

WVEB MATHEMATICS: A SUCCESSFUL WEB ENHANCED PROJECT OFFERING
COLLEGE LEVEL COURSES TO HIGH SCHOOL STUDENTS

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Abstract

Through the continued support of the West Virginia Higher Education Policy Commission and West Virginia University, the *WvEB* Mathematics Program has become a successful, collaborative project, offering college level courses to high school students. The DFW rate for *WvEB* courses is less than 10 percent. Results of a matched pair study comparing on-and off-campus students show that both groups show a significant gain in score on the math ACT test when used as a pre- and posttest measure. Course components include online assessments, JAVA applets, CD lectures, and video streaming. This project was funded in part by the NSF project number 0339117.

Introduction

In 1999, the Higher Education Policy Commission (HEPC) in West Virginia began to collaborate with the West Virginia Department of Education (WVDE) in efforts to increase the college going rate and ACT scores for West Virginia students (West Virginia Higher Education Policy Commission, 2002; West Virginia Department of Education, 2001). In order to better prepare students in transition from high school to higher education,

mathematics was chosen as the content area of focus and a web-enhanced course in college algebra was developed. A previous publication outlines an overview of the course structure (Pyzdrowski, Pyzdrowski & Mays, 2005). In addition, other publications detail first-year objectives, project outcomes and the formative assessments performed (Pyzdrowski & Pyzdrowski, 2002 and Pyzdrowski & Pyzdrowski, 2003).

The *WvEB* project continues to become more popular with both teachers and students. Since Fall 2000, approximately 1845 high school students have completed *WvEB Algebra* and 741 have completed *WvEB Trigonometry*, a follow-up course. Since the first offering of *WvEB Algebra* in Fall 2000, high school students have seemingly outperformed their on-campus peers.

Background

At the time of this study, WVU offered two on-campus versions of College Algebra and one version of Trigonometry. Students are placed into trigonometry or a 3-Day or 5-Day section of College Algebra by using results from a placement test or an ACT math score. Tables 1 and 2 show the percent of grades earned for the on-campus sections. The DFW rate is the percent of students withdrawing or earning the grade of "D" or "F" in the course.

Table 1

On-Campus 3-day and 5-day College Algebra Grade Distribution Fall 2004

		%A	%B	%C	%D	%F	%W	%DFW
Fall 2004	3 Day	10.9	22.7	21.5	14.2	13.1	17.6	44.9
	5 Day	9.6	20.5	21.1	15.2	15.4	18.2	48.9

Table 2

On-Campus Trigonometry Grade Distribution Spring 2005

	%A	%B	%C	%D	%F	%W	%DFW
Spring 2005	6.2	28.3	28.9	11.5	8.1	17.1	36

In the Fall 2004, 181 students were enrolled in *WvEB Algebra*. Students earned the grades as shown in Table 3. There was a 1.7% DFW rate.

Table 3

Total Grade Distribution for *WvEB Algebra* Fall 2004

A	B	C	D	F	W
98	61	19	1	1	1

In Spring 2005, 165 students were enrolled in *WvEB Trigonometry*. Students earned the grades as shown in Table 4. There was a 6.3 % DFW rate.

Table 4
Grade Distribution for *WvEB Trigonometry* Spring 2005

A	B	C	D	F	W	I
96	45	16	2	2	2	2

Students in the fall section of *WvEB Algebra* take a spring section of *WvEB Trigonometry*, therefore the fall and spring rates are reported respectively. The on-campus sections have much higher DFW rates compared to the *WvEB* sections. In order to determine if differences in student performance exist, a study was conducted to determine if there is a significant change in student achievement when comparing on- and off-campus students.

Method

Participants

During the Fall 2004 semester, 60 students enrolled in the *WvEB* College Algebra course from one local high school were randomly selected and then matched with students enrolled in on-campus College Algebra. Students were matched according to gender by a graduate research graduate assistant not affiliated with the course. The on-campus students had all graduated from West Virginia high schools. They all successfully completed Algebra I, Algebra II, and Geometry in high school with a “C” or better and had at least a 3.0 high school grade point average. In addition, the on-campus students were first-semester freshman who had just graduated from high school the spring prior to the study. The goal of the matched pairs was to get a homogenous sample of the on-campus students for comparison against the *WvEB* students.

ACT Test

The math section of a retired ACT assessment was administered at the beginning of the course and again at the end of the course to provide a standardized pre- and posttest measure of math performance. The 60-minute test contains 60 items. A special research version of the test was purchased from ACT to use in this study.

Data Collection

All students enrolled in 3-Day College Algebra and *WvEB Algebra* were given the Math ACT test twice. The scores from these tests were used to calculate bonus points for the course. The first administration of the test was given to all students after they had completed the review material. The second administration of the ACT math test was given to students prior to the final, but after the fourth exam and last laboratory assignment. The ACT test was given to *WvEB Trigonometry* students once again at the end of the course.

Results

Table 5 provides the means and standard deviations for the ACT scaled pre- and posttest scores for both groups in the matched pair study. A mixed-measures analysis of variance

(ANOVA) was conducted to evaluate the scaled ACT scores, using a between-subjects factor of Section (*WvEB*, Campus) and a within-subjects factor of ACT (Pretest, Posttest). There was no significant interaction between the two factors. There was a significant main effect of ACT, however, $F(1, 107) = 20.695, p < .001$, with students scoring higher on the posttest ($M = 21.91, SD = 3.30$) than on the pretest ($M = 20.50, SD = 4.17$). There was no significant main effect of Section.

Table 5

Means and Standard Deviations of Scaled ACT Scores for On-campus and *WvEB* Students Enrolled in College Algebra (Fall 2004)

Group	N	Mean ACT pretest	SD ACT pretest	Mean ACT posttest	SD ACT posttest
On-campus	51	20.69	2.96	22.71	2.93
<i>WvEB</i>	58	20.33	5.02	21.21	3.46

Table 6 shows the mean, standard deviation, *F*-values, and significance levels for all analyses for all students enrolled in both *WvEB Algebra* and *WvEB Trigonometry* in Fall 2004 through Spring 2005. A repeated-measures ANOVA indicated that there was a significant difference between the tests, $F(2, 188) = 5.147, p = .007$. Pairwise comparisons were then conducted to ascertain which tests differed from one another. Results from the pairwise comparisons indicated that the performance on the Post-Algebra administration ($M = 22.18, SD = 3.65$) exceeded performance on both the Pre-Algebra ($M = 20.91, SD = 3.33$) and Post-Trigonometry ($M = 21.22, SD = 4.55$) administrations, but there was no significant difference between the pre-Algebra and Post-Trigonometry administrations.

Table 6

Scaled ACT analyses for students completing *WvEB Algebra* and *WvEB Trigonometry*

Test	N	Mean	SD	F	Sig
Pre - Alg.	95	20.91	3.33	5.147	.007**
Post - Alg.	95	22.18	3.65		
Post - Trig	95	21.22	4.55		

Note. The asterisks (**) denote significance at the .01 level.

From the Fall 2004 *WvEB Algebra* and Spring 2005 *WvEB Trigonometry* pathway, 27 students entered the 4-credit Calculus Course at WVU in Fall 2005. The success rate of *WvEB* students (those with a C or better) was 55.5% as compared to the total on-campus success rate of 52.3%.

Discussion

Preliminary results show that when such things as high school GPA and grades in preceding courses are held constant, students enrolled in both on-campus and *WvEB* sections gain significantly in achievement with no difference in gain found between sections. Results also

show that as a group, all students in the *WvEB Algebra* course realized a significant gain in scaled math ACT score and exhibited an apparent drop in score after taking the *WvEB Trigonometry* course. It was discovered that among other things, the post-Trigonometry ACT test was given during the "prom" week at many schools in Spring 2005. In addition, the same incentives were not used to promote students to do their best. Therefore, a future study will investigate these relationships when a consistent structure is used. Finally, of those students enrolled in both *WvEB Algebra* in Fall 2004 and *WvEB Trigonometry* in Spring 2005 who attended WVU in the Fall 2005 semester, 27 enrolled in the 4-credit calculus course. The success rate of those students is slightly better than all students enrolled in the course. A more detailed article is being prepared which will include survey and questionnaire results.

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