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Extended Sections for at Risk Students in College Algebra

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EXTENDED SECTIONS FOR AT RISK STUDENTS IN COLLEGE ALGEBRA

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ABSTRACT

VSU is identifying students at-risk of failing College Algebra based on admissions data, including SAT/ACT-Math scores and high school GPA's. Fall 2014, the Department of Mathematics and Computer Science taught College Algebra to at-risk students via Extended Sections. In this study, we compared the common departmental final exam scores for the treatment group, Extended Sections, and the control group, Traditional Method Sections, in order to compare the students' performance. The mean SAT-Math and ACT-Math scores for the treatment group were significantly lower than the mean SAT-Math and ACT-Math scores for the control group. However, the students' performance on the departmental final exam for the treatment group and control group showed no significant difference. The at-risk mathematics students that take the Extended Sections can perform on average on the final exam just as well as the students in the traditional courses.

INTRODUCTION

Because it is a core requirement, college algebra is one of the most widely taken courses. Students find it very challenging and many must repeat the course once or twice before they are successful. There is a nationwide effort to improve student performance at all levels of primary and secondary education, yet many students are still not prepared for college algebra. In order to help students succeed, universities offer a variety of additional instruction through centralized tutoring, online tutoring, and online software (5).

Supplemental Instruction (SI) is a model of student academic assistance whose major goal is to help students succeed in courses that are historically difficult (2, 6). SI leaders are responsible for holding optional class sessions and providing assistance in mastering the course material by helping the students form study skills and strategies that will lead to success in the course (1, 3, 7).

Valdosta State University implemented SI with students as SI leaders. The SI sections were identified in the schedule of classes and were open to enrollment by any student. Students weak in mathematics were encouraged to sign up for SI sections. Courses met three times a week for a fifty-minute period with the assigned professor. Twice a week the classes met for a fifty-minute period with the assigned SI leader. Final exam grades for these students showed no significant difference between traditional and SI groups but the SI group had a significantly lower average SAT score. The implementation of SI at VSU proved to be suc-

cessful (8). However, the impact was limited because students only enrolled in the classes on a voluntary basis. While 30%-40% of students were at-risk of not being successful (grades of D/F/W) in college algebra, supplemental instruction sections garnered only 1%-3% of college algebra students.

In order to reach more students, VSU required at-risk students to take five-day-a-week Extended Sections (ES) to provide academic assistance to college algebra students. A major difference between ES and SI is that the instructor is responsible for holding mandatory class sessions and providing assistance in mastering the course material. The research contained in this paper investigates the effectiveness of the ES program for college algebra at VSU compared to the traditional method.

METHODS

Based on SAT/ACT-Math scores and high school grade point averages (HGPA), incoming VSU students are placed into their first college-level mathematics course. The lowest level of placement for traditional students includes College Algebra (MATH 1111), and the highest level of placement is Calculus I (MATH 2261). In addition, SAT/ACT-Math scores and HGPA are used to identify students who are at-risk of not being successful in College Algebra. Approximately 40% of incoming traditional freshmen are at-risk of not being successful (grades of D/F/W) in College Algebra.

During Fall 2014, all students taking College Algebra were included in the study. Both the control group (Traditional Methods) and treatment group (ES) met three hours per week and were taught using the traditional methods. In addition, the ES group met two more days per week (50 minutes per meeting) for lab classes in regular classrooms (not computer labs).

The Centralized Advising office advises all students at VSU who have fewer than 30 credit hours. It was not possible to randomly assign students into the control and treatment groups, so the middle 50% of at-risk students were advised and registered into one of eight five-day-a-week ES sections. These eight sections were taught by six different instructors.

A writing team comprised of VSU mathematics faculty wrote the College Algebra Lab Manual during summer, 2014. The lab manual is comprised of 30 lab activities, one for each lab meeting during the semester. All College Algebra topics cannot be covered in thirty 50-minute lab activities, so the writing team reached a consensus on topics to be covered.

The same instructor who taught the regular class sessions during the three traditional hours each week also conducted the lab for two days each week. The instructors introduce the activity at the start of the lab meeting, then helped the students as needed to complete the lab activity. Typically, the students work in groups. The role of the instructor is further described in Table I.

Table I. Lab Instructor's Role

• Include a syllabus policy stating that lab attendance is required.
• Include a syllabus policy stating that lab grades will count 10-15% of the course grade.
• Provide a lab manual, furnished by the department, to all students on the first day of lab.
• Take roll at each lab meeting.
• Select and facilitate one of the 30 lab activities in the lab manual for each lab session.
• Collect completed lab sheets at the end of each lab meeting.
• Grade, record, and return the completed lab activities.

At the end of the course all students enrolled in College Algebra at VSU took a common cumulative multiple-choice final examination. Data were then collected on all students enrolled in both the ES classes and the Traditional Method classes, as explained in the next section.

RESULTS

Data Collection

At the end of the semester, we collected data and reported the sample size (n), mean ($\overline{X}$), and standard deviation (sd) on the following variables: Final Exam, High School GPA (HGPA), SAT-Mathematics (SAT-M) test scores, and ACT-Mathematics (ACT-M) test scores. Table II summarizes the data. The sample sizes for SAT-M and ACT-M do not sum to the total number of students taking the final exam because some students took both the SAT-M and ACT-M.

Table II. Data collected on the performance of Traditional Methods verses ES.

Method of Content Delivery	**Final Exam $\overline{X}$ / sd / n**	**HGPA $\overline{X}$ / sd / n**	**SAT-M $\overline{X}$ / sd / n**	**ACT-M $\overline{X}$ / sd / n**
Traditional	67.34/15.92/598	3.25/0.462/598	481.96/51.34/459	19.96/2.71/296
Extended Sections	65.95/13.42/131	2.67/0.204/131	468.42/51.264/94	18.96/2.02/64

We compared the mean on the Final Exam, High School GPA (HGPA), SAT-Mathematics (SAT-M) test scores, and ACT-Mathematics (ACT-M) test scores between the two groups. Table III summarizes the comparison of final exam means, Table IV summarizes the comparison of HGPA means, Table V summarizes the comparison of SAT means in mathematics, and Table VI summarizes the comparison of ACT means in mathematics.

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

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.

Table III. Hypothesis testing for the final exam mean between Traditional vs. ES classes. Positive test statistic indicates the mean for the Traditional method was higher, however the mean difference was not statistically significant.

Category	**Statistics Value**
Traditional Mean	67.34
ES Mean	65.95
Test statistic	Z = 1.0364
P-value	P = 0.30

Comparison 2 - Null Hypothesis: There does not exist a statistical difference between the means on the HGPA for the two methods.

Table IV. Hypothesis testing for the HGPA Means between ES vs. Traditional Methods. Positive test statistic indicates the mean for the Traditional method was higher. Two asterisks (**) indicates the result was statistically significant at 0.01.

Category	**Statistics Value**
Traditional Mean	3.25
ES Mean	2.67
Test statistic	Z = 22.33**
P-value	P = 0.00**

Comparison 3 - Null Hypothesis: There does not exist a statistical difference between the SAT-Mathematics means for the two methods.

Table V. Hypothesis Testing for the SAT-Mathematics Means between ES vs Traditional method. Note: Positive test statistic means the mean for the Traditional method was higher. One asterisk (*) indicates the result was statistically significant at 0.05.

Category	**Statistics Value**
Traditional Mean	481.96
ES Mean	468.42
Test statistic	*Z* = 2.331*
P-value	*P* = 0.0197*

Comparison 4 - Null Hypothesis: There does not exist a statistical difference between the ACT-Mathematics means for the two methods.

Table VI. Hypothesis Testing for the ACT-Mathematics Means between ES vs Traditional method. Positive test statistic means the mean for the Traditional method was higher. Two asterisks (**) indicates the result was statistically significant at 0.01.

Category	**Statistics Value**
Traditional Mean	19.96
ES Mean	18.96
Test statistic	$Z = 3.36^{**}$
P-value	$P = 0.0008^{**}$

CONCLUSION

From Table III, we failed to reject the null hypothesis, i.e. there does not exist a statistical difference between the means on the final examination for the two methods, ES and Traditional. At first glance one may think the ES Method does not improve the Final Exam test scores. Evidence to the contrary comes from Tables IV, V, and VI.

From Tables IV, V and VI, the ES group had a statistically significant lower HGPA mean, statistically significant lower SAT-Math mean, and statistically significant lower ACT-Math mean than the Traditional group. These tables reveal that the students populating the ES group are much weaker in mathematics than the students populating the Traditional group.

Table III indicated that there is no significant statistical difference in the Final Exam mean between the ES and Traditional methods. Tables IV, V and VI indicated that weaker students in mathematics took the ES courses. Between the four tables, we can conclude that if weaker students in mathematics take the ES courses and can perform on the average on the final exam just as well as the students in the Traditional courses, then the ES method is successful. Weak students in mathematics might not have the same success on the final exam if the only alternative to them is the Traditional method. We believe that the ES course improves the final exam average for weaker students and that we should therefore continue using it.

REFERENCES

1. Commander, NE and Stratton, CB: A learning assistance model for expanding academic support. Journal of Developmental Education 20: 8-13, 1996.
2. Kenney, PA: Effects of supplemental instruction on student performance in a college-level mathematics course. Paper presented at the Annual Meeting of the American Educational Research Association, 1989.

3. Kenney, PA: Effects of supplemental instruction on student performance in a college-level mathematics course: A report of additional results. Paper presented at the Annual Meeting of the American Educational Research Association, 1990.
4. Kenney, PA and Kallison, JM, Jr.: Research studies on the effectiveness of supplemental instruction in mathematics. New Directions for Teaching and Learning 60: 75-82, 1994.
5. Lazari, A and Simons, K: Teaching College Algebra Using Online Software Versus the Traditional Lecture Method. Ga J of Sci 52: 162-169, 2002.
6. International Center for Supplemental Instruction, University of Missouri-Kansas City (2015). Overview. Retrieved April 2, 2015 from http://www.umkc.edu/asm/si/overview.shtml
7. International Center for Supplemental Instruction, University of Missouri-Kansas City (2015). Publications. Retrieved March 30, 2015 from http://www.umkc.edu/asm/si/
8. Lazari, A and Simons, K: Teaching College Algebra Using Supplemental Instruction versus the Traditional Lecture Method. Ga J of Sci 61: 192-198, 2003