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**Trinity Washington University**

**College of Arts and Sciences**

**Staff Semester Report.**

**MATH 109**

**Fall Semester 2012**

**Uzi Awret, Math specialist.**

**Introduction:**

**Objectives:** The purpose of this semester report is to evaluate our MATH 109 course and to start accumulating the necessary statistical data that will enable us to improve our course diagnostics and as a result both the student’s mastery and the instructors teaching efficacy of the course. Another goal is producing recommendations based on this semester that can improve the course.

**Course description:**

Math 109 was designed to provide students in the humanities that already master a Math 101s level curriculum with the kind of basic math skills needed for functioning in a modern society.

The course itself is not easy and has about 80% overlap with MATH 108 which was designed for science and health majors. While MATH 108 includes matrices and the factoring of quadratic equations, MATH 109 includes compound interest formulas which are quite intimidating and not always easy to grasp. As a result the course may be a bit more challenging than it was intended to be.

**The course includes five basic components:**

a)Logic , truth tables and critical thinking.

b) Scientific notation, scientific units and order of magnitude calculations, percentages and basic word problems.

c) Compound interest formulas, mortgages, loans, saving formulas and finances.

d) Probability.

e) Exponential Growth and Linear Modeling.

These components do not build on each other and that adds to the difficulty of the course. Different students seem to do better on different component subjects depending on their personal predispositions.

**Course Methods:**

The course is based on an adaptation of the MymathLab pedagogical model including VAK (Visual, Auditory and Kinesthetic) styled classroom lectures, culturally responsive mathematics activities and presentation of mathematical material. (For example, when teaching critical thinking we stress that it is part of education for leadership in an increasingly complex society full of people, media outlets and institutions that will use flawed logical or statistical reasoning to try and get the best of them. I actually start the critical thinking class with the word ‘bamboozle’.)We are in the midst of making this pedagogical approach more rigorous.

**Diagnostics:**

Despite the fact that this course has been taught for many years we don’t have enough useful past summary reports that would enable a vertical comparative analysis .However since the single most important conclusion in this report is to adopt a more structured format similar to the Math 101S Mymathlab based format we should begin to accumulate better statistics.

It is important to be able to gauge improvement in this course in a more systematic way. Unfortunately it is difficult to craft meaningful pre and post-diagnostic tests that can achieve that. One of the biggest challenges that we face in teaching this course effectively is designing proper diagnostic tools. On the one hand it is not exactly an introductory math course (For most of these students it is the second to last math course before MATH 110) and on the other the students who take it have very little math experience.

This summer we plan to produce pre and post-diagnostic tests that will gauge each of the 5 component subjects. The test should have 5 components:

1. Questions designed to assess improvement in critical thinking. This will probably will be the hardest part to design but its possible.
2. Questions designed to test mastery of scientific thinking, powers of ten, percenteges, units, scientific word problems and so on. This should be straightforward.
3. Questions that assess improvement in financial thinking including personal finances, budgets, interest, stocks, bonds and more. This should also be quite straightforward except questions about compounding which most students know very little about to begin with.
4. Questions that gauge improvement in probabilistic thinking. These should not pose too many problems.
5. Questions that gauge improvement in understanding of exponential vs. linear processes, graphs and linear modeling. Again this should be quite straightforward.

Looks like assessment of critical thinking and logic will be the most tricky one. One of the things that I would like to see eventually is a way to assess the students ability to understand A Scientific American article from the 70’s in something like Geology with graphs and charts. You do the pre-diagnostic test in the first semester and the post-diagnostic one in your senior year. However this is a separate project.

**Curriculum:**

The course’s two sections were taught by two instructors, Uzi – section 03 -, and Paul – section 01-. We tried to coordinate the teaching as much as possible. The most significant difference in the material taught was that section 03 was taught the chapter on Probability following the required curriculum and section 01 concentrated on introductory statistics instead. That difference in curriculum can be attributed to a discrepancy between the Course Paper Book and the corresponding Ebook. Live and learn. The tests and final exams were different. The Final in section 03 consisted of a substantial home review assignment that was averaged with the in class final exam and the final consisted of 60 problems while the section 01 final exam consisted of 11 problems with more individual sections. Section 03 received 2 whole period tests (excluding final) while section 01 received three. (excluding final). Also, section 03 received 4 extra hours of preparation for the tests to compensate for inclement weather, (I even offered throwing in a pizza) but less than 5 students showed up. Another difference between the two sections was that section was 03 was assigned a 5 point paper on either exponential growth (from population growth to Moore’s law and the effect of an exponentially increasing computational capacity on our immediate future.) or the history of Probability theory. Section 03 was also challenged with another extra credit assignment consisting of a beautiful riddle from game theory (with pirates and gold coins) unfortunately no one was able to solve it.

**Outcomes:**

**Grade distribution:**

**grade distribution of the whole class**,

 All 48 students including withdrawals.

Because of the differences between the two sections I am including the two individual sections’ pie charts.

**Grade distribution for section 01**

 This distribution is based on 24 students. The average class grade was 62.

 **Grade distribution for section 03**

This distribution is also based on a total of 24 students. The average class grade was 72.

There is not enough data to attribute statistical significance to the difference between the average grades of the two sections. (Certainly not without a better assessment of the state of the student’s prerequisite knowledge.)

 **RECOMMENDATIONS**

1. As a math specialist I need to improve coordination between the different instructors. Mymathlab enables us to give similar exams with slight differences. Next semester I will be teaching both sections so the coordination should improve.
2. Most of the students taking the course need a more structured approach including daily quizzes. I am working on making this course as similar to 101S as possible.
3. It is important to be able to gauge improvement in this course in a more systematic way. Unfortunately it is difficult to craft meaningful pre and post-diagnostic tests that can achieve that.
4. We may want to consider increased cooperation between MATH 109 instructors and critical reading instructors especially when it comes to word problems and short scientific essays. The course book is quite good and I recommend finding ways that force the students to become more engaged with the book.
5. I believe that it is crucial to identify and monitor basic mental operations that are crucial to scientific thinking and critical analysis like ‘the smallest thing that is still bigger than’, mental inversions and more. Some of these deficiencies can be corrected with special video games and need to be tackled directly otherwise they persist into MATH 110 and beyond.
6. decomposing complex problems into more manageable bits, looking for similar simpler problems that they still cannot solve. I teach my physics students that this kind of reduction that enables students to identify the source of their own ignorance and have an honest self assessment of what they don’t know is the secret of problem solving and proactive learning in general. That is, identify the simplest problem that they you still cannot solve and start from there by using the appropriate resources.
7. We need to compare the performance of students that placed directly into MATH 109 to the students that passed MATH 101S and also search for correlations between their performance in 101S and 109.
8. We need to analyze student performance on the separate course components to see if there are more problematic components. A cursory analysis of the results failed to pick out one obvious component that was more problematic than the others. In any event Mymathlab is ideally suited for such differential evaluation and monitoring, and we should take advantage of that.
9. External benchmarks. We need to be able to compare our course to similar courses produced in well established math departments like Bellwether award winners Cleveland State C.C. and Jackson state C.C. and compare our passing rates to well established national standards. This will take a bit of searching because of the peculiar structure of the course. If we find something that we like it may be worth changing our curriculum a little bit if it will result in sound assessment that is based on more objective standards.

**Addendum**: More detailed information is attached in the next Excell sheet.

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | LLetter Grade | Overall Grade | Grade on Final Exam | Home-work Grade | Exams Grade | Prob, Expon. Growth paper. | % Atten-dance | Month-Year | Arith | Elem Alg |
| 1 |  W | NA | NA | NA | NA | NA | 17 | Jan 2012 | 20 | 21 |
| 2 |  B+ | 85.2 | 92.8 | 93.1 | 82 | 50 | 83 | Aug 2012 | 64 | 60 |
| 3 |  D | 66.9 | 74 | 55 | 76 | 80 | 73 | Jun 2011 | 93 | 38 |
| 4 |  A- | 89.5 | 86.5 | 98.1 | 82.9 | 80 | 100 | Jun 2012 | 20 | 64 |
| 5 |  D | 63 | 57 | 64.6 | 59.7 | 80 | 80 | Jun 2011 | 22 | 22 |
| 6 |  D | 61.2 | 75 | 53.7 | 74.6 | 0 | 87 |  |  |  |
| 7 |  F | 58.7 | 68 | 71.8 | 48.1 | 50 | 73 | Apr 2011 | 44 | 26 |
| 8 |  C | 72.7 | 61 | 76 | 72.4 | 50 | 80 |  |  |  |
| 9 |  B- | 78.7 | 74 | 87.9 | 70.4 | 80 | 97 | Jul 2012 | 49 | 66 |
| 10 |  C | 73.5 | 67 | 87.2 | 64.1 | 50 | 83 | Jun 2012 | 20 | 58 |
| 11 |  W | NA | NA | NA | NA | NA | 63 | Jun 2012 | 48 | 82 |
| 12 |  C+ | 77.7 | 74 | 86 | 70.1 | 80 | 90 |  |  |  |
| 13 |  D+ | 65.7 | 68 | 67.5 | 65.8 | 50 | 73 |  |  |  |
| 14 |  B | 81.4 | 80 | 89.6 | 77.6 | 50 | 93 | Apr 2012 | 40 | 52 |
| 15 |  C- | 71.1 | 74 | 71.1 | 68.1 | 50 | 77 | Apr 2011 | 31 | 30 |
| 16 |  W | NA | NA | NA | NA | NA | 27 |  |  |  |
| 17 |  A- | 89.6 | 87 | 95 | 79.7 | 100 | 93 | Jul 2012 | 80 | 50 |
| 18 |  D+ | 67.5 | 72 | 63.8 | 72.7 | 50 | 90 | Jul 2011 | 32 | 44 |
| 19 |  C+ | 77.5 | 73 | 86.6 | 66.8 | 100 | 93 | May 2012 | 52 | 65 |
| 20 |  B+ | 87 | 92 | 90.6 | 87.9 | 50 | 93 | Aug 2012 | 88 | 67 |
| 21 |  B- | 78.3 | 82 | 86.1 | 74.6 | 50 | 80 | Jul 2012 | 70 | 69 |
| 22 |  F | 56.7 | 62 | 48.2 | 64.9 | 50 | 77 | Jul 2011 | 38 | 54 |
| 23 |  C | 73.4 | 63 | 85.5 | 61.9 | 80 | 90 |  |  |  |
| 24 |  F | 53.4 | 45 | 53.9 | 50.1 | 80 | 80 | Dec 2011 | 30 | 37 |
| 25 |  W | NA | NA | NA | NA | NA |  ---- | Jul 2012 | 40 | 55 |
| 26 |  D | 61 | 38 | 77.3 | 68 | NA |  ---- | Apr 2011 | 44 | 26 |
| 27 |  A | 91 | 87 | 93.17 | 93 | NA |  ---- | Jun 2011 | 80 | 92 |
| 28 |  W | NA | NA | NA | NA | NA |  ---- | Apr 2012 | 32 | 61 |
| 29 |  W | NA | NA | NA | NA | NA |  ---- | Aug 2012 | 58 | 65 |
| 30 |  F | 24 | 0 | 24.75 | 38 | NA | 75 | Jul 2011 | 45 | 31 |
| 31 |  B- | 83 | 78 | 78.33 | 87 | NA |  ---- | Jul 2012 | 70 | 62 |
| 32 |  F | 15 | 0 | 18.33 | 23 | NA | 25 | Jan 2012 | 74 | 56 |
| 33 |  D | 61 | 47 | 49.08 | 74 | NA |  ---- |  |  |  |
| 34 |  A | 90 | 94 | 94.25 | 85 | NA |  ---- | Jul 2012 | 69 | 67 |
| 35 |  W | NA | NA | NA | NA | NA |  ----- |  |  |  |
| 36 |  F | 41 | 24 | 19.17 | 60 | NA | 75 | Jul 2012 | 22 | 68 |
| 37 |  D | 66 | 67 | 64.25 | 67 | NA |  ---- | Jun 2012 | 60 | 43 |
| 38 |  W | NA | NA | NA | NA | NA |  ---- |  |  |  |
| 39 |  C- | 68 | 89 | 39.67 | 67 | NA |  ---- |  |  |  |
| 40 |  F | 25 | 15 | 31.17 | 29 | NA | 90 | Jul 2012 | 25 | 49 |
| 41 |  F | 0 | 0 | 0 | 0 | NA | 0 | Aug 2011 | 64 | 40 |
| 42 |  F | 36 | 45 | 11 | 40 | NA | 90 | Jul 2012 | 63 | 60 |
| 43 |  B- | 79 | 96 | 22.42 | 91 | NA |  ---- |  |  |  |
| 44 |  C | 75 | 75 | 67.67 | 78 | NA |  ---- |  |  |  |
| 45 |  D | 56 | 50 | 49.67 | 63 | NA |  ---- | Jul 2011 | 30 | 39 |
| 46 |  D | 64 | 54 | 63.5 | 71 | NA |  ----- | Apr 2011 | 37 | 36 |
| 47 |  W | NA | NA | NA | NA | NA |  ---- |   | 22 | 53 |
| 48 |  C- | 69 | 61 | 64.58 | 76 | NA |  ---- | Jul 2012 | 43 | 51 |