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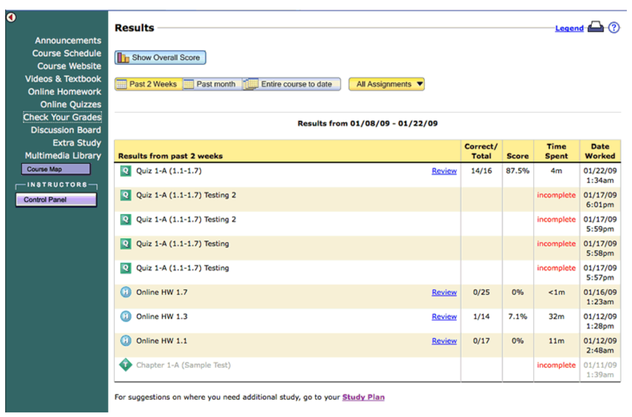
1. Introduction

Our research centered on whether or not the following changes made to the Pre-Calculus Algebra class positively affected student performance:

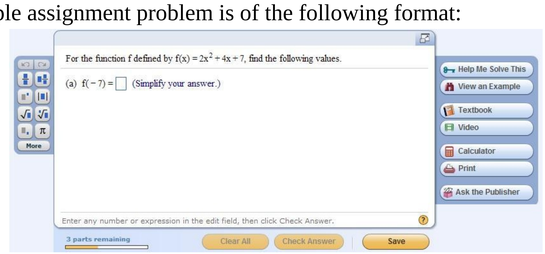
Prior to Fall 2004
- Lecture occurred three times a week
- Some graded homework and quizzes made by each instructor (0-2 per week)
- Individual instructors decided what material was covered and how far class progressed in terms of chapters
- Individual instructors made tests
- Common final exam
- No dedicated Math Learning Center

Fall 2004 and beyond
- Lecture two times a week
- Graded assignments every week (2-4)
- Uniform schedule concerning when chapters are covered
- Tests are written by coordinator and common
- Final exam is common for all students
- 3 hours in Math Learning Center required each week

In Fall 2004, a new way of distributing and grading student homework was introduced to the students of Pre-calculus Algebra. This new program was an online homework system called Course Compass with MyMathLab, and was designed to make it easier for students to get instant feedback on homework. Students are allowed to work homework problems within an assignment as many times as they need to feel comfortable with material until the set due date and time. Once a student has started on an assignment, the time spent working on it, the number of questions correctly answered, the percentage correct, and the date the assignment was worked on will display. A student view of the software's home screen is seen below.



A sample assignment problem is of the following format:



At the start of our research, the main question was whether or not this software was a worthwhile investment for the student and university. After beginning, data collection we saw that two trends were highly visible.

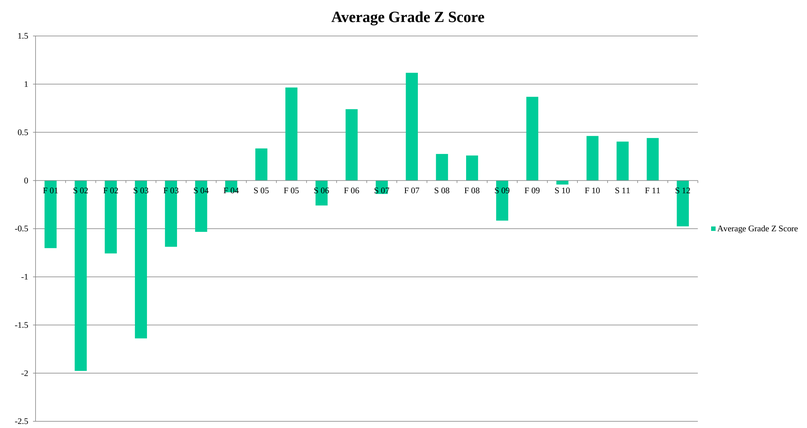
2. Method

For each section of Pre-Calculus Algebra from Fall 2001 to Spring 2012, we started by converting each student's letter grade to a number (A=4, B=3, C=2, D=1, F=0, W=0). After We then took the average of those numbers to come up with each section's average grade. We also divided the number of students who made a 2 or better by the total number of students in the class to come up with the percentage of students who passed and could continue on to the next math course. The section grades were then averaged for each semester. Passing percentages were also averaged for each semester. The corresponding semester averages were used for comparison to the overall mean grade for eleven years as well as the overall mean passing percentage. For the comparison, all scores were standardized by method of z-scores. Each semester's average grade/percentage had the corresponding population average subtracted from it, then was divided by the standard deviation, as seen in the formula below.

$$z = \frac{X - \mu}{\sigma}$$

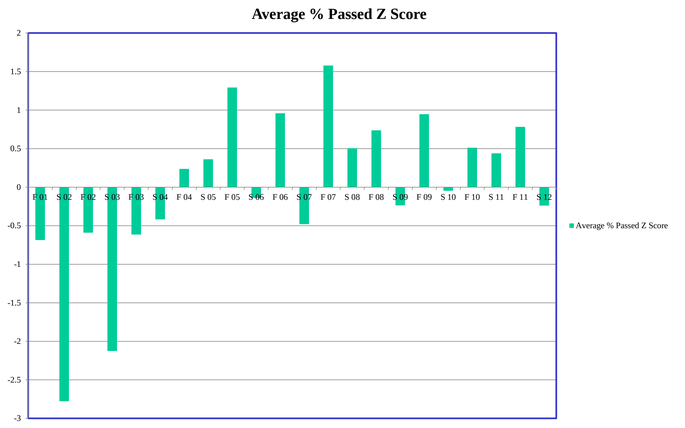
Using this method allowed us to easily see how many standard deviations away from the population average a semester's score was. The resulting graphs of these z-scores show how changes occurred across twenty-two semesters of data, and whether the changes were positive or negative.

3. Results

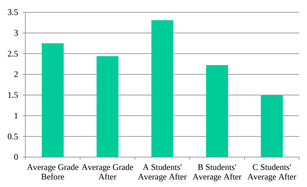


Before Course Compass was added to the coursework of students, each semester's average grade was below the 11-year average. After Course Compass was introduced in Fall 2004, average student grades improved with the exception of most Spring semesters. The average class grade for the eleven year period was a 1.87 on a 4.0 grade scale with a standard deviation of .45185 . The average grade for each semester ranged from a low of 0.98 in Spring 2002 to a high of 2.38 in Fall 2007.

3. Results (cont.)



Overall, the percentage of students passing the course has improved. The six semesters looked at before Course Compass was introduced were all below average in their percentage of students passed. After Course Compass was implemented, the majority of semesters were above average in percentage passed, with Spring semesters being the only semesters below average. The average percentage passed across all sections was 59.9% with a standard deviation of .10249 . The average percentage of students passed in a single semester ranged from a low of 30.1% in Spring 2002 to a high of 74.8% in Fall 2007.



It was also noted that students' grades decreased by between .50 and .78 grade points in their next math course across the eleven year period. Students with a 4.0 dropped to an average of 3.31; those with a 3.0 dropped to an average of 2.22; and those with a 2.0 dropped to an average of 1.49. The average grade of all students tracked over time went from a 2.75 in Pre-Calculus Algebra to a 2.44 in their next math class.

4. Conclusions

It appears that the Course Compass software has improved student performance since its introduction in Fall 2004. More students seem to be completing the class with better grades. Further research may be conducted to determine what variables may be affecting student performance in Spring semesters, as well as obtaining actual student feedback on the software itself.

Acknowledgments

This research was funded by the RCEU program with funds provided the Presidents/Provosts office, funds provided by the Vice President for Research, funds provided by the Chemistry Department through their patent account, and external funding from the Alabama Space Grant Consortium.