COLLEGE ALGEBRA – ONLINE SECTION VERSUS TRADITIONAL SECTION

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ABSTRACT

The 21th century is considered to be the electronic age. This electronic age brings opportunities for new ways to deliver a lecture or a whole course in higher education. By offering courses online, universities are trying to reach the population of students that cannot attend classes on campus. Professors also utilize technology in a variety of ways to help them teach traditional classes.

Valdosta State University (VSU) offers a variety of courses online including College Algebra (Math 1111). While we are trying to reach more students through the online courses, we should also examine the impact to student learning and success in College Algebra. In the fall 2016 and spring 2017 terms, VSU offered the first online sections of Math 1111 with 27 and 23 students, respectively. The course retention rate and the students' performance on the departmental final exam for the treatment group, online section (OS), versus the control group, traditional section (TS) of 350 students, were compared. The OS had a statistically significant higher departmental final exam average, but there was no statistically significant difference in retention rate.

Keywords: college algebra, online course, traditional course, college mathematics, computer uses in education, mathematics education

INTRODUCTION

Because it is a core requirement, College Algebra is one of the most widely taken courses at Valdosta State University. 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 (The National Council of Teachers of Mathematics 2004), 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 traditional section (TS) will have a higher chance of succeeding versus an online section (OS) because of more individual attention. One may think that students that find College Algebra very challenging should avoid registering for an OS. An

OS will only add to the challenges of the course, making it even more difficult to succeed. If an OS in College Algebra is designed correctly, it may have the same success or even higher than a TS. 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 courses and 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 include increasing the number of lectures a week (Lazari 2007), offering online courses and software-based classes (Lazari and Simons 2002), using the supplemental instructor (SI) leaders method (Lazari and Simons 2002), and offering graphing calculator-based and computer-based classes (Interactive Mathematics 1997). 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.

During fall semester, 2016, Valdosta State University offered the first OS in College Algebra with a particular interest to us. Would students registering in an OS instructional delivery method have a different retention rate in College Algebra than students registering in a TS instructional delivery method? Would students registering in an OS instructional delivery method perform differently in College Algebra than students registering in a TS instructional delivery method as evidenced by the score earned on the common departmental final examination?

ONLINE SECTION (OS)

An online Math 1111 course was developed during the summer of 2016 and has been offered the succeeding semesters. It is an 8-week course that covers all the concepts that a traditional 15-week course teaches which means the content is fast-paced. There is no prerequisite for the course. However, those students who have the most success in the course have a good background in algebra from high school and have good study habits.

The course is offered through Blazeview. All discussion boards, a gradebook, an introduction board, course software, and course information is posted on the Blazeview server. At the beginning of the course the instructor introduces herself and encourages each student to introduce himself and to share any interests, concerns, etc., with his peers via an introduction board. Within each content module is a discussion board which is initiated by the instructor. A student must participate with the dialogue in each discussion board by sharing his ideas and also give at least one meaningful contribution to the topic for the week. Discussion boards are created throughout the semester and are used to ask students for explanations to check their understanding and to encourage mathematical discussions between the students. The boards are communication tools that help the students feel like part of a group, share ideas, help others, and form study partners.

All assignments, including quizzes and exams, are done through the use of an online course management software by Pearson Education, MyMathLab, which is linked to the Blazeview server. No textbook is required for the course. An ebook is provided by the MyMathLab program as well as a lecture video for each section. The student is expected to purchase an access code to gain admission to MyMathLab. The access code is purchased through Blazeview, not from the Pearson website. Complete instructions for obtaining the code and registering for the course are provided in the *Getting Started* folder. In addition, each student needs a TI-83 or TI-84 graphing calculator.

The course consists of eight modules—six content modules and two exam modules. The student must complete one module per week. The student works at his own pace through the assignments in each module. Each content module contains assignments that help the student achieve success for goals that correspond to five sections of the ebook and a quiz. A student works through the module as his time and skills permit. A student may complete the assignments within a module at the beginning of the week, work on them throughout the week, or complete them near the end of the week. Once a student has mastered a concept, he is able to move on without having to wait for the other students in the class. The software provides opportunities for a student to work similar problems for more practice when needed, develop a study plan based on his responses, and develop a self-check quiz. At the end of the week, the student takes a quiz on the content of the module. The student's study habits are developed by him taking responsibility for his progress. The instruction is individualized since, when the instructor works with that student, attention can be focused on the items that are more difficult for that particular individual. Through the use of the MyMathLab software, the instructor can monitor student progress, time on task, and objectives that a student needs to master.

There are two exams required for the course. Both are monitored exams and can be taken free at the university testing center or the student can register with the Proctor U monitoring service online for a small fee. Module 4 is to be completed during the 4^{th} week of the course and consists of the preparation and taking of the midterm exam. The midterm exam covers all objectives from Module 1 through Module 3. Module 8 is to be completed during the 8^{th} week. This module is the preparation and completion of the final exam, which is a comprehensive exam for all objectives for Modules 1 through 7. Both exams are password protected and are given through the MyMathLab software.

Students have access to an embedded tutor provided by the Student Success Center. The tutoring service is free. Each week the tutor devotes 7–10 hours to helping students. The software program Blackboard Collaborate is used in this course for tutoring sessions. At the beginning of the semester the student must download the software and purchase a set of headphones with a microphone. The instructor is available at least one hour each day to offer instructional support to the students. The Blackboard Collaborate program can be used by the instructor for live demonstrations of concepts or graphing calculator exercises. We use a Wacom tablet to communicate with the student. A touch-screen monitor is another option for a teaching tool. Through the use of the gradebook feature of MyMathLab and the availability of the instructor, the student gains immediate feedback on their progress and is aware of his success at all times.

Future plans for the class are to produce live videos of the instructor teaching each lesson and posting the videos online. The student will then have these videos, the videos provided by Pearson, and an ebook for study material. In addition, the university is planning to offer free tutoring by a professional online tutoring service to help students succeed.

DATA COLLECTION

During registration the students had a choice of which class to register for, an online section class or a traditional section class. At the end of each semester, we collected data and reported the sample size (n), the mean ($\overline{x}$), and standard deviation (sd) on the departmental final exam. We also collected the total enrollment for each section in order to compute the retention rate. Table I summarizes the data.

Table I. Data Collected on the Performance of the OS Class versus the TS Class

Method of Content Delivery	Final Exam $\overline{x}$ / sd / n	Number Enrolled	Number Taking the Final Exam	Retention Rate	Semester
Online Section	65.94 / 20.44 / 18	27	18	66.67	Fall-2016
Traditional Section	57.96 / 16.19 / 671	833	671	80.55	Fall-2016
Online Section	62.00 / 15.95 / 16	23	16	69.57	Spring-2017
Traditional Section	52.55 / 16.93 / 250	336	250	74.4	Spring-2017

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.

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

Table II. Hypothesis Testing for the Final Exam Means Between the OS and the TS

	Fall 2016	Spring 2017
Online Section Mean	65.9	62.0
Traditional Section Mean	57.9	52.5
Test statistic	$t = 2.0487^*$	$t = 2.1715^*$
P-value	$P = 0.0409^*$	$P = 0.0308^*$

Note: The positive test statistic indicates that the mean for the OS method sections was higher.
*Indicates the result was statistically significant at $\alpha = 0.05$.
We have enough statistical evidence to reject the null hypothesis and accept the alternative that the two means are significantly different.

Table II shows that the difference in the mean for OS and TS classes is statistically significant in both semesters. Statistically speaking the students in the OS performed better on the final exam than students in the TS. If the test statistic is positive it means that the OS mean is higher than the TS mean.

Comparison II - Null Hypothesis: There does not exist a statistical difference in the retention rates between the OS and the TS classes.

Table III shows that the difference in the retention rate for OS and TS classes is not statistically significant for both semesters. Again, if the test statistic is negative it means that the OS retention rate is lower.

Table III. Hypothesis Testing for the Final Exam Means Between the OS and TS

	Fall 2016	Spring 2017
Online Section Percentage	66.67%	69.57%
Traditional Section Percentage	80.55%	74.4%
Test statistic	Z = -1.7791	Z = -0.5125
P-value	P = 0.0752	P = 0.6083

Note: The negative test statistic means that the proportion for the TS was higher.

CONCLUSION

From the hypothesis testing on the retention rate there is no statistical evidence that the online section classes have higher retention rates than the traditional section classes. However, the hypothesis testing for the means indicates that there is statistical evidence that the mean of online section classes is higher than the mean of traditional section classes. Several factors may influence the retention rate of the online course. Most of the students who withdraw are not prepared for a fast-paced course, even though they have been properly advised. Sometimes the student has not realized the time commitment the course requires, registers for the class, and then gets behind in the work quickly. Freshmen tend to register for this course along with a full load of other courses and have a difficult time handling the requirements for each. Another possibility is the learning style of a student does not fit well with online instruction. A student may do better with face-to-face instruction and should be in a TS. A time lapse between high school math and Math 1111 also makes things more difficult. One goal of the OS is to help adults who are employed during the day and desire to work on their education during off times. Those students sometimes find the pace of the class to be challenging when they have not studied algebra for years. However, once the class roll stabilizes and those students whose study habits, and background are proper for the OS course remain, the class makes a good team which is a factor in the higher final exam scores.

Our results show that an online 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 online sections if care is taken in how the course is managed and the material presented. Also, the instructor must be willing to hold office hours online so that the student can get the necessary help. Care must be taken to keep all students active online and to make sure that assignments are completed on time. Our case study shows that, with precautions and planning, online section courses in mathematics can be even more successful than traditional sections.

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