ASSESSMENT REPORT FORM FOR ACADEMIC PROGRAM

Assessment Period: Fall 2016 - Spring 2018

Department/Program: Mathematics Department - Developmental Level

Department Chair: Dr. Randolph Forsstrom

Department Assessment Liaison: Idanis Hayes

Assessment Committee: Afsheen, Akbar, Idanis Hayes, Alinah Malik, and Mark Wiener

Date Submitted:

❖ **Program Description or mission/goal statement of the Department/Program**:

The Mathematics Department-Developmental Level provides the opportunity for students to learn the skills and concepts needed to be successful in college by offering various courses to most efficiently meet students' needs. The Mathematics Department-Developmental Level seeks to foster student success through cultivating students' self-confidence, self-management, and by encouraging a positive attitude; as well as enhancing success through teaching and modeling study skills, problem solving, and critical thinking.

❖ **Program Learning Goals/Outcomes**:
Mathematics Department-Developmental Level has five Program Learning Goals as stated below:
- o PLG1: Demonstrate a working knowledge of the principles of Basic Arithmetic
- o PLG2: Demonstrate a working knowledge of the principles of Basic Algebra
- o PLG3: Develop study and work habits that lead to the success in mathematics and Science Courses
- o PLG4: Develop concise analytical thinking and problems skills that can be applied to their daily lives
- o PLG5: Have an increase in confidence, reduction in anxiety related to mathematics

1. Program Learning Goal(s) or Outcome(s) to be assessed (from the above section):

During this assessment cycle, we will be focused on assessing Program Learning Goal 2 (PLG2), which is to "Demonstrate a working knowledge of the principals of Basic Algebra."

The specific Student Learning Outcomes (SLO) that we are going to assess are SLO #2 and SLO #3 from our MAT 040 course, and SLO #3 from our MAT 048 course. As published in our course syllabi, these SLOs are as follows:

MAT 040 SLO #2

"Simplify arithmetic and algebraic expressions, including exponential expressions and polynomial expressions."

MAT 040 SLO #3

"Solve linear equations and inequalities in one variable and systems of linear equations."

MAT 048 SLO #3

"Solve equations, including linear equations in one variable, literal equations, absolute value equations, systems of linear equations, and quadratic equations."

The developmental mathematics assessment committee, based on input from the entire department, decided to focus on PLG2, MAT 040 SLOs #2 and #3, and MAT 048 SLO #3 because the students need to master these algebra skills to succeed in future math, science, and business classes. Because these skills are so critical to college learning in many areas, we feel that it is important that we use this assessment to evaluate the success of our current teaching strategies with an eye towards continual improvement.

2. Means of Assessment:

The Assessment Committee decided to use open-ended questions instead of multiple choice to examine the variety of solutions that the students applied so that we could assess their understanding of solution techniques. The committee selected the three open-ended final exam questions to assess the objectives.

MAT 040 SLO #2: Simplifying arithmetic and algebraic expressions, including exponential expressions and polynomial expressions.

(MAT 040 exam question 19; MAT 048 exam question 16)

Simplify: $3xy (2xy + 4) - (5x^2 + 1) + (3xy) (2xy)$

<u>MAT 040 SLO #3:</u> Solve linear equations and inequalities in one variable and systems of linear equations.

(MAT 040 exam question 16; MAT 048 exam question 21)

Solve the system of equations:

$4x + y = 31$

$3x - 3y = 12$

(Note: There were multiples versions of this question on the Final Exams to deter cheating, so the examples used in the rubric may have different numbers than those here. The example are constructed to test the same PLGs at the same level of difficulty.

<u>MAT 048 SLO #3:</u> Solve equations, including linear equations in one variable, literal equations, absolute value equations, systems of linear equations, and quadratic equations.

(MAT 048 exam question 25)

Solve: $2 \, |2x + 2| - 1 = 7$

Assessment Tool: We used the rubric below for assessment.

Evaluation Criteria

3-Point Response

The response shows complete understanding of the problem's essential mathematical concepts. The student executes procedures completely and gives relevant responses to all parts of the task. The response may contain a calculation error. The response contains a clear, mathematical or verbal detail indicating how the problem was solved so that the reader does not need to infer how and why decisions were made.

2-Point Response

The response shows nearly complete understanding of the problem's essential mathematical concepts. The student executes nearly all procedures and gives relevant responses to most parts of the task. The response may have minor errors. The mathematical or verbal detail indicating how the problem was solved may not be clear, causing the reader to make some inferences

1-Point Response

The response shows limited understanding of the problem's essential mathematical concepts. The response and procedures may be incomplete and/or may contain major errors. The mathematical or verbal detail indicating how the problem was solved may contribute to questions as to how and why decisions were made.

0 Point Response

The response shows insufficient understanding of the problem's essential mathematical concepts. The procedures, if any, contain major errors. There may be no mathematical or verbal detail of the solution, or the reader may not be able to understand the solution. The reader may not be able to understand how and why decisions were made.

3A. Describe or attach assessment tool (s), including sources of data, timeline for data collection and how data will be analyzed.

With the assistance of previous assessment liaison and the current assessment committee, it was decided that we sample about 30% of the total students who took the MAT 040 Final during Spring 2017 semester. This 30% was applied proportionately per faculty member, so that the individual faculty who taught more students would be more heavily sampled than those who taught fewer students. For example, we took 7 exams from Professor Malik's section, approximately 30% of 22 exams in total for that section. To preserve the anonymity of the faculty, we randomly assigned numbers to the booklets being reviewed and then separated them from the faculty exam folders so that the reviewers could not identify the faculty member whose final exams were being used for the assessment. The coding method was used solely for filing the exam booklets after the assessment project was completed. See Exhibit A for the chart with anonymity codes.

MAT 040 had 434 students take the final exam. We took a random sample of 133 exams (30.6% of 434) and evaluated their performance on questions 16 and 19.

MAT 048 had 168 students take the final exam. We took a random sample of 50 exams (29.8% of 168) and evaluated their performance on questions 16, 21, and 25.

In addition to looking at the performance for each of the two course numbers, we compared the performance of students from MAT 040 to MAT 048 students on each question. We did this to determine if the students in MAT 048 were doing better than those in MAT 040, since the major that they have selected requires higher level mathematics courses going forward.

The reason that we selected question 25 of the MAT 048 exam is that the solution of absolute value equations is a topic new to the syllabus. The committee decided that it was important to examine performance on this new topic.

The assessment committee consisting of Afsheen Akbar, Idanis Hayes, Alinah Malik and Mark Wiener. Idanis Hayes served as assessment liaison. The committee members scored the participating question based on the rubric. The results were then compiled together and are presented in the Exhibit C.

3B. Desired outcomes.

The faculty has established as a baseline goal that at least 70% of students scoring 2s and 3s on each of the questions that we are assessing.

4. Summary of Results (attach aggregated data table, survey tool, etc., to support the summary)

See raw data attached as Exhibit C.

Results of assessment of student outcomes on the SLO of solving linear equations

    1) Simplifying arithmetic and algebraic expressions

The first question under assessment was a question that tested MAT 040 SLO #2, "Simplifying arithmetic and algebraic expressions, including exponential expressions and polynomial expressions." The same question was tested as MAT 040 #19 and MAT 048 #16.

Students from MAT 048 demonstrated satisfactory performance on this question, with 82% exhibiting at least "nearly complete understanding" of the objective. 68% of the students from MAT 040 reached the target level of performance, which is slightly below the departmental goal of 70% success.

The students of MAT 048 demonstrated clear mastery of this topic in the aggregate. The results of MAT 040 were just below the departmental minimum objective, but the 2% shortfall is within the margin of error for this sample of size 133 students.

One explanation for the higher performance of the MAT 048 students is that they are required by their majors require the higher level of mathematics taught in MAT 048. Their willingness to undertake a more demanding mathematics load suggests that they may have greater confidence in their prior knowledge of Algebra. If this is the case, these test results validate their self-assessment.

In our prior assessment ("Academic assessment report for 2014-16"), we did not test this topic, so we cannot compare results directly. On the topic we tested instead, solving linear equations, the success rate in MAT 040 was 86% and that in MAT 048 was 91%.

    2) Solving Linear Systems of Equations

The second question under assessment was a question that tested MAT 040 SLO #3, "Solve linear equations and inequalities in one variable and systems of linear equations." The same question was tested as MAT 040 #16 and MAT 048 #21.

Students from both MAT 040 and MAT 048 demonstrated satisfactory performance on this question, with 74% and 72% respectively exhibiting at least "nearly complete understanding" of the objective. Based on the sample size of the two classes (133 and 50), this small difference in outcomes is not statistically significant.

Closer review of the final examinations revealed that the students used a variety of acceptable methods in reaching the correct results, solving the systems using both the elimination method and the substitution method. This demonstrates a true understanding of the material as opposed to mere rote repetition of a single learned skill. *This outcome is the same outcome that was observed in the 2014-2016 academic assessment.*

In our prior assessment ("Academic assessment report for 2014-16"), we did tested this exact topic, so we can compare results directly. The success rate in MAT 040 was 83% and that in MAT 048 was 77%. Thus, MAT 040 results were significantly better, and those in MAT 048 were also somewhat better.

3) <u>Solving Absolute Value Equations</u>

The third question under assessment was a question that tested MAT 048 SLO #3, "Solve equations, including linear equations in one variable, literal equations, absolute value equations, systems of linear equations, and quadratic equations." This question was tested as MAT 048 #25. (It was not tested on the MAT 040 exam, as the topic is not covered in that class.)

Students from MAT 048 did not demonstrate satisfactory performance on this question, as only 24% of the sampled examples showed at least "nearly complete understanding" of the objective. There was a wide variety of errors observed across the exams. Based on this result, the committee recommends that the department analyze these errors in greater detail with a view to formulating a plan for improving these results.

5. Recommendations for Improvement:

We have no specific recommendation for improvements on MAT 040 SLOs #2 and #3, as the results meet the departmental target goal.

Students from MAT 048 did not demonstrate satisfactory performance on this question, as only 24% of the sampled examples showed at least "nearly complete understanding" of the objective. There was a wide variety of errors observed across the exams. Based on this result, the committee recommends that the department analyze these errors in greater detail with a view to formulating a plan for improving these results. Initial examination has revealed that in this first experiential semester with solving absolute value equations, there has been a disconnect between teaching and testing. It appears that the assigned homework has been insufficient and/or of a lower degree of difficulty when compared with the question(s) on the module test and the final examination. These two elements must be at a more balanced level, an important discovery and outcome from a successful, or fruitful, assessment.

- **Feedback from Dean:**

6. Use of Results:

On MAT 048 SLO #3, the success rate of 24% is far below the target minimum success rate of 70%. We found several areas that need improvement in the preparation that is given to help the students master this topic.

1) Add more homework on this topic in MyMathLab.
2) The review sheets for the final exam did not have any absolute value questions, which likely led the students to ignore the topic in their preparations. This needs to be remedied.
3) The practice tests for chapter 9 did not test this topic, and it should. Add questions on this topic to the practice test material.
4) Disseminate information about the low performance on this topic to full-time and adjunct faculty so that all faculty can try to help their students do better on this topic in the future.

▪ **Feedback from CIE:**

5/21/2018: The results gathered from your thorough assessment project are quite valuable as a springboard for better alignment of SLO#3 with the instruction of the topic provided within the course targeted. As you recognize above, the varied instructional strategies should be shared with all faculty in the Fall 2018 semester, which will result in improved teaching for improved learning. Your assessment committee should consider emailing this information to all full and part time faculty who teach MAT048 so that their students will benefit from your findings.

EXHIBIT A

MAT 040 Spring 2017

Anonymity Code	Faculty	Sections	# of Exams	Sample Size
29	Chiclayo	607LY	5	2
25	Malik	003	22	7
3	Haramuniz	012	22	7
7	Ferrara	026LY	14	4
31	Macchiarola	025LY	10	3
4	Demetrakis	603	15	5
8	Postman	021LS	10	3
19	Scheibe	027LY	7	2
20	Sheacin	00Y	18	5
26	Wiener	001	19	6
10	Muriel	009	21	6
27	Panza	010	22	7
30	Mastellone	008	23	7
11	Malik	002	21	6
13	Bilali	602	20	6
24	Akbar	028	22	7
14	Grasso	601	23	7
21	Hayes	005	26	8
22	Hafizi	011	15	5
82	Gunes	008T	7	2
16	Guiliano	024LY	23	7
28	Chiclayo	004	18	5
23	Chiclayo	006	15	5
68	Pitre	605T	23	7
70	Muriel	30T	13	4

MAT 048 Spring 2017

Anonymity Code	Faculty	Sections	# of Exams	Sample Size
1	Shewciw	002	16	5
5	Panykos	003	25	7
2	Malik	007T	4	1
49	Panykos	001	16	5
12	Mikhail	601	no blue books	
6	Ferrara	009LY	16	5
18	Platt	004	10	3
45	Mastellone	005	16	5
75	Gunes	606T	8	2
100	Pitre	006T	13	4
201	Verma	011T	24	7
103	Encarnacion	010T	20	6

EXHIBIT B

Spring 2016 Assessment Rubric

MAT040/048 Final Exam

MAT 040 SLO #2: "Simplify arithmetic and algebraic expressions, including exponential expressions and polynomial expressions."

(MAT 040 exam question 19; MAT 048 exam question 16)

Simplify: $3xy (2xy + 4) - (5x^2 + 1) + (3xy) (2xy)$

MAT 040 SLO #3: "Solve linear equations and inequalities in one variable and systems of linear equations."

(MAT 040 exam question 16; MAT 048 exam question 21)

Solve the system of equations:

$4x + 3y = 31$

$3x - 3y = 12$

16) $(4x + y = 18)^2 \rightarrow 8x + 2y = 36$
    $3x - 2y = 30 \quad + 3x - 2y = 30$
    $\overline{\frac{11x}{11}} = \frac{66}{11}$
    $x = 6$

$4(6) + y = 18$
$24 + y = 18$
$-24 \qquad -24$
$y = -6$

$\boxed{\begin{array}{l} x = 6 \\ y = -6 \end{array}}$

21) $x + 5y = 7$
    $2x + 3y = 0$
    $x + 5y = 7$
    $\underline{-5y \quad -5y}$
    $x = -5y + 7$

$2(-5y + 7) + 3y = 0$
$-10y + 14 + 3y = 0$
$-7y + 14 = 0$
$\underline{-14 \quad -14}$
$-7y = -14$
$y = 2$

$x + 5(2) = 7$
$x + 10 = 7$
$\underline{-10 \quad -10}$
$x = -3$

MAT 048 SLO #3: " Solve equations, including linear equations in one variable, literal equations, absolute value equations, systems of linear equations, and quadratic equations."

(MAT 048 exam question 25)

Solve: 2 |2x + 2| - 1 = 7

$$25)\ 3|2x-3|-6=9$$
$$+6\ +6$$
$$\frac{3|2x-3|}{3} = \frac{15}{3}$$

$$|2x-3| = 5$$

$$2x-3 = 5 \qquad\qquad 2x-3 = -5$$
$$+3\ +3 \qquad\qquad +3\ +3$$
$$\frac{2x}{2} = \frac{8}{2} \qquad\qquad \frac{2x}{2} = \frac{-2}{2}$$
$$x = 4 \qquad\qquad\qquad x = -1$$

$$\{4, -1\}$$

EXHIBIT C

Topic	Course	SLO	Question	0	1	2	3	Total	% getting 2 or 3
Algebraic Expressions	MAT 040		19	22	21	23	67	133	67.7%
Algebraic Expressions	MAT 048		16	3	6	12	29	50	82.0%
System of Equations	MAT 040		16	24	10	17	82	133	74.4%
System of Equations	MAT 048		21	10	4	5	31	50	72.0%
Absolute Value Equations	MAT 048		25	24	14	5	7	50	24.0 %