Spring 2012 Transfer Math PSLO Assessment

Background:

To assess the achievement of Program Level Student Learning Outcomes for Transfer Math, we assessed one PSLO in Math 34, Math 50 and Math 75. By using the assessment data we are able to obtain a snapshot of the transfer level math students through the one PSLO, as well as determine areas for improvement in the Transfer Math Program.

The PSLO used in this assessment report is PSLO #3: Problem-Solving Ability. This PSLO was chosen as it is the most consistent PSLO assessed in all three courses whose CSLO assessment has been completed and submitted and results available on the LMC p-drive folder for Course Assessment.

Math 34 is the capstone course for the Transfer Math Program; it is the transfer level math course that about 80% of all transfer students enroll in. This is the first summative assessment of Math 34 finals. The assessment used was completed in Spring, 2008.

Math 50 is the first semester course in the Calculus sequence. This assessment was completed in Fall, 2011.

Math 75 is one of two courses that may be taken after students have completed the Calculus sequence of courses. The assessment was completed in Fall, 2011.

Sampling Design:

The methodology for assessing the PSLO for all three courses was similar in that student work on Final Exams was used as the data for the assessment. In Math 34, a random sample of students' Final Exams were used, in Math 50 the Final Exams for all students were used for the assessment, and in Math 75 all final exams and chapter exams were used.

The assessment of Math 34 was performed by the 11 full and part-time Math faculty who were teaching Math 34 that semester. The assessment was done for 3 CSLO's for Math 34, with a rubric generated by the assessment faculty for the assessment of each CSLO. Five instructors submitted seven class sets of student work on a common Final Exam problem. Final Exams used were made anonymous. The faculty summary of the Math 34 CSLOs was used in this assessment.

In Math 50, only two sections were offered in the Fall 2011, so all final exams were collected and assessed. All exams were made anonymous with regard to the student and the instructor. The faculty summary of the Math 50 CSLOs was used in this assessment.

In Math 75, there was one section offered, so all final exams and chapter exams were collected, and assessed. The faculty summary of the Math 75 CSLOs was used in this assessment.

Method:

PSLO #3: Problem-Solving Ability was used in this assessment. Its description is

a. Reason with and apply mathematical concepts, principles and methods to solve problems or analyze scenarios in real-world contexts relevant to their major;

b. Use technology effectively to analyze situations and solve problems;

c. Estimate and check answers to mathematical problems in order to determine reasonableness, identify alternatives, and select optimal results.

This PSLO is incorporated into the CSLOs of each of the courses in this assessment.

In Math 34, the CSLOs are

CSLO 4: Modeling and Inference (PSLOs: modeling and problem-solving)
Students will analyze data to identify an appropriate statistical model, use technology to perform statistical tests or find confidence intervals, explain the concepts underlying inference, and interpret results in a context. Students will also use correlation coefficients and scatter plots to determine if a linear regression model is appropriate, then find, use, and interpret linear regression models when appropriate.

CSLO 5: The Role of Probability in Inference (PSLOs: modeling and problem-solving)
Students will be able to explain in layman's terms how variability and probability are connected to statistical inference, as well as be able to interpret and apply basic laws and concepts of probability to sampling distributions.

For Math 34: The Statistics Teaching Community wrote common final exam problems aligned with the Transfer Program Outcomes and Math 34 SLO's. These problems comprised at least 50% of each instructor's final exam. Three of the five Transfer Math Program Outcomes were holistically assessed using the students' work on the final exam.

In Math 50, the CSLO used in this assessment is

CSLO #4: Calculus Applications and Analysis (PSLOs 3, 4, 5)

Students will be able to apply differential calculus and introductory integration concepts to create and justify appropriate models of realistic (including scientific) scenarios, and determine the appropriateness and correctness of the results.

In Math 75, the CSLO used in this assessment was

CSLO #3: Linear Algebra Applications and Analysis

Students will be able to apply linear algebra concepts to create appropriate models of realistic scenarios, and determine the appropriateness and correctness of the results.

Technique:

The assessment report for each of the classes was used as data in this assessment of the Transfer Math Program.

In the Math 34 report, we looked at their summary of student work on the Comprehensive Assessment of Outcomes in a First Statistics Course test (CSLO #3 & 4.

In the Math 50 report, we looked at the results for CSLO #4: Calculus Applications and Analysis.

In the Math 75 report, we looked for the results for CSLO #3: Linear Algebra Applications and Analysis.

Results:

The Math 34 data of student work is

CSLO 4: Modeling and Inference:
Relevant questions on the Comprehensive Assessment of Outcomes in a First Statistics Course test (CASO): questions # 21-32, 39, 40.

	Percent correct						
	Min	Q1	Med	Q3	Max	Range	Mean
LMC sample n=100	18.0%	37.0%	45.0%	60.0%	80.0%	62.0%	48.0%
National sample n=1470	18.6%	50.5%	55.9%	64.5%	83.3%	64.7%	55.5%

Analysis of the problem (part b) on the final exam: 13/52 = 25% proficient (score of 3 or greater on the rubric)

CSLO 5: Probability in Inference:
Relevant CASO questions: 16-19, 25-31, 34, 35, 37

	Percent correct						
	Min	Q1	Med	Q3	Max	Range	Mean
LMC sample n=100	9.0%	37.0%	44.5%	61.3%	76.0%	67.0%	47.4%
National sample n=1470	22.4%	48.0%	55.8%	67.3%	80.0%	57.6%	55.8%

Analysis of the problem on the final exam: 21/52 = 40% correctly interpreted P-value

Math 34 Summary results:

On a standardized test, performance of LMC students and the national sample were not statistically different. In other words, the top 25% of LMC students performed at levels comparable to the national sample.
For all of the outcomes, the first and second quartile marks for LMC are significantly lower than the national sample. In other words, for students performing in the bottom 50%, LMC students score significantly lower than the national sample.

Students' written work on the common problem of the final exam highlighted difficulties in the following areas:

CSLO 3 Data Exploration and Representation: the majority of students in the sample either chose an inappropriate graph, drew a graph that did not illustrate the distribution of the variable, or had problems with accuracy when constructing their graphs. Many students did not address the tasks noted in part a. They did not justify their choice of numerical summary or did not include a description of patterns in the data.

CSLO 1 and 2 Data production and Statistical Literacy: the majority of students did not give suggestions for improving the study that addressed fundamental issues of quality data production, such as selecting a random sample or controlling for factors that may be confounding the study.

CSLO 4 Modeling and Inference: the majority of students omitted or inaccurately performed portions of the significance test, such as not accurately stating the hypotheses symbolically or in words, not verifying the conditions for the test, performing the wrong test, choosing the wrong conclusion based on their P-value.

The Math 50 data:

	FA 11
Sample size	60
Mean	2.68
St. Dev.	1.26
Low	1
1st quartile	2
2nd quartile	2
3rd quartile	4
High	5
% proficient or better	48%

Analysis: Both CSLOs were distributed very similarly overall, and both ended up having a 48% proficient or better rate. This was a bit disappointing, but not surprising after looking over all the students' work. There was a surprisingly large difference in the quality of the work of a large number of papers. It appeared that some students didn't get it at all, while some really got it, but with fewer than expected in the middle "proficient" but not "above proficient" range. No instructor effects were accounted for as this was not tracked in order to protect the anonymity of both the students and the instructors. Also, a large number of students did not attempt portions of the assessment question. This could have been due to the fact that the problem appeared last on both instructors' exams.

The Math 75 data:

High Proficiency___4___

Meets Proficiency__18____

Below Proficiency___6___

Analysis: Most students were proficient at applying linear algebra and determining the appropriateness and correctness of their results.

Analysis:

Our assessment of the transfer math students' work on their final exams with respect to PSLO # 3 on Problem Solving Ability is based on these summary results:

Math 34: The majority of the students were not proficient (CSLO #4: 25%; CSLO #5: 40%). These results seem consistent with student scores on the national statistics test.

Math 50: 48% of the students were proficient or better. This result based on the last problem on the final exam, which is suspected as having a large effect on this percentage as many exams had little or no work on this problem; time and fatigue possible factors. Moving the problem to earlier in the exam may result in significantly improved scores.

Math 75: Most students (22 of 28) were proficient.

Closing the assessment loop: improving learning

Math 34: The group of 11 instructors participating in the assessment made the following recommendations for this PSLO:

1. Incorporate more opportunities within the course for students to practice exploratory data analysis, including more work on interpreting graphs, seeing connections between graphical representations, and understanding standard deviation.
2. A follow-up assessment of student work on the common Final Exam from Spring, 2008.
3. The Math Department offer statistics retreats for faculty to focus on the teaching and learning of introductory statistics with a focus on exploratory data analysis and statistical literacy.

Math 50: The instructor participants' recommendations for improvement are:

More work needs to be done to determine what proficiency looks like early in the semester and spend more time with those students who are just below it. More time in Math 50 needs to be given to understanding the definition of a definite integral and its uses. It also may be that the student struggling occurred in large part due to the fact that much of this material appears at the end of the semester. **It is recommended that when assessing these CSLOs again, the assessment team use a more spread out approach** assessing students understanding of a limit both from a differential and an integral lens (CSLO 2). Similarly for assessing

applications and analysis, both the derivative and the integral should be seen to be applied (CSLO 4). This could be done using periodic quizzes instead of the final exam. Finally, if one does use exams to administer assessment questions, it was the instructors' opinions that they should not have placed the assessment questions at the end of the exam.

Math 75: No recommendations regarding this PSLO.

Overall recommendations for improved student learning is that increased course-focused teaching communities are needed and to be fostered and supported by the college, through grants, and initiatives that foster increased student learning and transfer to 4-year institutions.

Instructor Participation:

Instructors participating in the assessment of these courses are a mix of full-time and part-time instructors. Some instructors have participated in Math Department professional development activities that inform and promote use of materials and activities and methods known to foster student learning and understanding of our PSLOs. Increased offerings of this form of professional development seems needed and is recommended; as well as enticements for faculty to participate and incorporate ideas and materials and methods into their classes.