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COLLEGE ALGEBRA SUPPORT PROJECT (CASP): A MULTIFACETED COURSE SUITED FOR TODAY'S CLASSROOMS

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Abstract

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It is known that the retention rates in standard college algebra courses have been puzzling. Educators and administrators are grappling with this situation on a day-by-day basis as they attempt to improve the retention rates among students in these courses and find a way to remedy the situation. Several ideas have emerged yet the challenges are still enormous. The College Algebra Support Project (CASP) was initiated with a main goal to increase the success rate among students in these college algebra courses taught at Texas A&M International University (TAMIU), Laredo, Texas. The approach is based on the belief that students learn mathematics by actually doing it. Homework, quizzes, laboratory projects, assessments, and exams were used to help students understand concepts and build problem-solving skills. This article outlines results of a survey conducted for this undertaking at TAMIU in Fall 2008 in terms of course features, and most importantly, what components of the course-delivery led to its success for the benefit of other faculty and college administrators.

Keywords: ALEKS, College Algebra, Special Program Aids, STEM-RRG (STEM-Recruitment, Retention, and Graduation), ULC, Instructors, and Students

Introduction

The vast majority of students indicated that they have difficulty in entry level college mathematics courses such as College Algebra. Evidence suggests that they are not

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spending enough time studying because they have many additional responsibilities (Cerrito & Levi, 1999). An additional emphasis needs to be given to the success of this course as it serves as core curriculum requirements for all programs at TAMIU. The Texas Higher Education Coordinating Board (THECB) requires that 3 semester credits of College Algebra or above is needed to fulfill the mathematics core curriculum. However, the course continues to be one of the lowest passing rates of courses on the campus. As a result, administrators took the appropriate steps with the clear intent to increase the success rate by providing adequate funds to improve the situation and to achieve desirable goals (Wynegar & Fenster, 2009). A study suggests that a student who has not taken the course would have achieved more by doing reinforcement problems (Gamoran & Hannigan, 2000). Furthermore, students from families with weaker educational tradition have more to gain from starting school early with adequate support. A great deal has been written about students' diversity in today's classrooms (Kauchak & Eggen, 2003). These authors argue that early college concept may not provide an answer to new approaches sought by educational authorities, however there appears to be a strong driving force in their collection of effective approaches to higher educational deficiencies.

This CASP project, like many other projects, represent future demographic needs as future college graduates are challenged by a society that is increasingly diverse in terms of race, culture, and values (Pascarella, Edison, Nora, Hagedorn, & Terenzini, 1996). A capable, experienced, and qualified teacher could deliver this task to the best of

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individual's ability. Their practices stem from a concern with learning that is strongly presented and communicated using carefully planned lessons (Bain, 2004). However, there are limitations for this effort. What needs to be accomplished is to cater to students' learning needs. In this regard, familiarity with the content, techniques, and finally, how to solve the problems are continuously sought after by the students to advance in a course.

Classroom management consists of all teacher thoughts, plans, and actions that create an orderly learning environment for students. This accommodates enough learning curriculum into a single classroom lesson. Students can extend lessons and practices through these lessons. If any subject can be taught to any college student with a set of strong accountability measures, then it should follow a curriculum that seems to be worthy of the continual concern of its members (Gall & Ward, 1974).

Most students have the ability to be successful in the transition from the prerequisite developmental course to a college level mathematics course (Aycaster, 2001). Students who are transitioning into college mathematics courses may be confronted with an instructional pacing reality and set of expectations different from their high school experience and without adequate support structures in place. Unfortunately, this attributes to high failure rates in introductory college mathematics courses that have become a concern for many years, particularly among underrepresented student groups (Duncan & Dick, 2000).

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Though, online course offerings can provide some needed solutions to the logistic nightmares that every institution confronts with the growth of its student population (Paloff & Pratt, 2005), it is important to encourage students to take in-campus instructional classes to successfully master a particular subject to ease the barrier for learning as depicted in Figure 1.

Figure 1: An apparent wall between students and instructors in the learning environment.

Project Synopsis

The general topics in college algebra courses include equations and inequalities, system of equations, graphs, polynomial and rational functions; exponentials and logarithmic functions, matrices, sequences and series, and the binomial theorem (Barnett, Ziegler, & Byleen, 2008). The course also provides the algebraic background necessary to enter higher level of mathematics courses such as business mathematics, introductory statistics, and mathematics for other disciplines. Student learning outcomes require that upon successful completion of this course, the student will be able to: (a) set up and solve polynomial, rational, radical, exponential, and logarithmic equations and inequalities of one variable, and systems of linear and non-linear equations two or more variables, (b) sketch the graphs of equations and inequalities, (c) perform operations of complex

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numbers and solve equations, (d) perform operations of matrices and apply matrices to solve problems, (e) perform expansion of a positive integer power of binomials, (f) compute a general term of sequence and the sum of its terms, (g) identify functions from algebraic, graphical, tabular, and verbal expressions and apply them to solve problems, and (h) derive theorems and formulas such as quadratic formula, distance formula, equation of circles, and remainder and factor theorems.

The prerequisite for the course is freshman classification with a passing score on a mathematics placement exam for students who do not have an ACT Math score of 19 or an SAT Math score of 450 or above. However, conscientious students with solid mastery of the material of high school mathematics are expected to be able to succeed in the course or be eligible to register for more advanced mathematics courses. It is noted that the students with inadequate high school mathematics preparation will still have difficulty in this course; and for this case, they should consult with a mathematics advisor to determine proper placement for student success in the program that they pursue. Academic placement of students into appropriate courses therefore becomes a critical issue, but it will not necessarily solve this problem as even with completion of developmental courses, the problem remains.

Project Features and Delivery

CASP consisted of four main components that include:

- classroom instructions by designated mathematics instructors,

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- supplementary instruction sessions managed by experienced students,
- software for assessments,
- regular tutorials and homework assignments, and additional help sessions conducted by the University's tutorial facilities

Instruction, curriculum, assessment, and delivery of all college algebra sections in a given semester were guided by a common course syllabus. In addition, it included common assessments as well as a common comprehensive final exam all administered on selected dates. The aims of CASP and student learning outcomes were given and stipulated in a common syllabus used by the instructors. The questions included in the final exam contributed by all instructors are naturally tied to the student learning outcomes. It contributed to 35% of the final grade. As such, the student course grade is a reflection of the students having met these learning outcomes. Setting goals for educational accomplishment based on these essential outcomes can indeed change the approach to academic study. This work ensured that students have the necessary background to be able to succeed in their program of study, particularly where the relevant background is required to meet expectations of students. In addition, course policy required that students keep up regular and punctual attendance to be successful in these types of courses. Furthermore, students are required to read the textbook and class notes for comprehension, as well as to work through problems and exercises for understanding. It is expected that each hour of lecture requires two hours of preparation on the part of the average students. A course coordinator makes sure all these components are

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implemented. It is clearly understood that it is the student's responsibility to learn the material and that the instructor's job is to offer help and guidance. The College Algebra Committee consists of all instructors teaching the courses, additional mathematics faculty, and several ex-officio who meet from time to time to make any policy decisions.

The involvement of STEM-RRG program in this project is multifaceted. It provided a devoted group of students designated as Special Program Aids to assist each mathematics instructor in their classroom management, homework grading, tutoring, and laboratory supervision. In-house mathematics help and tutorials were provided to every college algebra student by them as well as University Learning Center (ULC) and Technology and Enrichment in Mathematics (TEMA) computer lab. Supplemental Instruction (SI) session was another component in this effort. Each section of college algebra has a supplemental instruction session. Students meet one hour per week in addition to the regular class meetings. An SI leader takes a survey at the beginning of the semester for the most effective scheduling of each SI section. Up to 25 extra credit points out of 1000 points are awarded for full participation of students at SI sessions. A student is encouraged to attend the SI sessions arranged for their specific course section; however a student may choose to attend one or more of the other SI sessions if desired.

Use of Software for Learning

New and emerging learning environments are surfacing everyday in dealing with various cross sections of students such as juvenile delinquents (Stager, 2005). Walk-in tutoring

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offered by ULC and TEMA computer lab allowed students to work practice problems. Well-trained tutors were available to assist students in these labs. In addition, course instructors had some of their office hours scheduled in these locations as well. Several ideas emerged including embedding technology in teaching in order to obtain the desired results. This allows for all students to achieve outcomes at the end of the course.

ALEKS is a powerful artificial intelligence-based assessment tool that concentrates on the strengths and weaknesses of a student's college algebra knowledge, reports its findings to the student, and then provides the student with a learning environment for bringing this knowledge up to a level appropriate to succeed in the course. Students can access ALEKS anywhere they have access to Internet with a web browser; however, it is encouraged to work on ALEKS at TEMA computer lab. Assessments include two midterm exams, the comprehensive common final exam, and problem-solving on ALEKS. As the instructors cover a section in class, the students is expected to work through the homework problems for that section. There were about 10 problems per section. Students were also required to take the midterm and final assessments on ALEKS as designated by the course syllabus. With a trained SI leader, students could discuss practice problems, practice on ALEKS, prepare for the exams, and do more to be successful in the course. The scores of midterm and final assessments counted toward the final course grade. All assessments were held at the TEMA computer lab, unless otherwise stated. Students were also required to work out the problems suggested by ALEKS with a minimum of 3 hours per week on average. Students received 5 points each

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week for achieving this minimum that counted toward their final course grade.

Methodology, Data, and Results

Table 1 is constructed to demonstrate the improvement that, the multifaceted CASP approach had with retention of the student body in the college algebra courses from Fall 2008 to Summer 2010 at TAMIU by recording the number of DFWI (D's, F's, Withdrawals, and Incompletes).

Table 1: DFWI rates for college algebra courses from Fall 2008 to Summer 2010

Semester	Fall 2008	Spring 2009	Summer I & II 2009	Fall 2009	Spring 2010	Summer I & II 2010
Students	469	308	90	565	418	130
DFWI Counts	259	151	42	226	123	40*
DFWI Rates	55.22%	49.03%	46.67%	40%	29.43%	30.77%

* There were some students never showed up in the classes.

In order to determine the extent of success of this project over the period, an impact survey was developed to include six categories: I. the value of each activity in increasing participant understanding of mathematics, II. the extent of the gains from the project, III. the extent of participant understanding of contents, IV. the level of agreement with the successes/objectives, V. the impact of the project in their academic life, and VI. the level of the participants' interest in pursuing STEM programs. More than 250 survey forms were distributed to students taking College Algebra in Spring 2010 through their course instructors. One hundred-eighty-six completed survey forms (75%) were received that allowed us to analyze a snapshot of the responses to these six categories. Figures 2, 3, and 4 summarize the findings from this survey using commonly used descriptive statistics. The assessment of this survey addresses what is generally expected from these

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courses. The conclusions can be mitigated by spot-checking (Motschnig-Pitrik & Holzinger, 2002).

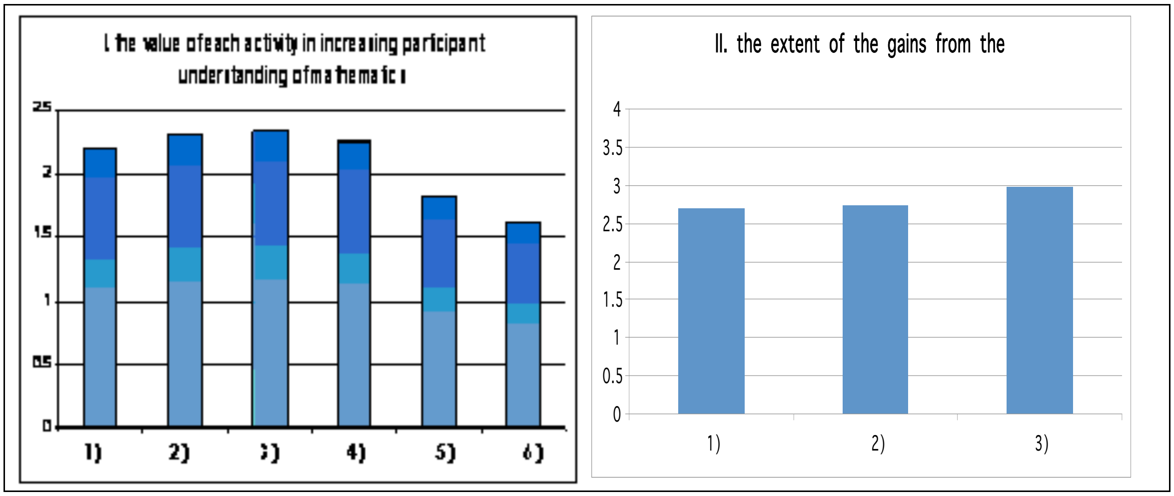

Figure 2: I. the value of each activity in increasing your understanding of mathematics rated at: Very Valuable (@ 3), Valuable (@ 2), Somewhat Valuable (@ 1), Not Valuable (@ 0) on the items: 1. Homework, 2. Additional resources provided by the University Learning Center (ULC) for help with homework, 3. In-class tutoring, 4. Supplemental Instruction (SI) sessions, 5. ALEKS or MyMathLab, and 6. Projects / Journals, and II. the extent of the gains you made in each of the following as a result of this class rated at: A Great Deal (@ 4), A Lot (@ 3), Somewhat (@ 2), A Little (@ 1), Not At All (@ 0) on the items: 1. Understanding how mathematics concepts relate to concepts in their other science classes, 2. Understanding the relevance of mathematics to the real world, and 3. Confidence in my ability to use mathematics concepts

Tutorial sessions for assignments, additional resources, and lesson activities provided by ULC seem to have increased understanding of mathematics as per Figure 2 and the confidence in their ability to use mathematics concepts contributed to gain in the courses as a result of this project.

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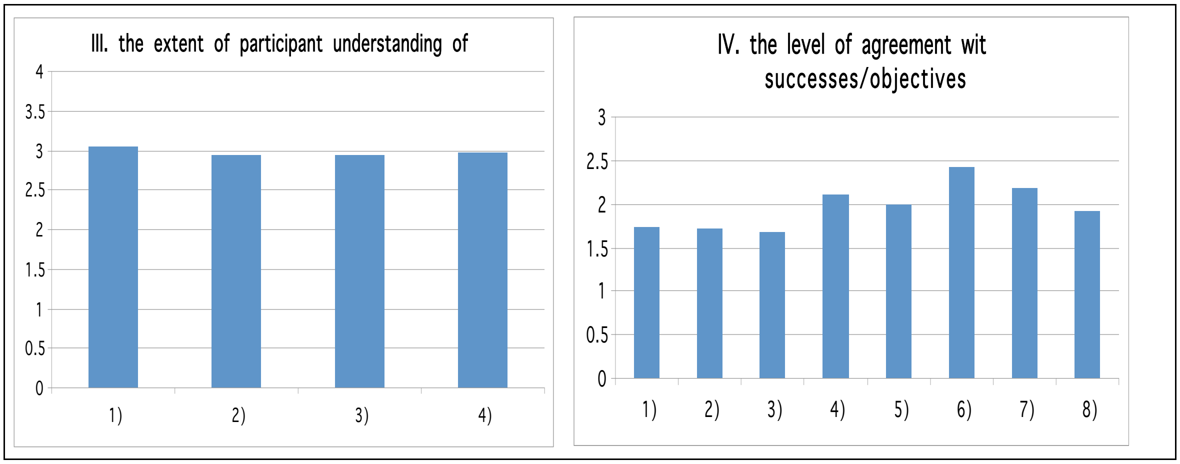

Figure 3: III. the extent of participant understanding of contents rated at: A Great Deal (@ 4), A Lot (@ 3), Somewhat (@ 2), A Little (@ 1), Not At All (@ 0) on the items: 1. The structure of a mathematical expression, 2. The relationship of mathematics with other disciplines, 3. The model of mathematics, 4. The operations and properties of polynomials and IV. the level of agreement with the successes/objectives rated at: Strongly Agree (@ 3), Agree (@ 2), Disagree (@ 1), Strongly Disagree (@ 0) on the items: 1. In this class, I learned about careers that use mathematics, 2. This class increased my interest in taking more mathematics classes, 3. This class helped me see how mathematics is used in my chosen career, 4. This class helped me have enough understanding to use mathematics in my other classes, 5. Understanding mathematics is important to my success in my major, 6. If I devote enough effort, I can understand what is taught in mathematics classes, 7. I will be satisfied with my performance if I can just pass this class, 8. Having homework online was helpful to me

According to Figure 3, the extent of participant understanding of contents as a result of this project was rated by students at different levels. Most of them agreed to the opinion that if they have devoted enough effort, they can understand what is taught in these mathematics classes. This reason supports the purpose for the implementing of this project to overcome student difficulty, particularly, in this course.

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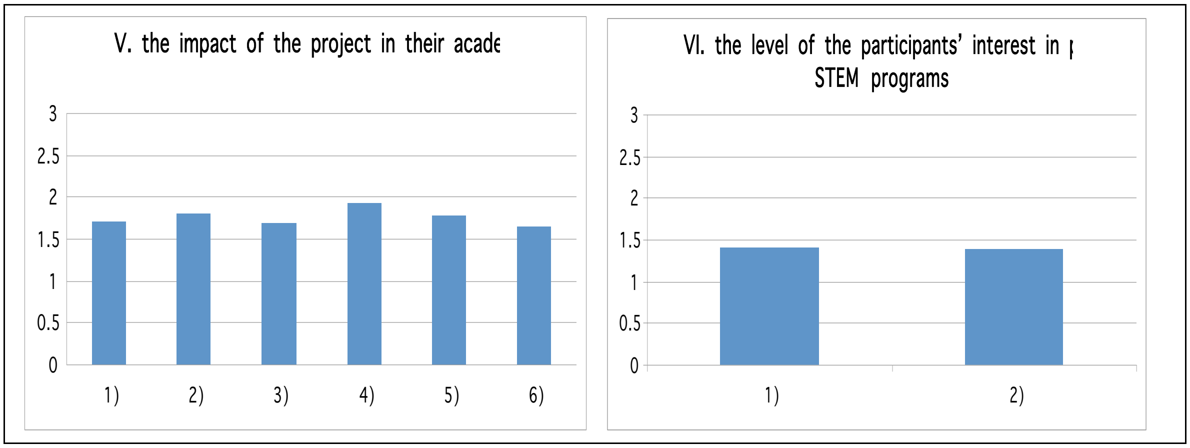

Figure 4: V. the impact of the project in their academic life rated at: Strongly Agree (@ 3), Agree (@ 2), Disagree (@ 1), Strongly Disagree (@ 0) on the items: 1. My interest level in my major field has increased because of my participation in activities of the college algebra course, 2. My understanding of the content in my major field has increased because of my participation in activities of the college algebra course, 3. My participation in activities of the college algebra course increased my interest in doing research, 4. My participation in activities of the college algebra course increased my confidence in my choice of major, 5. My activities of the college algebra course experiences provided more information that will help me in my career choice, 6. I am more interested in pursuing a graduate degree (Master's and/or PhD) because of my participation in activities of the college algebra course and VI. the level of the participants' interest in pursuing STEM programs rated at: Strongly Agree (@ 1), Agree (@ 2), Disagree (@ 3), and Strongly Disagree (@ 0) on the items: 1. I plan to complete a degree in STEM program and 2. I am excited about a career in STEM

Figure 4 shows that majority expressed that their participations in these activities of the college algebra project increased their confidence in their choice of major, and also that an equal amount of students expressed that they will either pursue a degree in STEM program or are excited about learning a career in STEM field.

Conclusions and Future Plans

This concept appears to be the right recipe for students to ease the difficulties faced in today's college algebra classrooms. Preliminary data showed that the aggregate of DFWI (D's, F's, Withdrawals, and Incompletes) rates for all college algebra courses from Fall

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2008 to Summer 2010 at TAMIU have significantly improved as a result of the introduction of these multifaceted approaches. The data suggested that the activities of ULC and TEMA computer lab seem to have provided an increased understanding of mathematics and confidence in their ability to use mathematics concepts and were contributed to gain it in this course. The extent of participant understanding of contents is greater than anticipated. Most of them agreed to the opinion that if they devote enough effort, they can understand what is taught in the course. The majority of students also expressed that their participation in the activities increased their confidence in their choice of major while equal amounts of students expressed that they will either pursue a degree in STEM program or are excited about learning a career in STEM field.

While this format may not answer all questions that the higher education authorities are currently grappling with, it can help in seeking a reasonable solution to remedy the situation once and for all.

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