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**Trinity Washington University**

**College of Arts and Sciences**

**Outcomes Assessment Report**

**Fall 2014 – Spring 2015 Academic Year**

**MATH 109 – Foundations of Mathematics**

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1. **Introduction**

Objectives: The objective of this Fall 2014 and Spring 2015 Semester report is to assess the small rewrites/revisions to MATH 109 based on the previous Outcome Assessment Report, continue looking at the longitudinal study of the success of 109 students in MATH 110 (the next sequential course) and renew a discussion on possible changes after looking at statistics based on student performance and preference.

Goals: The goals of this report are twofold: to continuously examine and re-examine the content and rigor of MATH 109 to ensure that it is meeting the needs of our students to have a knowledge base of practical math skills and to make sure that Trinity’s completion and retention goals are met without compromising the course integrity or the course content standards.

Courses: MATH 109 Foundations of Mathematics

**Summary of Achievement**:

The main achievement of focus for the Fall 2014 – Spring 2015 (F14-S15) year is the increase in completion for students in MATH 109. We often look at the percentage of students who pass the class out of the subgroup of those who complete the course (defined later as those who sit for the final exam) but looking at the percentage of students who actually complete the course is also of significance and a focus I had after analyzing data from the previous two semesters of MATH 109.

Secondly, the restructuring I proposed in the previous report proved fruitful. Performance on Linear & Exponential modeling went from an average of 58.63% (F13 – S14) to an average of 72.85% (F14 – S15) which is a marked improvement! The current data suggests more changes are needed which will be discussed under the Key Assessments portion.

The basic structure of the class and relevance of topics resonated again with the new data. Delivery of this class in both context and content can be seen in overall performance. Again, I will point to the increase in average with the Financial Literacy section, the first section in the course. For F14 – S15, the average on the first test was 63.75% and this percentage increased to 72.43% on the final exam. Any subject where students perform better on the final exam than on the in class test right after the material has been taught must be something which the students find interesting and useful.

Finally, the longitudinal study continues to show success for students who pass MATH 109 and go on to the MATH 110 Introduction to Statistics. While this data only looks at students who enroll in MATH 110 during the very next semester, a pass rate of 88% of MATH 109 students since the Fall 2013 semester is still quite substantial. As will be discussed in the final section of this report, if you switch from simply pass rate to “C or higher” (which is what most majors require from students in MATH 110), the rate stays strong at 73% of all MATH 109 students taking MATH 110.

1. **Dashboard**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | Students Enrolled and Registered | | |  | Students that Complete the Course | | | |
| Course | Number of Students | Pass Rate | Retention Rate |  | Number of Students | % Completing Course | Pass Rate | Retention Rate |
| Fall 2014 | 38 | 71% | 82% |  | 32 | 84% | 84% | 91% |
| Spring 2015 | 55 | 66% | 76% |  | 45 | 82% | 80% | 85% |
| F14 – S15 | 93 | 68% | 79% |  | 77 | 83% | 82% | 88% |
|  |  |  |  |  |  |  |  |  |
| For Comparison Purposes Only | | | | | | | | |
| Spring 2013 | 44 | 61% | 70% |  | 31 | 70% | 87% | 77% |
| Fall 2013 | 50 | 62% | 86% |  | 37 | 74% | 84% | 92% |
| Spring 2014 | 40 | 68% | 80% |  | 30 | 75% | 90% | 93% |
| F13 – S14 | 90 | 64% | 82% |  | 67 | 74% | 87% | 93% |

**Definitions:**

**Students Enrolled and Registered**: This counts all students on the roster as of the add/drop deadline for the semester.

**Students that Complete the Course:** This counts all students who sit for the final exam, thereby having completed the course.

**Pass Rate:** This represents the percent of students earning a D or better in the class.

**Retention Rate:** This represents the percent of students registered for the next sequential semester.

1. **Report on Fall 2013 and Spring 2014 Semester Outcomes – Students Enrolled and Registered**

***Grade Distribution***

This pie chart on the top of the next page on the left shows the distribution of grades for the Fall 2014 semester and has many positive aspects to highlight. First, the percent of students not finishing the course because of a withdrawal (W) or failing because they stopped attending class (FQ) is down to a combined 16% from 26% in the Fall 2013 semester. Second, the percent of A grades went from 14% up to 24% from Fall 2013 to Fall 2014 and the total percent of students not passing the class decreased from 38% to 29%. While a 29% overall failure rate is still much higher than desired, the fact it is decreasing is a positive sign.

The pie chart on the top of the next page on the right shows the distribution of grades for the Spring 2014 semester and it is much more of a “mixed bag” than the Fall semester. Compared to the Spring 2014 semester where 0% of students achieved an A, seeing 12% here is most exciting. The percentage of students who did not finish the class (again, W and FQ) did decrease from 25% to 20% when comparing Spring 2015 to Spring 2014, but comparing Fall 2014 to Spring 2015 does show an increase for this abandon rate (16% up to 20%). Another interesting aspect of this grade distribution is the 0% of D grades in the class. Most grades were either well into the passing territory with a C grade or well into the failing F grade with no one in the middle ground of these scores. Apparently the Spring semester lived up to the saying, “they either got it or they didn’t.” A pass rate higher than 64% is definitely sought, so the Spring semester continues to be a worry.

Finally, the third pie chart, below, combines the two semesters to give an overview of the second year for the revised MATH 109 content. Overall, compared to the first year of this course, the abandon rate (W and FQ) decreased from 25% to 18% and the percent of students achieving an A or B increased from 25% to 35%. Both of these trends are promising and hopefully they will continue well into the future of this course.

Furthermore, the dashboard on page 2 provides the basic percentages (pass rate and retention rate) for all the previous semesters of this course with readily available data. The data is provided for analysis to show if a trend exists and to give a basis of comparison.

***Retention***

One can see, by looking at the aforementioned dashboard, all of the retention rates are quite high. Even so, they are actually a decrease from the prior academic year and this should be a motivator to target this in future semesters to pull our numbers back up. The retention rate in both semesters is, however, still high above the last reported numbers before the MATH 109 remake.

1. **Report on Fall 2013 and Spring 2014 Semester Outcomes – Students that Complete the Course**

**Pass/Fail Rates**

As can be seen in both the Dashboard on page 3 and the pie charts below, the pass rate for students who persisted through the course to its completion is quite high. While nothing about this data can point to a cause for the success of the class, hopefully the continued revisions to this course have helped increase student interest and involvement, paving the way for these success rates.

**Retention**

When focusing on students who persisted in the course, the retention rates for MATH 109 during the Fall 2014 semester was 91% and during the Spring 2015 semester, actually decreased to 85%. While this is still higher than the 77% rate in the Spring 2013 semester (cited for comparison on the Dashboard on page 3), it was alarming to see a dip in the total retention levels this academic year. Again, none of the collected data can really pinpoint a reason or cause for this. A focused effort to get students to register early for classes next semester and to stay at this institution will take place throughout the next two semesters in the hopes of improving these numbers at least back to the levels of the F13 – S14 academic year.

1. **Key Assessments**

**Test Performance versus Final Exam Performance**

Students were again asked to complete a comprehensive, targeted course evaluation as the fifth Test Supplement in the form of a two-page paper. Students were asked in particular what they felt was the most useful and least useful Test Supplement as well as the most useful and least useful class material taught. The results of three of the five sections of MATH 109 for the Fall 2014 and Spring 2015 (two sections taught in the Spring 2015 semester did not utilize this Supplement) were as follows:

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | Test Supplement | | Class Material Taught | |
| Topic | Most Useful | Least Useful | Most Useful | Least Useful |
| Financial Literacy | 35.85% | 13.95% | 68.49% | 8.93% |
| Unit Conversion, CPI | 37.74% | 20.93% | 9.59% | 39.29% |
| Linear & Exponential Modeling | 16.98% | 34.88% | 6.85% | 8.93% |
| Probability & Statistics | 9.43% | 30.23% | 6.85% | 14.29% |
| Political Math | N/A | N/A | 8.22% | 28.57% |

From this information, it becomes quite evident the Financial Literacy section is appreciated by a majority of students in the MATH 109 classes, whereas Unit Conversion is found to be the least useful topic delivered. What became of interest is how students performed on these topics to see if there was a correlation between what the students found useful and how they performed on those topics.

The following table has two pieces of information for each topic. First, the overall test average (out of 100%) is given for each topic. This includes all students, even those who abandoned the class. Second, the final exam was broken down into the five different topics (since it is comprehensive), the average for every student was obtained for each section, and the overall class average is given. Obviously, this does not include the students who abandoned since they did not take the final exam. The final column shows the percentage difference of the first two columns. Three particular pieces will be highlighted from this information.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  |  |  | Original Test | Final Exam Portion | Difference |
| Financial Literacy | | | 63.75 | 72.43 | 8.65 |
| Unit Conversion, CPI | | | 57.51 | 56.91 | -0.60 |
| Linear & Exponential Modeling | | | 72.85 | 57.24 | -15.61 |
| Probability & Statistics | | | 80.65 | 73.24 | -7.41 |
| Political Math | | | 74.13 | 72.87 | -1.26 |

First, the Financial Literacy portion was the only grade which improved overall from the first test to the final exam. While students would have seen that material more than other topics with Cumulative Review Quizzes given during test weeks, the fact the class average improved and improved drastically with the oldest material in the class is significant. This most likely means the students did indeed start to internalize this material and are able to better perform the required tasks on tests which will hopefully carry over to their everyday life outside of college. From student comments in course evaluations and the fifth test supplement, this material also was the most relatable to students’ lives outside of college and even during college with discussions about loans and credit cards. Since the students found the information relevant to themselves, they invested themselves in the material more which most likely also explains the rise in percentage points. Couple this with the fact these results mirror the previous academic year and the conclusion I reach is that I need to make the other four sections more relatable to students and their lives both in and outside of college.

Second, the Unit Conversion section obviously does need some help. We will start with the positive aspect. Compared to the previous academic year, the percentage on the original test increased 0.75 percentage points and the final exam portion increased 12.34 percentage points. Further, in the previous academic year, there was a 12.29 percentage point drop to the final exam, and this academic year there is less than one percentage point drop meaning the retention was significantly improved. However, while these are all good indicators, the fact both percentages are still below 60% is not encouraging. To attempt remediation to this problem, I am proposing a few changes for the next academic year:

1. This section has homework problems which differ from our in class problems and the test is a mixture of both in class and homework type problems. Attempts will be made to make this much more cohesive so students are seeing the same material in class as they are in their homework and as they will on their exams.
2. A truly flipped classroom approach to this section might be useful. I am planning on making videos of myself going through the PowerPoint Presentations which I normally did in class, and posting those videos online for students to watch. Then, class time will then be used for working on problems instead of learning the material. Hopefully in class work will aid the students understanding.

Third, there is evidence that moving the Linear & Exponential Modeling section to the middle of the curriculum instead of at the end was successful. The original test percentage increased 14.22 percentage points taking the class average from an F to a C performance. This was a very welcome sight and encouraging result. However, seeing the drop off on the final exam by 15.61 percentage points deflated most of that accomplishment. While this is still 3.22 percentage points higher than the previous academic year, it did more than wipe out all the gains from the original test. After analyzing this information and looking at the class structure, changes for the next academic year I am proposing are:

1. Keep the order the same but increase the relevance of the material. While it did seem to benefit students to have this material earlier in the semester where we could spend more time on it, there was obviously no true connection to the students to make them want to remember the material. Create more problems and find more in the homework assignments which the students will hopefully find both interesting and relevant to themselves.
2. The test supplement for this section was the hold over for Logic & Venn Diagrams. Students find the Test Supplements to be helpful in learning the material in more detail but also to make it more relevant to them. For this reason, I want to change Test Supplement 3 to be something relating to everyday life and exponential/linear modeling.
3. Add more review for this topic. Make sure it appears in more of the Cumulative Review quizzes as well as potentially adding a review day for this material before the final exam. Perhaps adding some review worksheets for this material and making them available before the final exam as well.

**Target Topic: Longitudinal Outcomes – MATH 110 Performance for Students From the Revised MATH 109**

Another useful indicator whether MATH 109 is meeting part of its objectives is the performance of the students in the next course, MATH 110. There are two pieces which make this a tricky identifier:

1. Not all students who take MATH 109 are required to take MATH 110, so there will seldom be a semester where a majority of students from MATH 109 will enroll in MATH 110.
2. MATH 109 is one of several courses which can count as a pre-requisite for MATH 110 and was not created exclusively as a feeder course. However, one of the five portions of the course is purposefully directed specifically at MATH 110 content.

Despite these two qualifiers, the success of those who do continue on to MATH 110 is important. The following bar graph shows how students who took MATH 109 in one semester did when they took MATH 110 in following semester. It does not take into account students who take the revised MATH 109 and wait to take MATH 110 during a semester other than the subsequent one.

With three semesters worth of data for students taking MATH 110 immediately after MATH 109, the data is showing a very strong success rate with a total of only four students not passing MATH 110. If, instead of pass rates, we look at students who earn a C or better (meaning they will not have to retake MATH 110 for any major/minor requirements), the percentage stays strong with 75% of students with a C or higher.

1. **Conclusions**

First, all of this evidence points to MATH 109 still being a strong course in both rigor and relevance for students. Initial goals were well met with the initial rewrite of MATH 109, and the tweaks enacted last summer paid dividends this academic year. Based on the above recommendations, tweaks will continue into the next summer to hopefully continue improving this course.

Second, another change suggested for the MATH 109 course is the development of a Test Supplement 5 which relates to the political math element instead of the course analysis/review. I do not know if I will retain the course analysis/review supplement since it does give so much more information than the Moodle Course Evaluations, or if that will be discarded from the course as a result.

Finally, the data collected from these semesters should continue to be collected and analyzed to make sure the course is improving and meeting the needs of the students. Better communication will need to happen between the Specialist and any other adjunct, Specialist or faculty member teaching the MATH 109 course. It should also be decided if we should look deeper into the performance of students in MATH 110 after taking the MATH 109 course. While Statistics as a course is far different than any other MATH course and MATH 109 (as well as MATH 108) have components preparing students for MATH 110, the question remains of if performance in MATH 108 or MATH 109 is truly indicative of how a student will perform in MATH 110.