

## W<sub>V</sub>EB ALGEBRA: A WEB ENHANCED COLLEGE COURSE for High School Students

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### Abstract

The State College and University System of West Virginia Central Office and the West Virginia Department of Education funded an innovative college algebra course which was offered to high school students for college credit during the 2000-01 academic year. The project increased the knowledge about educational problems faced by students in transition from high school into higher education. Students enrolled in the course showed significant gains in content test scores and had higher average course GPA's a lower DFW rate than on campus students in the same course. Student as well as high school teacher feedback indicates that the first semester pilot was a success and that the project should be continued at a larger scale.

The state of West Virginia has long been a leader in curriculum reform. In 1999, the State K-12 mathematics program of study was ranked as one of the best in the nation by Education Week's *Quality Counts*. It is natural for math educators in the State to turn to the improvement of curriculum for students in transition between high school and college mathematics. The members of the *W<sub>V</sub>EB Algebra* Steering Committee and Course Design Committee are State leaders in mathematics, mathematics education, and administrative governing bodies. The initial collaborative efforts allowed the following goals to be reached:

- Analysis of statewide instructional goals and objectives for College Algebra
- Development of a common set of instructional goals and objectives
- Comparison of the common instructional goals and objectives for College Algebra to the State Instructional Goals and Objectives for Algebra II and Precalculus
- Development of State instructional goals and objectives for the concurrent enrollment course *W<sub>V</sub>EB Algebra*
- Development of a *W<sub>V</sub>EB Algebra* syllabus
- Evaluation and selection of appropriate instructional materials for *W<sub>V</sub>EB Algebra*
- Development/refinement and implementation of video lectures
- Initial development of online quizzes
- Research Design development and implementation
- Professional development of high school facilitators
- First year implementation of course

### **Significance of the Project**

Although West Virginia students have shown improvement in every grade level on the Stanford - 9 test for the past three years, State SAT Math results show that students are still below the national mean. (Education Week, 2001, West Virginia Report Cards, 2001). These statistics show that our students neither meet the state goal that mathematics performance will equal or exceed national averages nor the United States goal that our students will be first in the world in science and mathematics achievement.(WVDE, 2000).

*The  $W_vEB$  Algebra project has the following initial year objectives:*

- 1) Make available a college level algebra course for concurrent enrollment, thus helping students remain in the mathematics pipeline while in high school, and allowing for a smooth transition into entry level college mathematics.
- 2) Systemically collaborate to improve student mathematics achievement, and the number of high school students taking college courses while in high school.
- 3) Provide professional development in content and pedagogy for high school mathematics teachers.
- 4) Implement a statewide partnership between high school and higher education.
- 5) Engage the support of superintendents, principals, counselors and parents.

### **Project Design**

$W_vEB$  Algebra is designed to meet the needs of high school students who have completed their secondary mathematics requirements but wish to take further mathematics for college credit. It is designed for the “middle track” student, although those high school students in a higher mathematics track may also be interested in enrolling. It is not the intent for  $W_vEB$  Algebra to replace any of the mathematics courses in the high school curriculum. Instead, it is developed as a mathematics course that a student would take in lieu of a “mathematics void” in a given semester or year. The course is web enhanced and has a university professor instructor of record and a high school mathematics teacher facilitator.

#### *Implementation:*

This course was piloted in Fall 2000 at three high schools in West Virginia. The pilot design is comprised of an electronic course based in part on the College Algebra courses currently offered at three participating universities. High school teacher facilitators were provided professional development in content and pedagogy. There were seven one-day workshops spread throughout the year. During the sessions, teacher participants: strengthened the content knowledge and methodology of teaching algebra, strengthened technology skills, demonstrated appropriate ways to integrate technology into the classroom, examined the syllabi, course requirements, and structure of entry level mathematics courses at institutions of higher education, and identified content and pedagogy problems that high school students have in transition to college level courses. An email list and electronic bulletin board were set up to enable facilitators the opportunity to communicate with each other and with the professors of record outside of the development sessions. The support of school administrators, principals, counselors and parents was encouraged by scheduled informational seminars at host sites. These visits were conducted by representatives from the higher education institutions. Seminars for parents and students were held prior to each offering of the course, and once for school administrators and counselors.

### *Participants*

Twenty-nine high school students participated in the first semester pilot of *WEB Algebra*. Student participants were enrolled in three high schools from around West Virginia. All students enrolled in the *WEB Algebra* course were required to have an overall GPA of 3.0 and a C or better in Algebra I, Algebra II and Geometry. In addition, each higher education institution used its own mathematics placement test to determine course eligibility. Only 21 of the students completed the course and took both a pre and post content test.

### *Instruments*

The *Accuplacer* college level mathematics test was used. It is designed to provide placement, advisement, and guidance information for students entering two- or four-year institutions of higher education. Students were required to take a web version of a 20 item multiple choice test as both a pre test (common placement test) and post test (common final evaluation) in the course. In addition, high school facilitator and student course evaluation paragraphs were written and submitted to the project director. Students and facilitators were directed to document if they found the course to be beneficial and what changes could be made to make it better.

### *Treatment*

The pilot course was conducted over a typical university semester. Beginning and ending dates were adjusted slightly to accommodate school calendars. All students used the same text book, had the same content outline and laboratory activities, and were provided a CD containing video lectures of course material. Each student was asked to take a common placement test during the first week of the course; however, the test was not used to eliminate anyone from the course. After completing the university-of-record final for the course, each student was asked to take a common final test. This test did not influence the final grade of a student

Students worked through the material using the outline provided on the CD to guide their progress. Each student was guided through lessons that included a reading assignment, a video lecture, a homework assignment, and at times a computer laboratory. There were 13 laboratory assignments during the semester. Students could read, watch the lectures and do homework at home or in school. However, the laboratory assignments were done in teams of two or three and in a facilitated school setting. The high school facilitator helped with individual homework questions, supplemented the video lectures when necessary, and facilitated laboratory activities, thus taking on the role of a tutor which is a service offered by university learning centers. Four tests and a comprehensive final were developed by three professors of record and were found to be of similar structure and content. The tests were mostly open ended. All course grading was done by the instructors of record with the exception of the pre *Accuplacer* placement test and the post *Accuplacer* common final. All tests were given at a common time in a supervised setting.

### **Results**

A *t* test was computed to determine whether there was a significant difference between the pre *Accuplacer* placement test and the post *Accuplacer* common final of 20 pilot participants.

The data concerning the results of the t test on Table 1 show that there is a mean difference of 12.23 between the pre and post test. The t was significant at the .003 Level of confidence.

**Table 1 t Test For Pre and Post Accuplacer Scores For WvEB Fall 2000**

Time of Test	M	SD	t
Pre	36.81	17.29	-3.37 *
Post	49.04	22.29	

\* p < .005

The grade distribution for the 29 students enrolled for the pilot semester of the *WvEB Algebra* course are found in Table 2. There were 6 A's, 11 B's, 4 C's, 1 F and 7 Withdraws.

Table 2 Course Grade Distribution For WvEB Fall 2000

Grade	A	B	C	D	F	W
Number	6	11	4		1	7

Table 3 shows that students in the *WvEB Algebra* course had a higher GPA average and a lower Drop, Fail Withdraw rate than the West Virginia University on campus sections.

Table 3 Avg GPA and D/F/W Rate For WvEB Fall 2000

Course	WVU <i>WvEB Algebra</i>	Total <i>WvEB Algebra</i>	WVU On Campus
Semester	Fall 2000	Fall 2000	Fall 2000
Average GPA	2.9	3.1	2

### Discussion

Although 20 students completed the pilot course, is hoped that more will take advantage of this opportunity. Although each high school enrolls small numbers of students, in total the

number of students involved can be large. Thus, each high school facilitator becomes an important link in the project. It is a recommendation that more high school mathematics teachers who are leaders in the state be recruited and offered professional development in order to increase the number of schools involved. Further research is warranted to study the affects of the preparedness of the high school facilitator on student success.

There is a significant mean difference between the pre and post test *Accuplacer* scores. This is especially interesting since the posttest common final had no affect on a student's grade and there was no motivation for a student to do well on the test. Because the test was given twice in a four month period, an *Accuplacer* representative was contacted to find the normal gain for that time period. There are no studies documenting expected gains in a four month turn around time, so caution should be used when interpreting the results. Also, the pretest mean of 36.81 places the students on average in less than the 20<sup>th</sup> percentile for students taking this test. The posttest mean of 49.04 places them in the next level according to *Accuplacer*, but on average this is still less than the 50<sup>th</sup> percentile.

Of the 29 students enrolled in the course, 1 earned an F and 7 withdrew. It was found that 6 of those eight were enrolled in a Saturday section of the course. The high school facilitator felt that the students withdrew from the course because of the time of class. The student earning the F, also in the Saturday section, stopped attending and neglected to withdraw from the course. From a second school, a student withdrew after only a few weeks of class. The student was too busy and did not feel that the time commitment could be made. Only one of the students receiving a "W" withdrew due to poor performance. Due to these results, it is recommended that sites consider offering the course during a regular school class period.

Students in the *WEB Algebra* course had a higher GPA average and a lower Drop, Fail Withdraw rate than the West Virginia University on campus sections. Caution should be taken when making these comparisons. Typically, the class size of college algebra at WVU is between 100 -200 students. Difference in class size could be enough to make a difference in the GPA and DFW rates. What can be confirmed is that even though students in this course were in non-traditional college classrooms, they did not have a lesser GPA average or higher DFW rate than those students in the on campus course. The first semester pilot is considered a success. Qualitative Analysis and results from the second semester course which had 47 student participants will be discussed in future work.

### References

- Accuplacer [Computer software].(2001). College Entrance Examination Board, New York, and Vantage Technologies Knowledge Assessment, Yardley, PA.
- Davis, K. (2001). Education First – Goals 2000 [On - Line], Available: <http://wvde.state.wv.us/ed1st/goalsed1st.html>
- Jerald, Craig, D. (2000). The State of the States. Education Week, 19(18), 62 - 163.
- Orlofsky, G. F., & Olson, L. ( 2001, January 11). State of the States. Education Week, XX (17). 86-193.
- Stewart, D. (2001). West Virginia Report Cards: County -by-County Trend Data 1995-1996 Through 1999-2000[On-Line], Available: <http://wvde.state.wv.us/data>