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College Algebra - Large Section Versus Traditional Size

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COLLEGE ALGEBRA – LARGE SECTION VERSUS TRADITIONAL SIZE

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ABSTRACT

The economic crisis facing our nation forced many companies and universities to downsize and learn to operate with smaller budgets. Valdosta State University (VSU) was not immune to this economic crisis. To deal with this crisis VSU started offering large sections of core area courses, including College Algebra (MATH 1111). It is clear from a financial point of view that large sections will benefit the university during this financial crisis. What was not clear was the impact to student learning and success in College Algebra. In the fall 2010 and fall 2011 terms, VSU offered the first large sections of Math 1111 with 150 and 175 students, respectively. The course retention rate and the students' performance on the departmental final exam for the treatment group, Large Section (LS), versus the control group, Traditional Section (TS) of 35 students, were compared. The LS had a statistically significant higher retention rate and departmental final exam average.

INTRODUCTION

Because it is a core requirement, college algebra is one of the most widely taken courses. Students find it very challenging and many have to withdraw from the course once or twice before they are successful. There is a nationwide effort to improve education in general, including college algebra. There is constant pressure from the government to improve student performance at all levels of primary and secondary education (1), and soon to come, higher education. Still the fact remains, that our students are not prepared for college algebra. Universities offer a variety of additional instruction through centralized tutoring, including online tutoring, to help the students succeed. A student taking college algebra in a smaller classroom size will have a higher chance of succeeding versus LS because of more individual attention. One may think that students that find college algebra very challenging should avoid registering for a LS. A LS will only add to the challenges of the course, making it even more difficult to succeed. If a LS in college algebra is designed correctly it may have the same success or even higher than a small size-class. The

designing of such a course requires a great deal of thought about the means of delivering the course and the way the course is managed.

At higher education institutions, part of our job is to assess our core area and course degree programs and make relevant changes. Universities across the country are introducing new ways of teaching college algebra in order to improve the success rate of students. Some of these new methods are the number of lectures a week (2), online courses, software-based classes (3), using the Supplemental Instructor (SI) Leaders method (3), and graphing calculator-based, and computer-based classes (5). Even though these methods are very successful and help many students succeed, there is still a need for new ways in which to help more students succeed.

Fall semester, 2010, Valdosta State University offered the first LS in college algebra with a particular interest to us: (a) Would students registering in LS instructional delivery method have a different retention rate in College Algebra than students registering in TS instructional delivery method, and (b) Would students registering in LS instructional delivery method perform differently in College Algebra than students registering in TS instructional delivery method as evidenced by the score earned on the common departmental final examination.

LARGE SECTION (LS)

A super section of Math1111, College Algebra, was taught twice: once with an enrollment of 149 and once with an enrollment of 174. We began prepping for the class months ahead of time by typing up my lecture notes. These notes were designed to complement the textbook. They were inclusive of all definitions and theorems. We included the examples that we wanted to be worked out during class; however, these were not worked in the notes. Blank spaces were left in the notes so that these could be worked either by us in class or by the students in class as practice.

In a big lecture hall, students may not always be able to see to write all the notes from a board. We thought it would be best for them to have the notes ahead of time so that we could discuss the material and they could listen and comprehend instead of worrying about copying. We left the blanks so that we could do the problems together. Also, it is not only important for us to work problems, but for the students to have time during class to practice problems as well. This gives them more confidence to do their homework.

The management system MyMathLab (6) was used for the course. This is a system that went along with our textbook and is from Pearson Education. The previously mentioned notes were made available to the students through this delivery system. Also, all homework and quizzes were assigned through MyMathLab. MyMathLab also had an online grade book which allowed the students to be aware of their grade at all points during the semester up until the final. To encourage the students to do their online homework, we made sure that it counted as part of their grade. Every professor has his own preferences, but we chose to count it as 14% of the semester grade. Knowing

that there is a correlation between students practicing math problems and doing well in the course, we wanted to motivate the students to do more practice problems. While doing their homework with MyMathLab students had the options of viewing a similar problem, viewing short videos, and seeing problems solved. With these aids, students had options when they were stuck on a homework problem. They did not have to wait until the next class period to ask us. There were also video lectures available on each topic so that the student could reinforce what was taught in class if needed. These videos could be used if a student had to miss class. The first time we taught the large class the average homework grade was 78.9% and the median was 85.3%. The second time we taught the course the average was 73.9% and the median was 84%.

As mentioned earlier, we also used MyMathLab for administering quizzes. we gave six quizzes both times we taught the class. We made each quiz worth 2% of the final grade, totaling 12%. These were done at each student's convenience at home with a due date and a three hour time limit. The quizzes served as practice exams for the in-class tests. To encourage the student to do more problems and hence practice more problems, we allowed them to take the quiz up to three times and took their highest quiz grade. MyMathLab would generate different, yet similar, problems for each quiz. Unfortunately, we found that the majority of students did not take advantage of this "three chance" opportunity. Both semesters the quiz average was 53.6%. The first year's median was 57.2% and the second's was 57.7%. Considering the quizzes were at home with open books and notes with three hours and three chances to take them, we were surprised by the averages. We picked the problems from the same problem bank on MyMathLab that we used for the homework. In fact, many of the problems only had one number changed. When we examined the results more closely, we discovered that there were usually 1-20 students in the class who did not attempt the quiz and therefore got zeroes. This brought down the averages and medians.

Another factor that is directly correlated with a student's grade is class attendance. Because of this, we made attendance mandatory. Role was taken every day. Students who missed more than 20% of the class received an automatic F for the course. This is university policy at our school. For a 3-day a week semester course, 9 days would be the maximum number of classes a student could miss. We made attendance 3% of the semester grade and gave the students either 0, 1, 2, or 3% based on their attendance.

One problem with such a large class is the loss of individuality of the students. They sometimes feel removed from the teacher and are reluctant to come by during office hours and ask questions. We started going to class 15-30 minutes early. We would walk around the classroom and talk with the students. We would ask if they had any questions and if the material was going OK. If they had no math questions then we would just walk around before class and try to talk to different groups of them. Sometimes they'd talk about what town they were from or what football team they like; just something to

make them feel more comfortable in such a large class setting. We wanted them to feel comfortable talking with us and with asking us questions. As the semester progressed, that time was spent answering more and more math questions. However, we had a hard time getting them to come to our offices though, but at least they were asking us questions.

We gave the class only three regular exams. We would have loved to give them more exams, but in classes this large it is very hard to do. On exam day the students had to arrive to class early because IDs were checked before they could enter and take the exam. When one teaches a super-section class, you have to be sure that it is the actual student who is taking the exam. Once everyone is in the room, we counted the number of students and double checked that number with the number of people who had checked in with them. We also needed that number to verify the number of exams handed in. The tests each counted 17% of the grade for a total of 51%. The first year's class had an exam average of 68.9% with a median of 70%. The second year's class had an exam average of 73.4% with a median of 75.7%.

The final exam for the course is a departmental exam. The same exam is administered to every student taking the course each semester. This exam counted as 20% of the final grade for the students. We wanted to give them ample time to review and study for this exam. We timed the course so that when the last exam was given we had Thanksgiving Break and then had four class days left. We posted the review material for the final on MyMathLab for the students to work on over their break and we spent the last four days answering questions and reviewing. Our class average was 69.9 the first year and 65.32 the second year.

DATA COLLECTION

During registration the LS classes were listed under college algebra – Large Section. The students had a choice of which class to register for, a Large Section class or a Traditional Section class.

At the end of each semester, we collected data and reported the sample size (n), the mean ($\bar{X}$), and standard deviation (sd) on the Departmental Final Exam. Table I summarizes the data.

Table I. Data collected on the performance of LS class VS. TS class.

Method of Content Delivery	Final Exam $\bar{X}$ / sd / n	Semester
Large Section	69.90 / 15.96 / 149	Fall 2010
Traditional Section	65.86 / 16.55 / 1474	Fall 2010
Large Section	65.32 / 16.47 / 174	Fall 2011
Traditional Section	63.30 / 16.92 / 1372	Fall 2011

At the end of each semester we compared the mean on the Department Final Exam between the two groups. Table II summarizes the comparison of final exam means.

Comparison 1- Null Hypothesis: There does not exist a statistical difference between the means on the final examination for the two groups.

Table II. Hypothesis Testing for the Final Exam Means between LS vs. TS.

	Fall 2010	Spring 2011
Large Section Mean	68.90	65.32
Traditional Section Mean	65.86	63.30
Test statistic	$Z = 2.2081$*	$Z = 1.5193$
P-value	$P = 0.0272$*	$P = 0.1286$
Note: Positive test statistic indicates the mean for the LS method sections was higher. *Indicates the result was statistically significant at $\alpha = 0.05$. **Indicates the result was statistically significant at $\alpha = 0.01$. We have enough statistical evidence to reject the null hypothesis and accept the alternative that the two means are significantly different.		

A departmental final examination consisting of 50 multiple-choice items was administered at the end of the semester. A two-tailed Z-test was used to test the null hypothesis.

Comparison 2 - Null Hypothesis: There does not exist a statistical difference between the retention rates between LS vs. TS Classes.

	Fall 2010	Fall 2011
Large Section $\bar{P}$	79.87%	82.76%
Traditional Section $\bar{P}$	77.42%	84.57%
Test statistic	$Z = 0.6852$*	$Z = 0.6229$
P-value	$P = 0.4932$*	$P = 0.5333$
Note: Negative test statistic means the proportion for the TS was higher. *Means the result was statistically significant at $\alpha = 0.05$. **Means the result was statistically significant at $\alpha = 0.01$.		

CONCLUSION

From the hypothesis testing on the retention rate there is no statistical evidence that the Large Section classes have higher retention rate than the Traditional Section classes. However, the hypothesis testing for the means indicates that there is statistical evidence that the mean of Large Section classes is higher than the mean of Traditional Section classes.

Our results show that a Large Section can be as successful, if not more so, than a Traditional Section. Note, we are not saying that this is the best delivery method for a course such as College Algebra. We are saying that good results can be obtained in Large Section if care is taken in how the course is managed and the material presented. Also, the instructor has to be willing to personalize the course so that the student doesn't feel like a number. Care must be taken to keep all students involved and to make sure that assignments are completed. Our case study shows that with precautions and planning, Large Section courses in mathematics can be even more successful than Traditional Section.

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