the connection between maximization and the derivative or were unable to carry out the derivative. 2 - Most understanding. Correctly set up and differentiate the revenue function R(p) but was unable to solve correctly for the optimal price or thought that there were two	**Semester and Year Assessment Conducted:** 2017-18 (Spring 2018) **Standard Met? :** Standard Met A total of 122 students were assessed across 5 sections of Math 165: Score of 0 - 3 students (<1%) Score of 1 - 17 students (14%) Score of 2 - 50 students (41%) Score of 3 - 52 students (43%) 102 students scored a 2 or 3 (that is, 84% success rate). Instructor Comments: Instructors overall responded well to the assessment. Some comments were made regarding providing students with practice strategies in solving application / word problems. In particular, having students recognize patterns. Professor Emma Niu commented on seeing improvement when she had students work collaboratively in small groups - allowing them to share their ideas. Lijun Wang: Frequent quizzes, once daily for my class that meets twice a week. Kun Niu: Most students missed the SLO problem because they did not realize their is a second question asking about the maximal revenue. Majority of the students got the revenue function correct and able to find the first derivative I believe that students need to practice word problems in class. And while we are doing word problems together, I	**Action:** Since we saw a very high success rate on this assessment, we would like to try to use a more complex problem to assess this topic in the future. Perhaps a optimization problem focusing on a different concept such as compound interest or a multi-variate problem. (09/07/2019) **Action Category:** SLO/PLO Assessment Process **Follow-Up:** Looking at results from a past final exam, about 55% of students solved a Lagrange Multiplier problem correctly involving the maximization of productivity given constraints with labor and capital spending. Assessing a topic such as this one in future assessments might shed some more light on how students are comprehending more involved topics covered later in the course. (10/14/2019)

Course SLOs	Assessment Method Description	Results	Actions
	different optimal prices. 3 - Complete understanding. Correctly set up and differentiate R(p), correctly solve for the optimal price and successfully evaluated R(p) at the optimal price to find the maximal revenue.	mentioned a lot on the similarity and difference between each problem. I would continuously include classwork in my future class but I will sit down with individual students more often and encourage group work so they can "teach" problems to each other to enhance their learning. (09/07/2018) **Faculty Assessment Leader:** M Granich **Faculty Contributing to Assessment:** Z. Marks, L. Wang, A. Gizaw, K. Niu	