

Sabbatical report Prepared by Ted Panitz
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Spring 2007

The purpose of this sabbatical was to investigate successful/innovative programs at community colleges, 4 year colleges, or universities, that promote student retention and success in developmental math courses.

The original proposal called for an analysis of Massachusetts community colleges with an emphasis on those schools that showed high completion rates as identified by the Board of Higher Education, namely: BERKSHIRE CC, BRISTOL CC , BUNKER HILL CC, QUINSIGAMOND CC, SPRINGFIELD TECHNICAL CC, MASSASSOIT CC.

The proposal also called for a survey of colleges beyond Massachusetts, via the internet, using several education discussion lists, Google searches, and email communications with faculty contacts made through AMATYC and NEMATYC. Direct phone conversations were also used to obtain program descriptions.

As more information was obtained the sabbatical was expanded to include information on helpful web sites for students, interesting articles for faculty, samples of modular programs, computer assisted tutoring programs, student oriented math department web sites, etc.

In order to help make some sense out of the large amount of information available a summary of findings is presented prior to the general table of contents. This section is intended to help focus readers attention on some of the key ideas and approaches identified in the report.

The following is a list of sections that comprise the report. Several sections have additional tables of contents to help the reader navigate the report, plus there is an expanded table of contents prior to section 1.

TABLE OF CONTENTS

1. Massachusetts Community Colleges, DE courses offered, innovative programs
2. Innovative Programs at Community Colleges Outside of Massachusetts
3. Innovative Interventions at community colleges
4. General suggestions for improving student retention and success
5. Reading List (Interesting articles on student retention)
6. Math web sites including student help sites
7. Samples of modular developmental math courses
8. Computer Assisted Tutoring Programs
9. Math help cites for students
10. Student Oriented math Department Web Sites

Appendix A: Mathematics Knowledge and Skills for Success

Appendix B: Math skills defined by CPT cut off scores

Appendix C: Application for Sabbatical leave

Appendix D: Case Study- How a 1 credit Math Lab was created at the University of New Mexico
Appendix E: email discussion

Summary and Review of Findings

Interventions that improve retention and student success

Student Oriented Improvement Approaches

- Tutoring courses- 1-2 credit tutorial courses
 - Taken in conjunction with credit courses
 - Mandatory more effective than voluntary registration
 - Include study skills, counseling for math and test anxiety, advising
- Required tutoring out of class
 - Through a math lab or learning center
 - By individual one on one tutoring
 - Remediation programs with counseling that is integrated into the entire remediation program
- Extra class time for in class tutoring- 4-5 credit courses
 - In class counseling regarding study skills, anxiety, test taking, etc.
 - In class tutoring by peers or professional tutors
 - Lab exercises in class
 - Cooperative learning activities possibly combined with lab type exercises
 - Writing in class
- Offer courses in modular form
 - Students sign up for 1-5 credits
 - One college allows students to de-register for credits not completed by the end of the course
- Use multiple options for offering courses
 - Regular credit
 - Modular course offerings
 - Self paced
 - Computer aided instruction (CAI)
 - Variable credit 3-5 credits
- Develop learning community options for students
 - Builds friendships and connections between students
 - Encourages study skills development within groups
 - Increases student enjoyment and performance in college
 - Long-term success: Studies show that students who enroll in collaborative learning environments such as Learning Communities are more likely than their peers to graduate.
 - Convenient Schedule
- Offer computer assisted tutoring
 - My Math Lab
 - Plato
 - ALEKS
 - Enable Learning
 - A+dvantage
 - IDL Systems
- Use Elementary Algebra as a prerequisite for college level math courses instead of Intermediate algebra
- Develop a Supplemental Instruction Program (SI)

- Use peer tutors
 - Bring students together in working cooperative groups outside of class
- Offer pre-semester or intercession refresher courses for students who did not test out of DE math
 - Retest students to help motivated students move ahead.
- Use student self assessment and placement approach instead of CPT
 - Students complete assessment online using non-timed computer placement system at their home computer or at school.
- Offer students a challenge exam if they feel their math background is stronger than indicated by the CPT.
 - Use the math lab as a testing center prior to the beginning of each semester or during the first week of classes.
- Offer accelerated courses in one semester.
 - Palm Beach CC- Two 8 week courses offered 4 days per week in one semester.(i.e. MAT 030/040)
- Develop early warning system for advising students who are at risk early in the semester.
 - Track students carefully.
 - Use faculty referral forms to advisors.

* Lewis-Clark College – Mandatory Mastery Skill Quizzes

- * use a mastery skill quiz program in all DE math courses
 - * Faculty identify a list of fundamental skills for each course
 - * Faculty write short 5 minute quizzes that require the students to perform the skill
 - * Each student is required to pass each and every quiz without error to pass the course
 - * Students retake quizzes in subsequent classes or during office hours
 - * All DE math faculty must do the skill quizzes
 - * Courses have a common final graded together
- Train faculty in adult learning theories and teaching approaches:
 - Cooperative learning,
 - Hands on active learning,
 - Applied problems.
 - Adopt a SLA (Student Learning Assistance) program.
 - All students take a tutoring class up until the first test.
 - If students score below 80% then the tutoring stays mandatory, above 80% the tutoring becomes voluntary.
 - If they fall below 80% during the semester the tutoring becomes mandatory again.
 - Develop case manager approach
 - Students are referred to case manager by the instructor if they:
 - disappear, miss classes,
 - fall behind the class,
 - show an unacceptable level of performance on grades
 - The case manager works with the students and professor to encourage better performance and retention.

- Lamar State College-Orange policies
 - A student who enrolls for a second time in a DE course must enroll in a study skills course concurrently,
 - If a student fails a course twice the student is required to meet with a
 - A student who fails a DE course for a third time will not be allowed to enroll again,
 - Students who are absent from a course 6 times will be dropped from the course and risk dismissal from the college,
 - Instructors may drop a student from a DE course for failure to do the assigned work and/or testing.
- Provide adequate technology training to insure that incoming students have a mastery of computer technology, operating systems, file structure, communications or information literacy, etc.
- Use targeted study sessions with student and/or staff tutors
 - Offer multiple times during the week, including days and evenings for specific course homework study sessions.
 - Encourage groups from individual classes to attend to establish regular study groups
 - Target specific courses versus open tutorial labs
 - Combine homework help with computer help and training
 - Use study sessions for test review

Institutional Improvement Approaches

- Use bottom up planning starting with the faculty, with strong support from the administration for implementation of faculty suggestions.
- Utilize full time faculty in DE courses and minimize the use of adjunct faculty.
- Aggressive professional development.
- Careful hiring of developmental educators.
- Learner centered philosophy of operation-Instructional, policy, and administrative decisions based on the decision's potential impact on student learning.
- Connecting with high schools
- Providing aggressive mentoring for new developmental faculty
- Use consistent formative evaluation based upon data collection and analysis
 - Establish base line data for the past three years
- Encourage ongoing communication among DE educators
- Use aggressive professional development
 - Conferences and workshops that stress innovative instructional methods
- Limit class size in DE courses
- Provide aggressive mentoring for new DE faculty
- Partner with local high schools
 - Review each others curriculum and course content
 - Review the college's entrance requirements

TABLE OF CONTENTS

1. Massachusetts Community Colleges

- a. DE math course offerings for all 15 community colleges
- b. Prerequisites for college level math courses at all 15 cc's
- c. Retention and success programs at select Mass community colleges
 1. BERKSHIRE CC
 2. BRISTOL CC
 3. BUNKER HILL CC
 4. QUINSIGAMOND CC
 5. SPRINGFIELD TECHNICAL CC
 6. MASSASSOIT CC

2. Innovative Programs at Community Colleges Outside of Massachusetts

1. BROOKDALE CC
2. LANE CC
3. MARICOPA SYSTEM- CHANDLER GILBERT CC
4. COLIN COUNTY COMMUNITY COLLEGE DISTRICT
5. SINCLAIR CC
6. PRINCE GEORGE'S COMMUNITY COLLEGE
7. MIDDLESEX COUNTY CC- NEW JERSEY
8. VALENCIA CC
9. PALM BEACH CC- FLORIDA
10. NORTHERN KENTUCKY UNIVERSITY
11. EASTERN KENTUCKY UNIVERSITY
12. AUSTIN COMMUNITY COLLEGE- TEXAS
13. CAMDEN COUNTY College- NJ
14. UNIVERSITY OF MARYLAND COLLEGE PARK

3. Innovative Interventions at community colleges

1. GLENDALE COMMUNITY COLLEGE (ARIZONA)- 2 CREDIT MATH TUTORIAL
2. LEWIS-CLARK STATE COLLEGE- MANDATORY MASTERY SKILL QUIZZES
3. FERRIS STATE UNIVERSITY- SLA- STRUCTURED LEARNING ASSISTANCE
4. CALIFORNIA CC'S- PATHWAYS THROUGH ALGEBRA PROGRAM
- 5- IONDIANA UNIVERSITY AT BLOOMINGTON- Learning Strategies for Mathematics
- 6- NORTHERN KENTUCKY UNIVERSITY--Developmental Mathematics Courses Offered
- 7- SANTA BARBARA CITY COLLEGE- GATEWAY TO SUCCESS PROGRAM
- 8- AMERICAN RIVER COLLEGE- BEACON PROGRAM
- 9- TREISMAN'S MODEL Merit Workshop
10. SAN FRANCISCO STATE UNIVERSITY- CARP (COMMUNITY ACCESS AND RETENTION PROGRAM)
11. AMERICAN RIVER COLLEGE- Online Informed Self-Placement for Math
12. NASSAU CC- USE OF A+DVANCER AND ACCUPLACER FOR TUTORING
13. DAVIDSON COUNTY CC- STUDENT CENTERED ADVISING- FOUR TIER SYSTEM
14. MT. SAN ANTONIO COLLEGE- CALIFORNIA- MATH ACADEMY BRIDGE PROGRAM- A LEARNING COMMUNITY
15. DE ANZA COLLEGE- CA- MATH PERFORMANCE SUCCESS PROGRAM

16. **FOOTHILL COLLEGE- CALIFORNIA- PASS THE TORCH PROGRAM**
17. **SAN JOSE UNIV. MASTERY LEARNING IN DE MATH BY SUSAM MCCLORY**
18. **SAN JOSE UNIV.-MULTI-FACETED PLACEMENT**
19. **UNIVERSITY OF MINNESOTO- RISING STARS COHORT PROGRAM FOR ELEMENTARY EDUCATION TEACHERS REQUIRING DE MATH COURSES**
20. **UNIVERSITY OF MEMPHIS- USING AN INTERNET MATH HISTORY TO SUPPLEMENT ALGEBRA INSTRUCTION**
21. **PHILLIPS EXETER ACADEMY- THE HARKNESS PROGRAM**
22. **PLATO LEARNING SYSTEM-**
23. **LAMAR COLLEGE- TEXAS**
24. **MODELS FOR USING INFORMATION TECHNOLOGY TO IMPROVE TEACHING AND LEARNING**
25. **ARAVAIPA COMMUNITY COLLEGE- LEARNING COMMUNITY WITH DE MATH COURSES**
26. **UNIVERSITY OF WASHINGTON- STOUT CAMPUS USE OF MY MATH LAB**

4. General suggestions for improving student retention and success

- **Noel Levitz Article suggestions**
- **Weber State Univ. Ogden Utah- DE Math task force**
- **Pre-collegiate math research in California**
- **Strengthening Mathematics skills at the Postsecondary Level: Literature review and Analysis**
- **Texas Association of Community Colleges Study of Successful CC's**
- **Harvard Symposium 2000: Developmental Education**
Developmental Education: Demographics, Outcomes, and Activities

5. Reading List (Interesting articles on student retention)

6. Math web sites including student help sites

7. Samples of modular developmental math courses

**Berkshire CC,
Springfield Technical CC,
Massasoit CC,
Lane CC,
Collin County CC District,
Northern Kentucky University,
California State University,
Valencia CC**

8. Computer Assisted Tutoring Programs

- **My Math Lab**
- **A+dvantage**
- **EnableLearning**
- **PLATO**
- **Aleks**
- **IDL Systems**
- **Smarthinking Tutoring**

9. Math help cites for students

10. Student Oriented math Department Web Sites

Appendix A: Mathematics Knowledge and Skills for Success

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Appendix D: Case Study- How a 1 credit Math Lab Was created at the University of New
Mexico - Valencia Campus

Appendix E: email discussion

Math Courses and Prerequisites for the 15 community Colleges

Cape Cod Community College DE courses

Prerequisites for

%

College success MAT010 MAT020 MAT030 MAT040 STATS SURVEY notes

Berkshire		MAT-018 3cr	MAT-028/029-3CR	MAT-102 3cr	MAT-029	MAT-029		83/80/ 77/76/72
Bristol		MTH 01 1cr	MTH 1N MTH 07 3cr	MTH 08 3cr	MTH 1N MTH 07	MTH 1N		82/74/ 77/77/74
Bunker Hill		MAT-090 3cr	MAT-095 3cr		MAT-095	MAT-095		81/84/ 8484/82
Cape Cod	3cr	3cr	3cr	3cr	MAT-040 3cr	MAT-040 3cr		59/55/ 59/57/52
Greenfield	MAT 090 3cr	MAT 094 3cr	MAT 095 3cr	MAT 096 3cr	MAT 096	MAT095		87/69/ 73/71/67
Holyoke	MTH 010 1cr	MTH 075 4cr	MTH 085 4cr	MTH 095 4cr	MTH 095	none	MTH 155 topics	65/66/ 69/76/69
Mass Bay		MA 090 3cr	MA 095 3cr	MA 098 3cr	MA 098	MA 098		63/57 63/65/67
Massasoit	MATH 001-2-3 1cr each	Math 010 3cr 3-5 hours	MATH 101 3cr/3-5hrs	MATH 112 3cr/3-5 hrs	MATH 112	MATH 112		69/73/ 73/67/68
Middlesex	MA 1100 3cr	MA1101 3cr or MA1102 4cr	MA 1103 MA1104 3cr each	MA 1106 3cr	MA 1106	MA 1104		72/70/ 74/72/68
Mt. Wachusett		MAT 100 3cr	MAT124 3cr MAT120/121 3cr/3cr	MAT 128 3cr	MAT124 or MAT 121	MAT124 or MAT 121		73/78/ 70/70/68
North Shore	MAT 011 4cr	MAT 013 4cr	MAT 091 4cr	MAT 092 4cr	MAT 092 or MAT 094	MAT 092 Or MAT 094	MAT 094 is 091092	65/64/ 68/58/58
Northern Essex		MAT 020 3cr 2 lec/2lab	MAT 021 3cr 2 lec/2lab	MAT 022 3cr 2 lec/2lab	MAT 120 Col. Alg.	MAT 021		63/60/ 60/65/64
Quinsig.		MAT 090 3cr	MAT095 3cr	MAT 099 3cr	MAT 099	MAT 099		78/74/ 83/78/77
Roxbury	MAT 096 5cr	MAT 097 5cr	MAT 098 5cr	MAT 099 5cr	MAT 099			54/52/ 82/66/62
STCC		ARTH078 3cr	ALGB087 3cr	ALGB097 3cr	ALGB097	ALGB097		69/63/ 57/62/62

TABLE OF CONTENTS -ANALYSIS OF MASSACHUSETTS COMMUNITY COLLEGES

- 1. BERKSHIRE CC**
- 2. BRISTOL CC**
- 3. BUNKER HILL CC**
- 4. QUINSIGAMOND CC**
- 5. SPRINGFIELD TECHNICAL CC**
- 6. MASSASSOIT CC**

Highlights of Innovative Programs at Other Mass. Community Colleges

BERKSHIRE CC-

- * Prerequisite for college math is elementary algebra which is split into two courses.
MAT 028 is first half and MAT 029 is second half of elementary algebra
- * 3 credit courses offered as math labs where 3 one credit modules are covered.
Module classes have 1 faculty for 16-25 students
Class covers all modules needed by students during each class
About half the students pick lectures and then some switch to lab format
Modules use 4-7 quizzes, 10 questions each, 80% to pass- mastery approach with
3
versions of each. quiz
- * Students may elect to take a 3 credit course. C+ required to pass.
- * No letter grades in DE math
- * College algebra MAT 102 is actually intermediate algebra

DRISTOL CC-

- Prerequisite for college math is elementary algebra- MTH- 1N
- Passing grade for C- for MTH-1N
- They have only a 1 credit arithmetic course
- Intermediate algebra is split into two 3 credit courses MTH- 07/08 (see flow chart in the appendix)
- Elementary algebra is split into two courses to pursue higher level math

BUNKER HILL CC-

- Prerequisite for college math is elementary algebra
- Passing grade is C or better in prerequisite courses
- They have only 2 DE math courses: arithmetic, MAT09,0 and elementary algebra, MAT095
- 3 credits each.
- They have a 6 credit immersion course to accelerate MAT090 and MAT095

QUINSIGAMOND CC- (See additional program description article below)

- Prerequisite for grade is C for college level courses
- They use intermediate algebra as the prerequisite for college level math courses
- Faculty have developed course manuals that everyone follows
 - Group activities
 - Quizzes
 - MyMathlab for homework data collection
 - Helps keep courses consistent with high number of adjuncts
- They have a center for academic excellence that helps train faculty
- They use 3 DE math courses

STCC-

- Intermediate algebra is the prerequisite for college level courses
- 3 credit courses are offered as lecture classes
- 1 credit modules in a self paced approach are also offered (algb 099)
 - Use the same text in both courses
 - Tests can be done in a test center or class at instructors discretion

- Students may work alone/with a tutor/with teacher in class.
- All students are assigned a class time with a teacher available
- Tests are scored immediately
- Students may transfer from lecture to self paced at any time and get credit for exams taken in the lecture class.
- They offer 3 credit bilingual courses in DE math

MASSASSOIT CC- OFFERS 4 OPTIONS (3 credit lectures, 5 day lectures, modular, self paced)

- 3 credit courses
- 5 day algebra (students pay for 3 credits teachers get 5 credit workload)
 - 50 minutes per day
 - Many tests which are cumulative
 - In class work, group work
 - Many quizzes/hand in assignments
 - Classes limited to 25, usually less
 - Student profile
 - At risk
 - Failed before
 - Disabilities/math phobia
 - Referred by the math department
- Modular-
 - 3 one credit modules for each course
 - 3 sections/ 3 instructors/ 1 time period
 - Students take same exams at same times (2 in each five week module)
 - After 5 weeks students who are failing start over (same after 10 weeks)
 - After first 5 weeks students are rearranged and one faculty member starts the repeat section while the other two sections move on to the second module
 - Similar rearrangements take place at the end of ten weeks
 - Students completing the three modules in one semester receive a single grade for the 3-credit Introductory Algebra course
 - Students not completing the three modules in one semester receive three individual module grades)
- Self Paced
 - 2 instructors or instructor plus tutor
 - Students work at their own pace
 - Mastery approach is used with an 80% competency rate required to pass
 - Offered in combination with either prerequisite arithmetic or next algebra sequence
 - Intended for well motivated students who score well on cpt, but not enough to move ahead
 - Students can complete two courses in one semester

Article from “Making the Grade - A Report on the Success of MyMathLab in Higher Education Math Instruction”

BY MICHELLE D. SPECKLER • SPRING 2007 for Pearson Education

Quinsigamond Community College (QCC) was established in 1963 to provide a first-rate education for residents of central Massachusetts. The college offers more than 60 associate degree and certificate career options to a diverse population of more than 7,000 day and evening students. Roughly 93 percent of QCC’s incoming students test into at least one level of developmental math. They typically have a high level of math anxiety, a long history of math failure, poor study skills, and an overall lack of preparation for college-level math. In 2001 the number of developmental math students started to rise. QCC knew it needed a plan—a systemized and measurable way to ensure that these students received the kind of high-quality education QCC was created to provide. The award of a \$1.7-million, five-year Title III grant gave the school the resources they needed to do just that. Faculty and administration assessed the challenges that lay ahead—large numbers of developmental math sections, large numbers of part-time faculty, inconsistent delivery of objectives and grading, poor student performance, and diverse student educational goals—and in 2002 embarked on the Developmental Math Program. The program borrows heavily from the theory of Universal Design for Learning*, with MyMathLab as one of its delivery vehicles. Pass rates in all three developmental math classes—basic math, beginning algebra, and intermediate algebra—significantly increased, with beginning algebra showing the most striking average increase from the program pilot in 2003 through spring 2006: nearly 42 percent! Steadily rising pass rates convinced even the most skeptical faculty members, and today MyMathLab is standardized across the QCC developmental math program. Master Courses, created with MML, enable all instructors to copy a complete, predesigned course. One of the most visible changes has been an increase in the number of students utilizing math resources on campus. “Math Resource Center attendance figures went up significantly,” says Andreana Grimaldo, assistant professor of mathematics and developmental mathematics coach at QCC. “The increase was dramatic and an indication that students are taking responsibility for their learning. They’re engaged in math and enjoy the immediate feedback of getting 100 percent on their homework.” Standardized courses give students more options when help is needed. “Faculty, math center tutors, the textbooks, MML, and the students are all on the same page,” says Grimaldo. “Everyone knows what everyone else is doing, which means students have any number of resources for help.”

Faculty and adjuncts appreciate the standardization. “Everyone knows exactly what they need to do—no guesswork,” says Grimaldo. “It saves time—time that can be spent teaching and working one-on-one with students.” And by combining MML and QCC’s unique instructor resource manual, QCC can keep nearly 70 faculty and adjunct instructors on target and communicating. Instructors have many opportunities to meet and discuss what works best in the classroom and to share how they use MML to keep students excited. “Standardizing the courses has opened a space for sharing and discussion and enabled us to learn from each other. In a community college, the population is always changing and the dynamics are always shifting. The constant sharing of new ideas is important for us,” says Grimaldo.

MML is also helping QCC improve retention. Its Gradebook and multiple reporting features facilitate close tracking of students’ attendance and performance, thereby leading to early intervention. “The moment they start slipping, you can see it,” says Grimaldo. “There’s no need to wait for an exam to find out.” MML’s e-mail feature enables instructors to communicate with students. “Every time you connect with students, you increase your chances of retaining them. It lets the students know that you care.” The average age of a QCC student is 27 years old. The college has a high proportion of adult, learning disabled, part-time, nonnative English-speaking, and evening students. These generally underserved populations have benefited as well. “About

10 percent of our population have accommodations for learning,” says Grimaldo. “MML provides us with the resources to help them. They have video options and audio options, and they can enlarge text to a size that suits them. I have a student who is very intelligent and has cerebral palsy. She can run the computer beautifully, but she has trouble interacting with people. Because homework is almost exclusively online, she’s been able to succeed in my class.” English as a Second Language students also find extra support in MML. “They can go back and practice English, review assignments, and listen to the audio as many times as they need to,” she says.

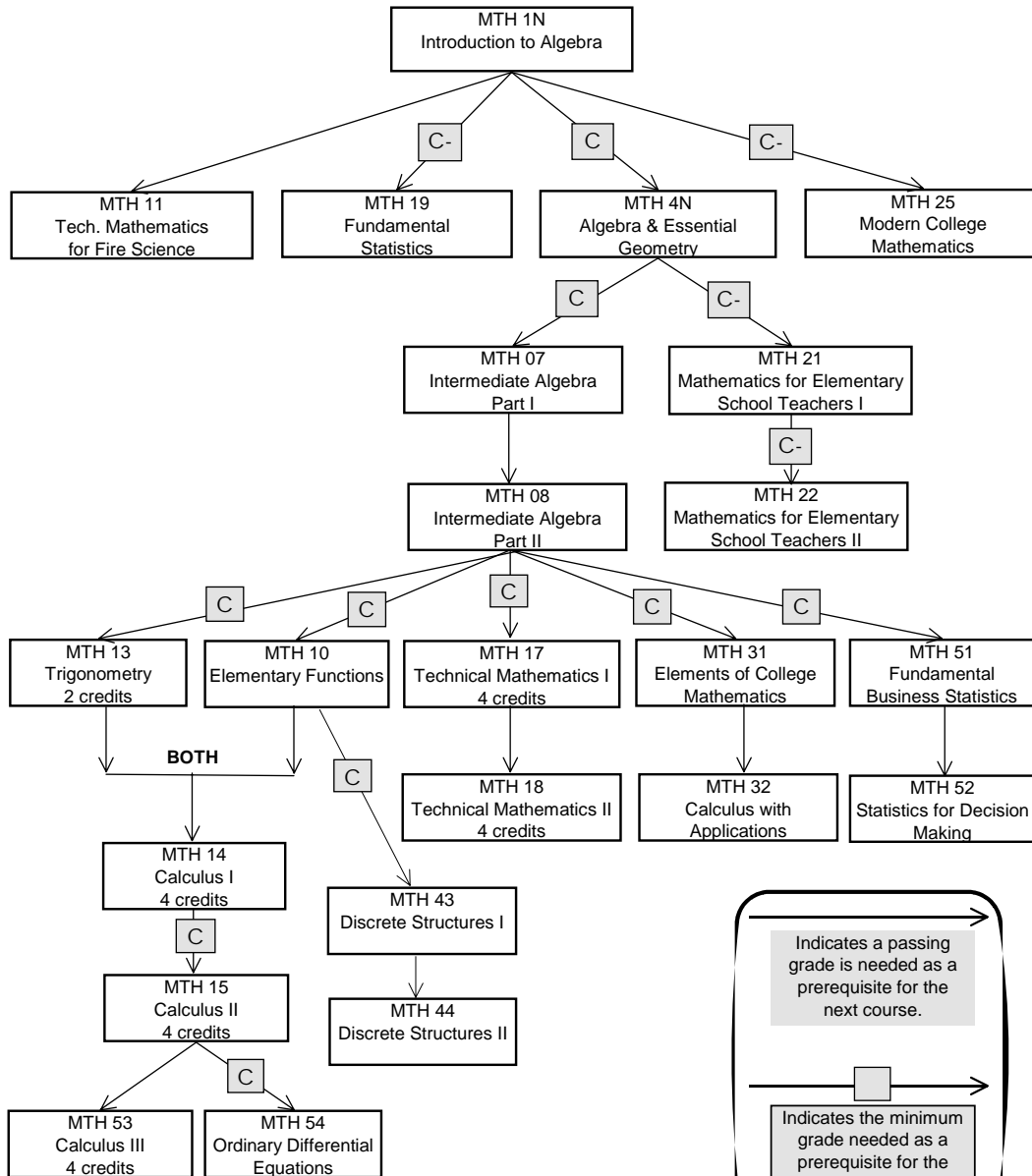
Even those students who’ve had frustrating experiences and faced constant failure in math are empowered by MML. “It’s incredible to see them succeed,” says Grimaldo. “It increases their self-esteem and thus their potential to succeed in life. They learn math, but also technical reading and comprehension. MML teaches them how to follow directions, use a math symbol palette, and overlay it on a present need. These skills will serve them the rest of their lives.” MML works with every type of student and every student’s learning style: those who are embarrassed to ask questions in class can send an e-mail, returning students who need more support can watch videos, and those who have the ability appreciate that they can get in and get out without repeating what they already know or can quickly learn. “They all like using it,” says Grimaldo. Grimaldo and the rest of the QCC faculty are pleased with the successes they’ve derived from standardized use of MML on campus and online. Students are achieving at higher levels and instructors are thriving in an atmosphere of professionalism and collaboration. Says Grimaldo, “This couldn’t happen if everyone wasn’t on the same page.”

* Universal Design for Learning is an approach to design of course instruction, materials, and content to benefit people of all learning styles. It provides equal access to learning by allowing the student to control the method of accessing information while the teacher monitors the learning process and initiates beneficial methods. The design enables the student to be self-sufficient, although the teacher is responsible for imparting knowledge and facilitating the learning process. Those who benefit the most from this approach include students who speak English as a second language, international students, older students, and students with disabilities.

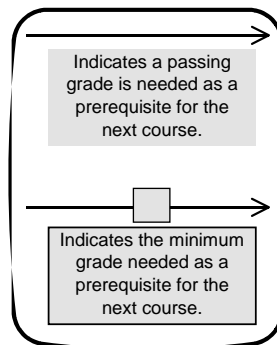
Bristol Community College Developmental/College Math Course Sequence

All courses are 3 credits unless otherwise indicated. Each course has as its prerequisite the course immediately preceding.

{ **MTH 01-Arithmetic Review (1 credit = 14 class hours) or a passing score on the Accuplacer Arithmetic Test is a pre- or co-requisite for all MTH courses and BUS 11.** }

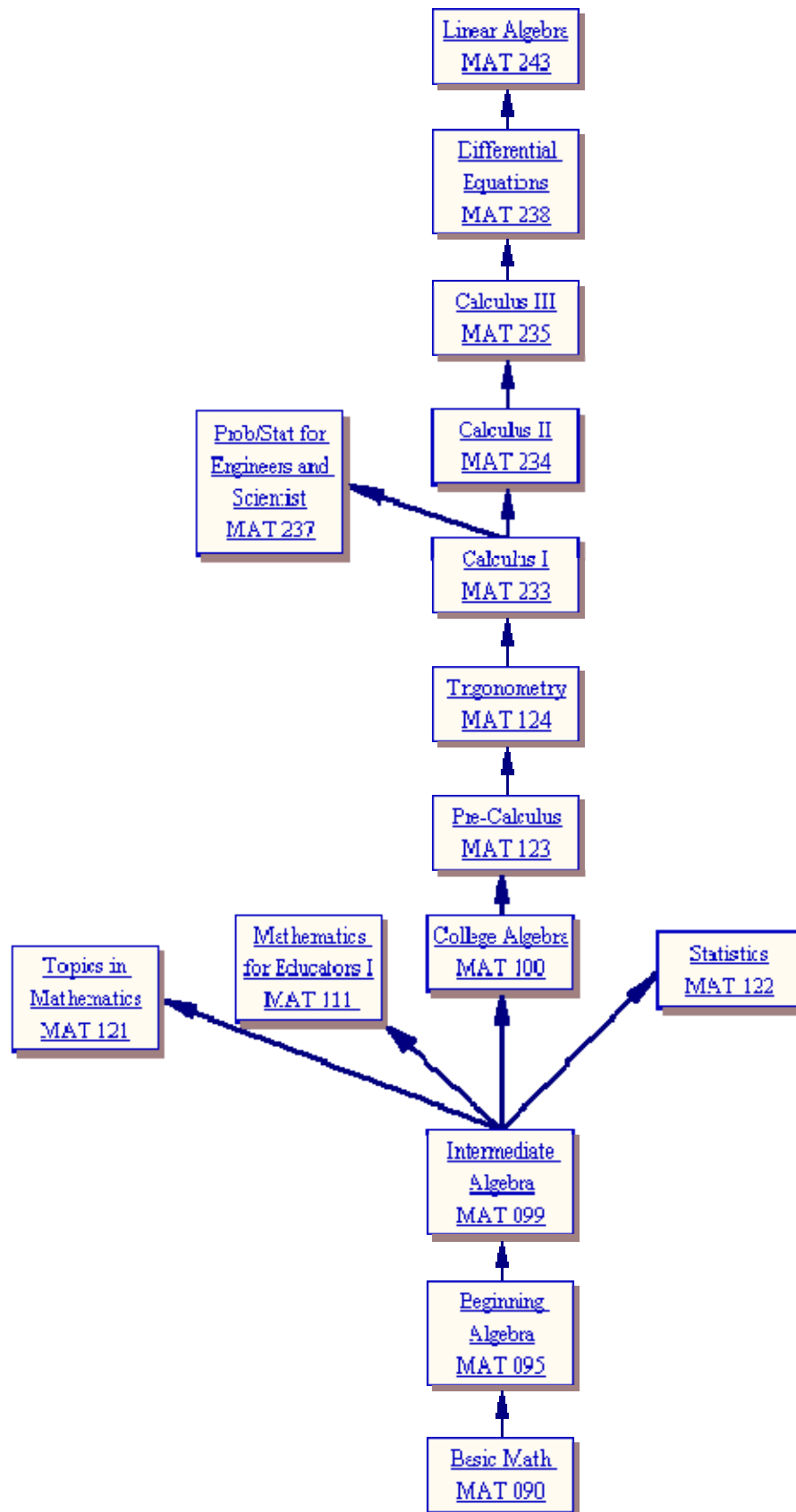


REFER TO THE CURRENT BCC CATALOG FOR COMPLETE EXPLANATIONS
AdvPkgFeb05-Page4



Jerry M - 2-15-05

Quinsigamond Community College Course Sequence





Mathematics Department

[Math Department Home](#)

Flow Chart of Math Prerequisites				
	<p>MATH 010 Fundamentals of Mathematics (C- or better, no prerequisite)</p>			
	<p>MATH 101 Introductory Algebra (C- or better)</p>			
<p>MATH 116 Mathematical Experience for Early Childhood Education</p>	<p>MATH 112 Intermediate Algebra & Trigonometry* (C- or better)</p>			<p>MATH 115 Contemporary Mathematics I</p>
	<p>MATH 123 Principles of Math I</p> <p>MATH 124 Principles of Math II</p> <p>MATH 131 Introductory Statistics</p>	<p>MATH 203 College Algebra (C- or better)</p> <p> </p> <p>MATH 204 Pre-Calculus (C- or better)</p> <p> </p> <p>MATH 221 Calculus I (C- or better)</p> <p> </p> <p>MATH 222 Calculus II (C- or better)</p> <p> </p> <p>MATH 223 Calculus III</p>	<p>MATH 121 Topics in Math I or MATH 122 Topics in Math II</p>	

TABLE OF CONTENTS FOR OUT OF STATE COMMUNITY COLLEGE'S INNOVATIVE PROGRAMS

- 1. BROOKDALE CC**
- 2. LANE CC**
- 3. MARICOPA SYSTEM- CHANDLER GILBERT CC**
- 4. COLIN COUNTY COMMUNITY COLLEGE
DISTRICT**
- 5. SINCLAIR CC**
- 6. PRINCE GEORGE'S COMMUNITY COLLEGE**
- 7. MIDDLESEX COUNTY CC- NEW JERSEY**
- 8. VALENCIA COMMUNITY COLLEGE**
- 9. PALM BEACH CC- FLORIDA**
- 10. NORTHERN KENTUCKY UNIVERSITY**
- 13. CAMDEN COUNTY College- NJ**
- 14. UNIVERSITY OF MARYLAND COLLEGE PARK**

1. BROOKDALE COMMUNITY COLLEGE- NEW JERSEY

- Offers two DE math courses- Arithmetic and Elementary algebra (Intermediate algebra is considered college level)
 - Courses are offered in two formats
 - One 4 credit course offered over one semester
 - Two four credit courses offered over one year
 - Courses are offered as two class hours twice a week
 - Courses include a lab activity during each class
 - Courses are mastery based. Students may retest once in the test center
 - Passing grade is a “C”
 - All courses have a department created manual for faculty which contains (see attached materials)
 - Guidelines for instructors
 - syllabus
 - Day-by-day course outline
 - Overheads for class use
 - Lab materials
 - Quizzes
 - Exams

- Approach to courses
 - Courses are based upon problem solving from multiple perspectives
 - Numerical
 - Graphical
 - Verbal
 - Symbolic

- Class time
 - A mixture of activities is encouraged for each class
 - Short lectures
 - Group work
 - Individual work
 - Quizzes
 - Exams

- Labs
 - Each class has a lab associated with it (except review and exam days)
 - Labs are done by groups with the instructor as facilitator
 - Labs may be done any time during class
 - Labs may take from 25-45 minutes
 - Labs are graded and count as one test grade

- Tests
 - Tests are cumulative
 - Students have review sheets purchased as part of the assignment package
 - Tests are available in the test center for make ups or missed tests
 - The instructor manuals have model tests for use or the instructor makes their own test
 - If students pass the initial test with a 70 they may not retest
 - If students do not receive a 70 they are allowed one retest with a maximum score of 70

2. LANE COMMUNITY COLLEGE- FLEXIBLE SEQUENCE ALGEBRA

- Courses are offered for 5 credits as lecture and by modules
- Module offering consists of five 2-week modules
 - **Sample syllabus** (<http://teach.lanec.edu/~hillb/fsasyllabus.htm>)
 - When a student passes a module they earn one credit
 - If a student passes fewer than 5 modules they modify their schedule online to reflect the number they passed
- **Course Description:** MTH 095 Intermediate Algebra (FSA) is identical to MTH 095 but is delivered in five 2-week modules, each worth 1 credit. This approach provides students the option of repeating modules in which they have been unsuccessful instead of repeating a whole term of MTH 095. Students will take a computer-based module test every two weeks. Those who pass every module will complete 5 credits of MTH 095 in 10 weeks. Students who do not pass a module will retake the module the next two weeks, finishing the fifth module in the following term. Retaking a module will establish a new grade for the failed module. The repeated class sessions will be at the same time of day but with a different instructor and on different days.
- Class format for each module is interactive lecture with some class activities
 - Class activities will be integrated into each module to increase understanding of concepts
 - Class activities will be done in groups but submitted individually
- Attendance is required in class and credit toward the grade will be given or a quiz will be used to take attendance
- Students need to pass an exam on each module before taking the next module. End-of-module exams will be computer-based, so that the results are obtained in time to assign students to the correct next module. After the Thursday/Friday review students will take the module exam in the Math Resource Center, which has a 30-station computer testing area. The multiple choice module exams will be created by a computer program which generates non-repeating questions in random order. Bill Griffiths of the Lane Math Division has used the program successfully for exams in beginning and intermediate algebra. Students who do not pass the module exam will retake the same module in a trailing section. Trailing modules will be held at the same time of day, so students will not have to readjust their schedule.
- testing- a computerized test will be given at the end of each module and may be repeated 2 times. Rules for testing are as follows:
 - You cannot stop a test and then come back to it after leaving the room.
 - You may not take the test more than once on the same day.
 - You may not have a review conference to go over a previous exam and then take the exam following the review conference *on the same day*. A review conference following an exam and taking the exam the next day is OK.
 - To take the test the first time you must have completed the module review handout given in class. Bring it with you to testing.
 - If you take the test twice, only your best score will count. You must receive 70% or better on each module test in order to go on to the next module. However, the grade you receive for the module will include class performance. See the grades information.
 - Modules must be tested in order; for example a student cannot take a test for module D without first passing the module C test.
- **Some details on exams:** The module A exam contains 25 questions. The module B, C, and D exams are 20 questions long and contain 2 or 3 review questions

from previous modules. The Module E exam is 10 questions long, all on module E. The final exam, which is written — not on computer— contains 9 review questions from modules A through D and one graphing question from module E. Together the Mod E exam and the written final exam total 20 questions; the minimum score to pass module E is 70%, on the basis of all 20 questions from both the “Mod E exam” and “final”.

- **Sequence and Module Content for Intermediate Algebra**

Class No.	Module A: Weeks 1-2	Module B: Weeks 3-4	Module C: Weeks 5-6	Module D: Weeks 7-8	Module E: Weeks 9-10
1 Mon	Basic operations, exponents	System of linear equations	Simplifying rational expressions	Simplifying and operations with radicals	Complex numbers
2 Tues	Solving linear equations	System of linear equations	Operations with rational expressions	Operations with radicals	Exponential functions
3 Wed	Graphing linear equations	Adding & subtracting polynomials	Operations with rational expressions	Solving radical equations	Exponential functions
4 Thur	Slope	Multiplication of polynomials	Rational equations	Graphing quadratic functions	Introduction to logarithms
5 Mon	Equations of lines	Factoring	Solving rational equations	Quadratic formula	Synthesis of previous topics, exploration
6 Tues	Linear inequalities	Factoring, zero product	Integer exponents and radicals	Quadratic formula	Synthesis
7 Wed	Functions	Applications	Applications	Applications	Synthesis
8 Thur	Review	Review	Review	Review	Review
Thur or Fri	Module exam in math resource center	Module exam in math resource center	Module exam in math resource center	Module exam in math resource center	Module exam in math resource center
Week 11					Comprehensive final exam after module E

3. MARICOPA COMMUNITY COLLEGE- MARS PROGRAM

- The MARS program was designed to improve retention rates and promote student success for developmental math students. It was a collaborative effort by Chandler-Gilbert Community College's Counseling and Mathematics faculty to develop an effective and efficient method to help developmental math students overcome math anxiety, develop successful study habits, set academic and career goals, as well as develop and employ effective test taking skills. It employs assessment tools that are used to assess student learning and to continuously improve the program.
- (This initiative is Chandler-Gilbert's 2005 Innovation of the Year.)

The objectives of the program are to reduce students' math and test anxiety, provide each student successful study habits and test preparation techniques, test-taking skills, develop student academic/career goals to improve MAT091 student retention, and to enhance student success rates in mathematics, as well as other academic areas.

Brief Overview of the Five Presentation Objectives

1. To identify past behaviors, obstacles and personal attitudes about math that hinder academic persistence, and to understand the importance of goal setting.
2. To identify and recognize causes and the disabling effects of math anxiety.
3. To understand academic success as it pertains to self-responsibility, and to identify and enhance individual study skills strategies for overcoming math anxiety.
4. To identify and understand individual learning styles and its relationship to the improved comprehension of math, and to learn how the brain stores information and how it is retrieved.
5. To learn some of the primary causes of poor math preparation and test anxiety, and to become aware of effective test preparation and test-taking strategies.

The quality of the MAT091 courses at CGCC is enhanced tremendously by the collaboration and utilization of counselors to introduce math anxiety reducing strategies. The counseling faculty bring their teaching experience and knowledge of topics such as test preparation, test taking techniques, study skills, stress and/or anxiety reducing strategies, as well as career decision making exercises, into the MAT091 classroom. This expertise helps to strengthen the quantity and quality of topics, strategies and understanding of math anxiety and the means by which to deal with and overcome it. The career component clarifies or strengthens student academic/career goals which is known to strengthen student persistence.

Evidence collected continues to show that the material, information and exercises are being clearly presented and understood and that MARS is an effective intervention tool. To measure student learning and understanding, and to continuously improve the presentations and overall program, assessment surveys are given to the students at the

end of each of the five presentations and at the completion of the program. The surveys ask students to provide feedback about their understanding of the material and the possible future use of the material learned. We are feeling confident that many of these students will utilize the stress reducing and test preparation strategies they are being introduced to. Another effect of this program is

that additional future educational costs to students will be reduced if they don't have to repeat their math course as a result of overcoming their math anxiety.

MAT093 20036-99999

LEC 5 Credit(s) 5 Period(s)

Introductory Algebra/Math Anxiety Reduction

Linear behavior; linear equations and inequalities in one and two variables; graphs; systems of equations in two variables; function notation, graphs, and data tables; operations on polynomials; properties of exponents; applications. This course will be supplemented by instruction in anxiety reducing techniques, math study skills, and test taking techniques. Prerequisites: Grade of "C" or better in MAT082, or MAT102, or equivalent or satisfactory score on District placement exam.

MCCCD Official Course Outline:

MAT093 20036-99999 **Introductory Algebra/Math Anxiety Reduction**

- I. Linear Behavior
 - A. Equations
 - B. Proportions
 - C. Inequalities in one and two variables
 - D. Graphs
 - E. Systems in two variables
 - F. Applications
- II. Functions
 - A. Notation
 - B. Graphs
 - C. Data tables
- III. Polynomials
 - A. Operations
 - B. Exponent properties
- IV. What is Math Anxiety?
 - A. The physiology of anxiety
 - B. Relationship of anxiety to cognitive processes
 - C. Disabling effects of math anxiety
- V. What Causes Math Anxiety?
 - A. Math myths
 - B. Former experiences with math
 - C. Self-defeating beliefs
 - D. Self-fulfilling prophecies
- VI. How Does Math Anxiety Limit People?
 - A. Career choices
 - B. Analysis of mathematical requirements of students' career choices

- C. Long-term effects of math avoidance on academic and career choices
- VII. How Do People Overcome Math Anxiety?
 - A. Interaction of cognitive processes and emotion
 - B. Self-talk exercise
 - C. Relaxation and desensitization
 - D. Study skills
 - E. Test-taking strategies

MCCCD Official Course Competencies:

MAT093 20036- Introductory Algebra/Math Anxiety Reduction 99999

1. Solve linear equations. (I)
2. Graph linear functions given data tables or an equation. (I, II)
3. Determine and interpret the domain and range of a function given its graph. (II)
4. Determine and interpret the slope and intercepts of a linear equation or function. (I, II)
5. Determine and explain the relationship between the slopes of perpendicular and parallel lines. (I, II)
6. Given sufficient information or data, write a linear equation. (I, II)
7. Use function notation to represent and evaluate linear relationships. (II)
8. Solve linear inequalities and graph solutions on the real number line and on the coordinate plane. (I)
9. Solve linear systems in two variables by graphing, substitution, and elimination methods. (I)
10. Simplify polynomial expressions. (III)
11. Perform operations on polynomials (add, subtract, multiply, divide, powers). (III)
12. Model and solve real-world problems using linear equations, proportions and systems of linear equations. (I, II)
13. Define math anxiety and describe several common symptoms of math anxiety. (IV)
14. List and describe the common causes of math anxiety. (V)
15. Analyze the mathematical requirements of personal career choices and describe the consequences of math avoidance on career choices. (VI)
16. Explain and practice techniques for coping with math anxiety, including study skills and test-taking strategies. (VII)

4. Collin County Community College District (CCCCD) - Mathematics Passport Program

- This math program allows students to receive condensed, intensive instruction in the specific segments of math needed to advance to the next level without having to complete the entire math course.
- The students begin the program from their individual current mathematical competence point, rather than from the points at which the traditional curriculum is designed to begin. This point is determined through a combination of testing and instructor assessment.
- The Passport Program, designed for high school graduates, current CCCC students and adults returning to college, is delivered in a five-week format that runs from June 2 - July 3. Students will meet from 8:30 - 11:30 a.m., Monday through Friday. The program fee is \$75 plus tuition.
- The unique aspect of the Passport Program is that students study only the math areas in which further instruction is needed. Students are not required to work through an entire textbook if they only need help in one or two chapters. With the help of instructors, they learn what they need to learn to move on to the next level. This individualized math curriculum is called a 'student success plan. Conceivably, a motivated student could work through several math levels in five weeks. Students who do not complete the first course during the 8-week Passport Program will be directed to withdraw from the 2nd course and will be given up to an additional 8 weeks to complete the initial course.
- After placement at a specific competency level, students may enroll in any of the following mathematics courses: Basic Math (Math 0300); Pre-Algebra (Math 0302); Beginning Algebra (Math 0305); or Intermediate Algebra (Math 0310). Students will also be taught how to use a graphing calculator in all of the Passport Program math classes.
- In the Passport Program the student's learning is predicated on the comprehension of concepts, NOT on a linearly mandated trek through a textbook. After the initial class meeting, the student may immediately progress to the material where additional study is needed. The program is also designed for each student to receive instruction on topics "missing" from their understanding of a previous course.
- During the 15-minute base group meeting, each student is counseled about recommended work strategies for the day. Each class day is structured as follows:

15 minutes	Base Group Planning
20 minutes	Lecture 1
20 minutes	Lecture 2
20 minutes	Lecture 3
20 minutes	Lecture 4
10 minutes	Base Group Wrap-up

- * All students are given the option to attend the Learning Pods rather than lecture if no scheduled lecture corresponds to their learning program. During the one-on-one instructor/student “exit” briefings each class day, content progress is assessed and future work session topics are identified.
- To create an effective student learning environment, this program offers the following learning tools: lectures, graphing calculators, videos, discussions, discovery, computer software, worksheets, tutoring, online support, manipulatives, group work, and real-world applications. The faculty help students identify how they each learn best by offering a Learning Style Inventory (LASSI). This facilitates an understanding by both student and instructor of the student’s inclination relative to attitude, motivation, time management, anxiety, concentration, and test strategies.

Procedures:

- A student registers for a course in the Passport Program.
- The student meets with an instructor at the beginning of each class to determine a study plan for the day based on the lectures being offered. A card will be used to help with the advising (see attached) and will be initialed by an instructor indicating a day strategy was discussed with the student/teacher.
- The student will take any chapter test for which they have shown competency through chapter reviews. This will allow for standard developmental education grading procedures of A, B, C, or F.
- The student attends Lecture 1. This topic may be a topic from a previous course but that was indicated as a weakness.
- The student attends Lecture 2. This topic may be unrelated to Lecture 1 but still one the student needs for success.
- The student attends Lecture 3. Again, this topic may be unrelated to the first 2 lectures or a continuation of previous lectures.
- The student attends Lecture 4. Again, this topic may be unrelated to the first 3 lectures or a continuation of previous lectures.
- If there are not 4 lectures the student needs on a given day, then he/she will go to the Learning Pod for individual study using computer aided instruction or study in the classroom.
- The student returns to BASE group to ‘wrap-up’ the day. The student updates the cards with an assessment of the day’s progress, whether more instruction on a topic is needed, or if he/she is ready to move forward. This card is presented to an instructor for checkout purposes. While cards are being checked, other students will be working on homework. No student may leave early without a tardy penalty.
- When a student, with instructor approval, feels he/she is ready to take a chapter test over assigned material, the program chapter review is completed. The instructor will record it and, if appropriate, give the student a test permit. All exams will be taken in the Testing Center.

Taking a Passport course will:

- allow students to begin at their competency level
- allow students to move at their own pace
- allow students to complete more than 1 course in a semester
- allow flexible entry/exit subject to availability
- expose students to different instructors and teaching styles
- empower students to be responsible for their learning
- decrease the length of time spent in remediation.
- increase academic retention in credit level mathematics courses.
- create a tailored path to college-level mathematics competencies for each student.

- offer alternative media in order to match learning styles

Personnel and Classroom Requirements for the Passport Program

1) 2 instructors **per campus** with these responsibilities:

- teach in the program
- maintain a file of all exams
- maintain a file of all reviews
- set up computer accounts on a secure class management system for student access
- advise base group students
- provide teacher training
- participate in the selection of daily lecture topics

2) Cost to student: Regular Tuition

5. Sinclair Community College Math Retention and Success program

Math Retention and Success Program - Our Mission

The Mathematics Retention and Success Program is a multifaceted initiative by the Mathematics Department at Sinclair Community College. This initiative strives to boost the success rate in various mathematics courses by offering one-on-one tutoring sessions to selected students, insuring proper course placement, and fostering mathematics study skills through the use of tailor made workshops.

Math Retention and Success Program – Placement

Prior to the beginning of every quarter, the retention specialist is responsible for insuring proper placement in MAT 102 by making a number of necessary phone calls. The three following groups of MAT102 students are identified:-

Group1: Students whose records indicate that they do not meet the course prerequisite. The retention specialist contacts each one of these student and a recorded message is left for the student to call back if no contact is made. The retention specialist provides the instructions on how to switch back to a MAT101 class. Follow-up emails are sent to the instructors to insure that students who were missed by the phone-calls process are still made aware about their predicament the first day of class-

Group2: Students whose records suggest that they would benefit from the Math Retention and Success Program and other opportunities for help at Sinclair. The Retention Specialist calls the student and informs them directly or through a recorded message about all available opportunities for help.

Group3: Student whose records indicate that either a significant time period had elapsed since they had met the course prerequisite and/or that after meeting the prerequisite they had not been successful in MAT102. The Retention Specialist tries to persuade students in this group to go back to MAT101, otherwise the student is at least made aware of the opportunities for help on campus.

Math Retention and Success Program – Tutoring

At the beginning of every quarter, the retention specialist sends out introduction forms, referral forms, and student letters to different sections of selected math courses. The instructor of each

targeted section receives one introduction form, one referral form, and a few students letters (the letter includes a description of the tutoring sessions and invites the student to participate in the Math Retention and Success Program).

After grading the first in-class exam, the instructor will identify candidates for the program. Each candidate will be given a student letter. The instructor will then fill out the referral form, include the names of the selected students, and return the form to the retention specialist. When deciding who to refer to the Math Retention and Success Program, the instructor should use the following guidelines:

- 1) The student is having difficulty but is within striking distance of being successful.
- 2) The student has the required prerequisites.
- 3) The student is attending class regularly
- 4) The student is completing the required course assignments.

Note: The instructor should not include students who are so far behind that the instructor does not think they have a good chance of being brought up to at least a C level.

Math Retention and Success Program – Workshops

FALL 2006 SCHEDULE FOR MAT 101 AND MAT 102 WORKSHOPS
 ALL STUDENTS ARE INVITED TO ATTEND ANY OR ALL THE WORKSHOPS
 FOR MORE INFO, CALL GLEN LOBO @ 512-2582 OR EMAIL glen.lope@sinclair.edu
 ALL WORKSHOPS ARE HELD **ROOM 1-346A**

Date	Time	Workshop Topic (Targeted Audience)
Week1/2	TBD	Math Anxiety (MAT 101 & MAT 102)
Week1/2	TBD	Math Test Preparation (MAT 101 & MAT 102)
Sep 19 (Tue)	1:00 PM – 1:50 PM	Rational Equations & Applications (MAT 102)
Sep 25 (Mon)	2:00 PM – 2:50 PM	Applications of Linear Equations (MAT 101)
Oct 9 (Mon)	2:00 PM – 2:50 PM	Exponents (MAT 101)
Oct 24 (Tue)	1:00 PM – 1:50 PM	Radicals (MAT 102)
Oct 25 (Wed)	2:00 PM – 2:50 PM	Factoring (MAT 101)
Nov 8 (Wed)	2:00 PM – 2:50 PM	Rational Expressions (MAT 101)
Nov 9 (Tue)	1:00 PM – 1:50 PM	Quadratic Equations, Functions & Applications (MAT 102)

6. Prince George's Community College- Developmental Mathematics Options

There are a number of options available for students to satisfy their developmental mathematics requirement and prepare for credit level mathematics courses. The appropriate choice depends on a student's placement test scores, academic background, course load, work schedule, and learning style. Students should consult with a College counselor before selecting an option. Advising/Counseling Services are located in Bladen Hall, Room 145.

1. The Math Review

- If you feel you learned math but forgot much of it.
- Arithmetic Only (SKB 329) or Arithmetic and Algebra (SKB 331) - page 2 in fall schedule
- DVM 002, if you plan to use financial aid
- Intermediate Algebra (DVM 008) - review of elementary and intermediate algebra, requires placement in at least DVM 007
- Sessions in June, August, January and at the beginning of fall and spring semesters
- Day and evening sessions.
- Retake placement test on last day of course and register for the math course you really need
- Late-start math courses linked to semester version

2. Fast Track Math

- DVM 003/DVM 007 or DVM 007/MAT 104 in the same semester: one-half semester courses, 12 hr/wk
- DVM 003/DVM 007/MAT 104 in same semester, 5 weeks each, 18 hours per week, reading prerequisite
- Day and evening sessions
- Reading prerequisite

3. Traditional Classes

- DVM 003 in one semester followed by DVM 007 in one semester

4. Self-paced Developmental Math: DVM 005

- Work almost entirely on your own.
- Have multiple opportunities to attempt chapter exams
- Not recommended for students with poor study habits
- Department/advisor signature required
- Online section available

7. Middlesex County CC- New Jersey

Overview of the Developmental Mathematics Program

The developmental mathematics courses are taken by students who need to learn or refresh the skills they are lacking to succeed in credit mathematics courses at Middlesex County College . Depending on Accuplacer Test results and the curricula they are taking, students might need up to three developmental courses. The three courses that make up the Developmental Mathematics Program at Middlesex County College are:

Basic Mathematics	Mat-010
Algebra I	Mat-013
Algebra II	Mat-014

These courses are offered all through the year in different formats and using a variety of teaching strategies.

DO STUDENTS RECEIVE COLLEGE CREDIT FOR DEVELOPMENTAL MATHEMATICS COURSES? Students do not receive college credit for these developmental courses. The courses are assigned credit equivalents or contact-hours. Mat-010 is a three contact-hour course and Algebra I and Algebra II are each four contact-hour courses.

IS THE GRADE IN THE DEVELOPMENTAL MATHEMATICS COURSE INCLUDED IN THE STUDENT'S GPA? The grades in developmental mathematics courses are included in the semester GPA. The grade is not included in the cumulative transcript at the time of graduation.

CATALOG DESCRIPTIONS OF THE DEVELOPMENTAL MATHEMATICS COURSES

Basic Mathematics - Mat-010 - 3 contact hours This course focuses on computational skills and problem solving skills. Topics include addition, subtraction, multiplication and division of whole numbers, fractions and decimals, ratio and proportion, percent, measurement, areas and perimeters of geometric figures and basic descriptive statistics. Applications are included as well.

Basic Mathematics Alternative - Mat-009- 1 contact hour This is a fast-paced, condensed version of Mat-010. It is sometimes taught during the winter or summer session as a stand alone one or two week Basic Mathematics course. Most of the time it is taught along with Algebra I or Algebra IA as part of a combination course.** This will be explained later on in the manual.

Basic Mathematics I (Part A)- Mat-010A - 3 contact hours * This course covers the first half of the Mat-010 course. Students who successfully complete this course take Mat-010B during the next semester.

Basic Mathematics II (Part B)- Mat-010B - 3 contact hours* This course covers the second half of the Mat-010 course. Students who successfully complete both Mat-010A and Mat-010B have fulfilled the course requirements for Mat-010.

Algebra I - Mat-013 – 4 contact hours This course introduces and develops elementary algebraic concepts. Topics include properties of real numbers, operations on real numbers, simplifying and evaluating algebraic expressions, solving linear equations, solving literal equations, verbal problems and polynomials, techniques of graphing, solving linear systems, polynomials and their operations, special products and factoring, rational expressions and equations and solving quadratic equations by factoring.

Algebra I Alternative - Mat-080 - 1 contact hour This is a fast-paced, condensed version of Mat-013. It is sometimes taught during the winter or summer session as a one or two week Algebra I course

Algebra I (Part A) - Mat-013A - 4 contact hours* This is the first half of an Algebra I course. Students who successfully complete this course must take Mat-013B in order to complete the Algebra I course. This course is sometimes taught simultaneously with Mat-009 as a combination course.

Algebra I (Part B) - Mat-013 B - 4 contact hours* This course covers the second half of the Mat-013 course. Students who successfully complete both Mat-013A and Mat-013B have fulfilled the course requirements for Mat-013.

Algebra II - Mat-014 - 4 contact hours Designed to polish skills developed in Algebra I and elevate them to a higher level of mathematical sophistication through the use of lecture, group work and the calculator. Topics include a review of elementary algebra, the coordinate plane and graphs of functions, functional notation, linear equations and inequalities, properties of lines, systems of linear equations, polynomials, rational exponents, radical expressions, radical equations, quadratic equations, rational expressions, rational equations and complex fractions. The use of graphing calculator is essential.

Algebra II (Part A)- Mat-014 A - 4 contact hours * This course covers the first half of the Mat-014 course. Students who successfully complete this course must take Mat-014 B to fulfill the course requirements for Algebra II.

Algebra II (Part B) - Mat-014B - 4 contact hours* This course covers the second half of the Mat-014 course. Students who successfully complete both Mat-014A and Mat-014B have fulfilled the course requirements for Mat-014.

*** TWO-SEMESTER DEVELOPMENTAL MATHEMATICS COURSES**

Many students take a one-semester version of the developmental course they need. However, students who would benefit from a slower-paced Basic Mathematics or Algebra course may take the course over two semesters instead of one. The first half of any developmental course is the 'A' version and the second half is the 'B' version. For example, Mat-010A is the first half of the Mat-10 course given in one semester and Mat-010B is the second half of the Mat-010 course taken in the following semester. Mat-013A is the first half of the Mat-013 course given in one semester and Mat-013B is the second half of the Mat-013 course given in one semester. Students who successfully complete the first half of a developmental course must successfully complete the second half of the developmental course to meet the full course requirement.

**** COMBINATION COURSES**

For students who can handle a faster paced Basic Mathematics, there are combination courses available which combine a one contact hour basic mathematics course (called Mat-009 or Basic Mathematics Alternate) with an algebra course in one semester. The algebra course that is combined is either Mat-013, the full version of Algebra I or Mat-013A, the first half of Algebra I. Either of the algebra courses is four contact hours. The student will be signing up for either Mat-009 for one contact hour and Mat-013 for four contact hours for a total of five contact hours, or for Mat-009 for one contact hour and Mat-013A for four contact hours, also for a total of five contact hours. The student signs up for two separate courses. Students who take the Mat-009/013A course must take the Mat-013B course in the following semester to complete the Algebra I course.

Most of the work that is done for the Mat-009 course is done in the Developmental Mathematics Lab/Tutoring Center in MH 142 on their own time (15 hours of time is required, including a diagnostic and a final exam). The algebra part of the course is worked on during specified class sessions.

Students' scores on the Computation and Algebra sections of the Accuplacer Test determine if students are eligible for a combination course and which combination course would be most appropriate.

Placement of students into a two-semester Basic Mathematics or Algebra sequence.

There are some students who know that they need a slower pace mathematics course and sign up for the first of the two-semester course on their own. Some Project Connections students are advised to take the two-semester version by their Project Connections advisor. There are some students who will be in your one-semester developmental mathematics section who would be better off in the two-semester version. Students who are in the one-semester have **three weeks** from the first day of class to transfer into the 'A' version of the course. They should realize that they will be taking the 'B' version during the next session. You cannot require students take the slower version, but at least you will keep an eye out for the students who might benefit 'dropping down.'

During the first day introduction, the instructor should mention the existence of the two-semester course and encourage any students who feel overwhelmed with the material during the first few

weeks to go to Center II to fill out the paperwork. It is a good idea to give some assessments early during the first few weeks of the semester to help you identify students who might be more successful taking the two-semester course.

Challenging Placement into Developmental Mathematics Courses

Sometimes students have not performed their best on the Accuplacer Test. This could be due to illness, anxiety or just “having a bad day”. To give students a second opportunity to place out of developmental mathematics courses, they are allowed to take a **Challenge Test** after receiving the Accuplacer Test results and **before the second week** of classes.

If you are approached by a student after the first class meeting who insists that he or she does not belong in your class because it is too easy, you may suggest that he or she go to the Testing Center in the Johnson Learning Center and request to take a Challenge Test for the course. For example, if the student is in Basic Mathematics, there is a Mat-010 Challenge Test. If the student reaches the cut-off score, he or she will have the Basic Mathematics requirement waived.

Students can prepare for the Challenge Test by going to Center II and asking for review booklets for the course they are trying to challenge. They may also be given the packet entitled “Review for the Accuplacer and Challenge Tests” that will help them to review the basic mathematics skills. Some students go to the library and look through developmental texts that are in the reference section to help them review. Students who want to use software to help study for the Challenge Test might drop into the Developmental Mathematics Lab/Tutoring Center and ask for assistance on accessing one of the many software programs available.

8. Valencia community college

Learning from the experts at Valencia Community College

On March 27, 2004 several representatives from Palm Beach Community College’s Institute for Student Success and math faculty visited Valencia Community College to review their exemplary

programs in preparatory math education and student services, in order to see what aspects of those programs could be incorporated here. We were welcomed by faculty, staff and students and treated to a day of intensive instruction and observation. Here are some of the things that we learned.

Student Services

Everyone at Valencia expressed the same vision: "Start Right". They believe that if students start off the "right" way, they can avoid many of the typical problems students encounter as they progress through their education. This belief was reiterated by everyone we met throughout the College and is clearly a shared vision.

Developmental Advising

Every counselor at the Valencia Advisement Center is trained in developmental advising. Of course, during peak time, it is difficult to do true developmental advising, so when students come

in during especially busy times, they are scheduled appointments to return to discuss their issues further.

The Answer Center

The Answer Center consists of approximately eight staff members who are given access to student information. While they are not academic advisors, they are trained to answer typical questions that students may have. If the staff person is unable to answer a question, they assist the student in formulating the question so that when the student is referred to the appropriate area, the student's question is specific. After a referral is made by the Answer Center a note is placed in the student's file tracking the visit to the Answer Center. This concept of creating a trained front line could result in significant time savings for the more highly trained personnel, who

could then concentrate on other more challenging issues.

Modules for Preparatory Math

Valencia offers prep math in several different formats, one of which is a modular approach which

Palm Beach Community College will test in the spring term. Valencia has divided their curriculum into five-week modules, and students who do not receive an A or B during the five weeks repeat the module until they have mastered the material.

Benefits of the modular approach

Since implementing modules, the faculty and staff at Valencia have found that those students who participate in the modules are more likely to stay in school as compared to those students who learn through the conventional approach (48% vs. 36%). One reason for this is that in order to repeat a course that a student was unsuccessful in, the time frame is only five weeks (the length of a module), rather than the 16 weeks involved in a standard semester course. This creates more of a sense of optimism that even though there may be some delays in getting to the finish line, it doesn't seem so far out of reach to become discouraging.

Another attractive feature of the module approach is that students who fail a module will be given

a new opportunity with a new professor. Since four professors are working together, they are teaching different modules every five weeks. A student who needs to repeat a module will not move on with the professor he was not successful with.

Curriculum Assistants

Another innovative feature of Valencia's modular approach is the inclusion of Curriculum Assistants. These assistants are former successful students who are paid to "live with" a class throughout the length of a module. In addition to sitting in the class, the Curriculum Assistant grades quizzes and homework and returns them to the student for immediate feedback. Because of the Curriculum Assistant's help, the students are assessed more frequently and in different ways than in the traditional classroom. Finally, Curriculum Assistants spend much of their time working with students before and after class, as well as being available for one-on-one tutoring.

Activity Book

A very important feature of Valencia's math modules is their effort to teach the material in non-traditional ways, such as, the use of real-world applications, group work, peer tutoring, and games. The professors and staff have an Activity Book containing many ideas for these non-traditional presentations.

Training math tutors to work with developmental students

Among the many issues to be addressed over the course of the training are:

- math lab resources and procedures
- the tutor/student relationship and an ideal tutoring session
- destructive behaviors exhibited by the tutee and ways the tutor can address these issues
- study strategies for math
- types of learning, including 4MAT

- computer-assisted learning.

Tutors will attend math prep classes in order to understand the teaching style of the prep instructors, so that they will be able to more effectively tutor developmental students in the way that individual instructors prefer. Ideally, the first question a tutor will ask a student is "Who is your instructor?" This type of partnering of tutors with faculty should increase the faculty's incentive to encourage students to use the lab.

How can we solve the problem of math anxiety?

Creating a classroom environment that allows students to feel comfortable, to ask questions and to make mistakes is critical to helping students achieve success. Developmental math students are particularly vulnerable to the fear of math, and need to feel engaged in the classroom in order to succeed.

One way to accomplish this is to replace the more threatening, traditional lecture-based approach to teaching mathematics with non-traditional problems that require students to talk to one another

about mathematics. This also has the effect of removing the "boring" aspect of math and replacing it with real-life meaning. By using examples and activities based on real-world events, students frequently become engaged in the hows and whys of mathematics before they even realize that they are "doing math".

Another method to help developmental education students is to introduce interactive, hands-on activities where students can "figure things out" on their own. Finally, research has suggested that evaluating the students constantly and using a variety of assessments is ideal.

9. Palm Beach community college- Florida

Pass Rates Increase in Math Combo Classes

<http://www.pbcc.edu/x9895.xml>

Students embrace combined algebra courses

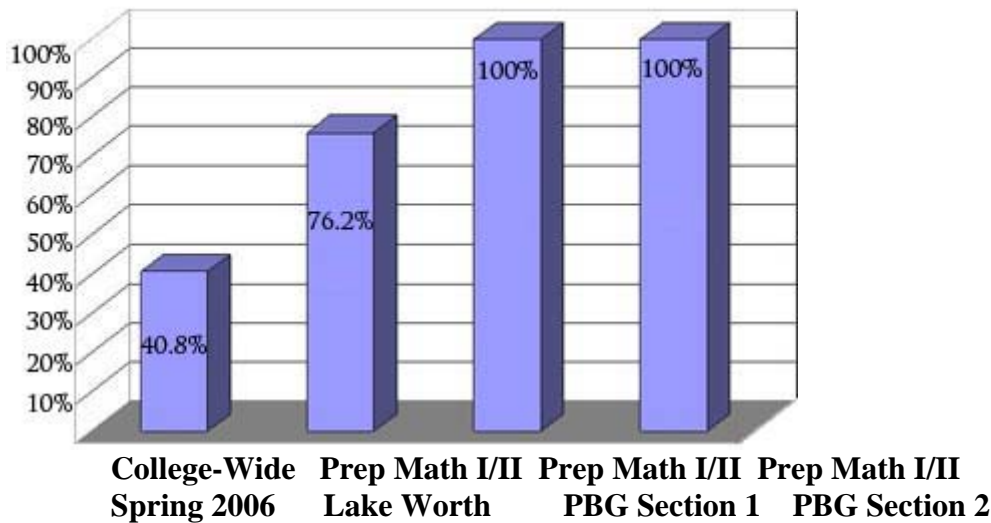
Last semester, Professor Gail Burkett on the Palm Beach Gardens campus launched her combined algebra course. Her creative teaching format offered students the opportunity to complete both Prep 2 (MAT0020) and Intermediate Algebra (MAT1033) in just one term instead of the usual two semesters. The Prep 2 material was completed during the first eight weeks of the

semester; Intermediate Algebra was completed during the second eight weeks. The combined course was more intensive than traditional classes: it met four times a week and homework was assigned daily. Preliminary data indicates that this combined class format has resulted in a higher than usual pass rate for students. For further information and data, view the pilot results presentation. We anticipate similar results for the long-term success and retention rates of this group of students. Student reaction to this course has been overwhelmingly positive. Students agree that Professor Burkett adds to the momentum and keeps the math both manageable and enjoyable. Professor Burkett has effectively achieved student engagement in this class and notes that her students were “a delight to teach.”

“The payoff came in the second phase when we didn’t need to spend much time reviewing the material and could concentrate on the new objectives being presented. I’ve had a great time getting to know the students and would certainly present this success as an indication that more should be offered, perhaps in other disciplines. I would like to add that that I was truly impressed with the support and encouragement I received from George Jahn, Allen Witt, Scott McLaughlin, Ed Willey, Sharon Sass and the Title III folks. I love it when a plan comes together!”
 The combined class will be offered again in the fall, taught by Professor Marty Pawlicki, and then again next spring by Professor Burkett.

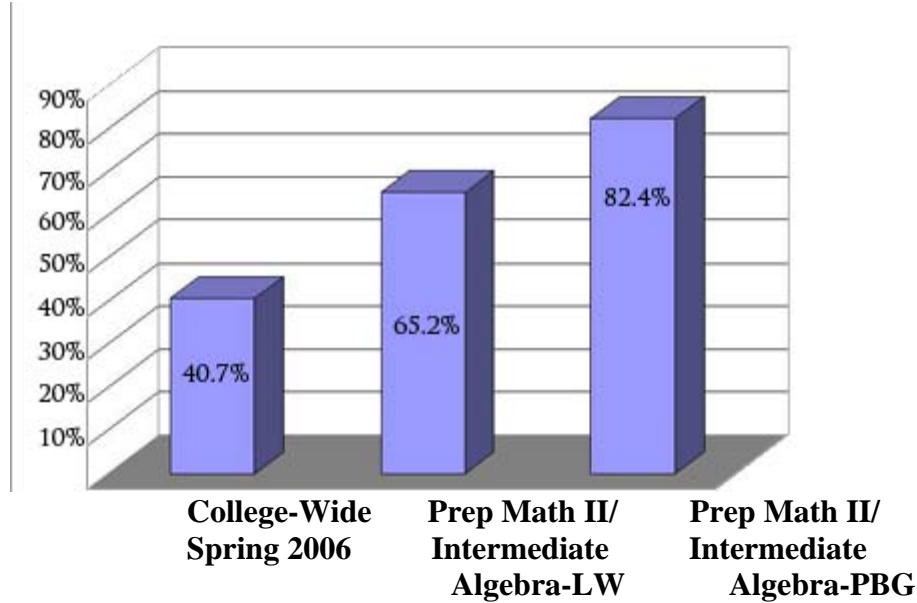
Beginning with the Fall 2006 semester, Basic Algebra I (MAT 0012) and Basic Algebra II (MAT 0020) have been combined over the course of a single semester, offered as two back-to-back eight week courses. (Previously, they were each semester-long classes.) Each class meets four times per week, allowing students to become immersed in the subject and form a class cohort. With the passing of the eight-week mark of the semester, the pass rates for the first half of the combo course (Prep I) are now available. The results for the three sections of Prep I are as follows:

Percentage of students passing MAT 0012 of Fall 2006 Prep Math I/II Combo Course for first eight weeks compared to College-Wide MAT 0012 rate from Spring 2006



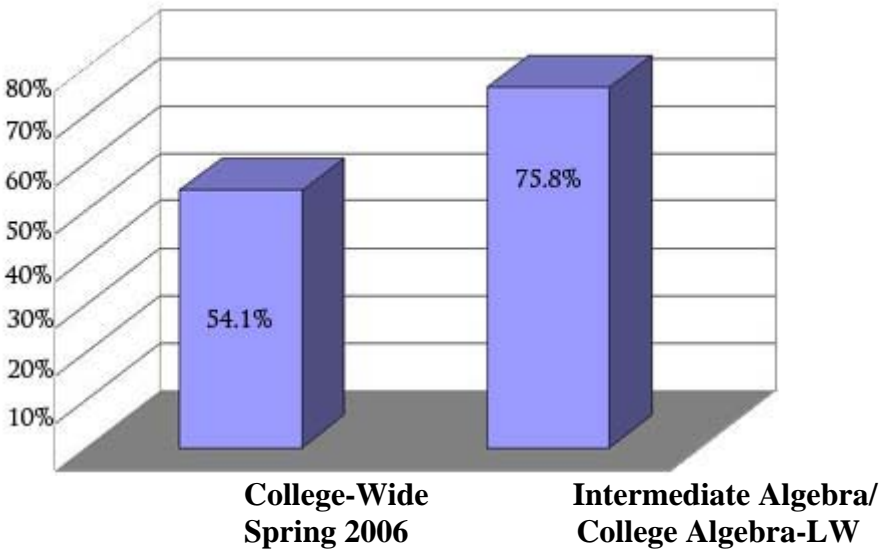
Also offered for the first time were combo classes for Prep Math II/Intermediate Algebra and Intermediate Algebra/College Algebra; the results for the first eight weeks of those courses are in as well. The results are as shown:

Percentage of students passing MAT 0200 of Fall 2006 Prep Math II/Intermediate Algebra Combo Course for first eight weeks compared to College-Wide MAT 0020 rate of Spring 2006



For the Prep Math II/Intermediate Algebra combo classes, the pass rate is **65.2%** at the Lake Worth campus and **82.4%** at the Palm Beach Gardens campus. The pass rate for the College in the Spring 2006 semester was **40.7%**.

Percentage of Students Passing Intermediate Algebra/College Algebra for the first Eight Weeks Fall 2006 Compared to College-Wide MAT 1033 from Spring 2006



The pass rate results for the Intermediate Algebra/College Algebra combo class at the Lake Worth campus is **75.8%**, a significant increase over the Spring 2006 semester overall pass rate of **54.1%**.

**Palm Beach Community College-
Title 3 improvements to DE math and Student Retention Generally**
<http://www.pbcc.edu/x9895.xml>

* An early alert system will be developed to help identify student who need intervention to help them remain in school. In many instances, faculty are the first to identify students who are experiencing academic problems. The Early Alert system is a means for faculty to address those academic issues “early” before students fail their courses. The system, currently being developed by Information

Technology, is an online tool which will be located on the faculty member's online class roster. It will provide faculty members a convenient way to refer students for specific interventions. It will

also provide faculty with the opportunity to contribute directly to the College’s efforts to increase the persistence and academic success of our students.

* Implement course modules to shorten the length of time students spend in the Prep Math sequence and to incorporate critical thinking and reading skill development into the prep math curriculum. Students will be required to pass each module before moving on to the next one. It

is expected that this requirement will help students achieve greater mastery of the arithmetic and algebra skills required to succeed in math.

Several new features will be added to the modules, each one setting the pilot classes apart from traditional delivery methods. Module elements include:

- Reassignment of students on the first day of class based on results of a diagnostic exam given that day.
- Placement of a Curriculum Assistant in each of the six classes.
- Study sessions offered twice weekly outside of class for students to receive study tips and homework help.
- Students organizing homework and assignments in portfolios.
- A requirement that students meet with an advisor at least once during the semester.

* Offer accelerated prep math courses. Students are offered the opportunity to complete both Prep 2 (MAT0020) and Intermediate Algebra (MAT1033) in just one term instead of the usual two semesters. The Prep 2 material was completed during the first eight weeks of the semester; Intermediate Algebra was completed during the second eight weeks. The combined course was more intensive than traditional classes: it met four times a week and homework was assigned daily. Preliminary data indicates that this combined class format has resulted in a higher than usual pass rate for students.

* A diagnostic tool (CSI) will also be used to allow more accurate placement of students into the proper math course based on the student’s competencies.

+ The CSI identifies for students their individual strengths and needs. Using student profiles created by the inventory, academic advisors can intervene early with support services to prevent at-risk students from failing or dropping out of college.

+ After taking the survey, participants will be required to attend a CSI workshop to retrieve their results. The workshop is designed to help students become aware of challenges they may face, and to inform them of all the resources the College provides to assist them. Participants will also be urged to make an appointment with an academic advisor to discuss their CSI results in more detail, as well as to plan their educational goals.

+ The CSI was administered by the Testing Centers to 300 first-time-in-college students who tested into prep math. These participants were encouraged to follow up by attending both a group workshop and an individual advising session with a CSI advisor, to discuss the results of the assessment and learn about the resources available at the College.

+ Results-

Students who participated in the CSI pilot were significantly more likely to re-enroll the

following semester than those who did not participate (77.5% vs. 68.8%).

- The role of the advisor was shown to be very important in student retention.

Those CSI

students who attended a CSI workshop or saw an individual advisor re-enrolled at a

significantly higher rate than those who did not participate in the pilot (81.5% vs. 68.9%).

- Interestingly, students who only took the CSI survey and did not receive any

follow up

treatment still retained at a somewhat higher rate than those students who did not participate in the pilot (71.1% vs. 68.9%).

- * A new tutor training program that is specifically designed for those who will be working with developmental education students.

Among the many issues to be addressed over the course of the training are:

- math lab resources and procedures
- the tutor/student relationship and an ideal tutoring session
- destructive behaviors exhibited by the tutee and ways the tutor can address these

issues

- study strategies for math
- types of learning, including 4MAT
- computer-assisted learning.

Tutors will attend math prep classes in order to understand the teaching style of the prep instructors, so that they will be able to more effectively tutor developmental students in the way that individual instructors prefer. This type of partnering of tutors with faculty should increase the faculty's incentive to encourage students to use the lab.

- * An Algebra Refresher Workshop for students who just miss placing into College Algebra. These will help students who wish to retake the College Placement Test (CPT) because they have missed specific cut-offs by five points or less. Other students may benefit from these workshops, including those who have been unsuccessful in passing Prep Math or Intermediate Algebra courses.

- * By placing all services, programs or interventions at the beginning of the first college year, we can derail some of those overwhelming things that intrude into the thinking of students who are not doing well.

- * Dealing with the problem of math anxiety

Creating a classroom environment that allows students to feel comfortable, to ask questions and to make mistakes is critical to helping students achieve success. Developmental math students are particularly vulnerable to the fear of math, and need to feel engaged in the classroom in order to succeed.

One way to accomplish this is to replace the more threatening, traditional lecture-based approach to teaching mathematics with non-traditional problems that require students to talk to one another

about mathematics. This also has the effect of removing the “boring” aspect of math and replacing it with real-life meaning. By using examples and activities based on real-world events, students frequently become engaged in the hows and whys of mathematics before they even realize that they are “doing math”. Another method to help developmental education students is to introduce interactive, hands-on activities where students can “figure things out” on their own.

Evaluating the students constantly and using a variety of assessments is ideal.

* Incorporate the training of all college faculty and staff on newly developed programs and career ladders, including workforce programs, in order to provide more accurate, useful information to students for their educational planning.

+ A career path is the educational path a student takes from the time he or she enters the College until he or she gets a job.

+ New online information about career paths.

+ Colleges and universities today would like to do more about improving the relationship between students and the college; they want to express care for each student. Care is expressed by building and nurturing relationships with students through communication, understanding, empathizing with, and listening to students. Advisors serve as friend, guide, resource, and advocate to students.

+ Advisors sometimes serve as "survival tools" for college students. However, we must ensure that students not only survive but also succeed.

Effective advisors are:

- Informed about the resources available on campus.
- Well organized and prepared with a list of names, offices, and phone numbers for reference.
- Professional when talking with students and attentive to their expressed and implied needs.
- Welcoming and accessible to students.
- Equitable when dealing with students while aware of their individual differences.
- Effective time managers, who don't allow advisees to go off on tangents but bring them back to the point of the discussion.
- Encouraging students to ask questions and encourage them to elaborate on responses to ensure your clarity.
- Considerate of students' abilities when determining questions

* In order to better track students' use of various PBCC resources, including the Student Learning

Centers (SLCs), the Information Technology department is developing a new student tracking database called PantherTrail. PantherTrail will interface with PantherNet, which will streamline the process of students' checking in and out of the various facilities. Students will be able to swipe their Panthercard and immediately select the purpose of their visit. If they are visiting the SLC for assistance with a course, the screen will display the student's current schedule. Traditionally, it has been difficult to enforce the requirement for students to sign in to the various labs. With PantherTrail, the process will be easier for students.

* Using Cooperative Learning in the prep math classroom. Each class session will include brief periods of lecture interspersed with group quizzes, pairs work and group activities. One critical element of Cooperative Learning is that students must teach one another to increase common understanding. In addition to working together in groups, students will be asked to present examples for the entire class.

* PBCC will designate one week in April 2006 to present Math Awareness Week. During April each year, colleges and universities around the country host campus events designed to encourage students to recognize the significant impact that mathematics has on our lives everyday. Our PBCC team will bring in career-related speakers and entertainment. A math competition featuring useful community-related projects and classroom games will also be sponsored. Prizes will be offered during the event. Workshops and seminars will be presented on all campuses throughout the week.

* Answer Center staff to support the transition from traditional advising to developmental advising, the Answer Center, provides support to academic advisors by:

- Providing a welcoming atmosphere to students
- Serving as the initial contact for advising
- Answering basic questions about financial aid, careers, disability services, admissions, student activities and testing
- Providing information about college policies and procedures

Meaningful relationships between advisors and students are a critical element to developmental advising and have proven to be instrumental to students' growth and success. Spending time with the student is essential to being able to effectively develop rapport. By answering basic questions and directing students to the appropriate resources, the Answer Center is designed to ease the burden on advisors and allow them to spend more time with each student.

Additionally, the Answer Center will provide a welcoming atmosphere that is important to student success and retention. Students cultivate an impression about their environment partially from the first contact with a representative from the institution. If students feel welcome they are likely to persist in their educational pursuits.

* Enablearning pilot takes off at Belle Glade- Belle Glade professor Lyndon Johnson is piloting the use of Enablearning, a web-based homework program, in three sections of prep math this semester. Students in those sections must attend a two hour per week lab session, during which they use the program. The Enablearning program is fully integrated with the curriculum and offers an adaptive approach to homework, providing students with problems of varying degrees of difficulty depending on the student's level of mastery. The Enablearning Company is partnered with Noel-Levitz, which provides a retention specialist to work with Professor Johnson. Using the students' homework data, retention strategies are being developed to help struggling students succeed.

10. NORTHERN KENTUCKY UNIVERSITY- RUNNING START PROGRAM

RunningStart Program at Northern Kentucky University
If you need 1 or more developmental courses, check out the schedule for RunningStart.

RunningStart is a collection of learning communities for students with ACT scores under 18 in Math, Reading and/or Writing. Many first-year students need to improve their skills or knowledge before taking a full load of college-level courses. *RunningStart* provides these students with a block of carefully scheduled classes with extra academic attention and support during their first college semester.

Courses Offered Include:

MAH 080: "Mathematics Assistance" offers supplementary instruction paired with selected developmental mathematics courses.

MAH 090: "Basic Mathematical Skills" is a prealgebra course for students who never took algebra in high school or who not have the computational skills needed to be successful in MAH 095.

MAH 095: "Beginning Algebra" includes topics covered in a first year algebra course. If students are required to take MAH 095, they must also successfully complete MAH 099 before they may register for college level math courses. (3 credit hours)

ENG 090: "Writing Workshop" instructs students to write papers in a variety of forms and guides them through the writing process. (3 credit hours)

LAP 091: "Reading Workshop" provides students with practice and instruction in literate behaviors, reading strategies/processes, and critical/creative responses to books read. (3 credit hours)

LAP 090: "Academic Assistance" offers supplementary instruction paired with different course. Offered on a pass/fail basis. (1 credit hour)

***RunningStart* features . . .**

- Classes with only 20 students — even in math!
- Tutoring built into students' schedules
- Special workshops or convocations to enhance students' academic skills and/or personal growth
- Convenient Monday, Wednesday, Friday or Tuesday, Thursday block schedules
- Opportunity to make new friends quickly in special learning communities
- Only 200 students
- All *RunningStart* students are strongly encouraged to enroll in UNV 101

How Do I Sign Up?

See the published Schedule of Classes and talk to your advisor at Orientation and register on-line through Norse Express. For more information about the *RunningStart* program, contact Diane Williams, Director of Developmental Mathematics, williamsd@nku.edu or (859)572-6473.

11. Eastern Kentucky University- Developmental Education Program

<http://www.developmentaleducation.eku.edu/>

The Developmental Education Program at Eastern Kentucky University helps students achieve their maximum potential and enhances their chances for academic success by providing opportunities for skill development through courses and programs designed to improve basic skills in writing, reading, and mathematics. Courses in the Developmental Program include ENG 090 (Basic Writing), ENG 095 (Developmental Composition), ENR 090 (Developmental Reading I), ENR 095 (Developmental Reading II), MAT 090 (Prealgebra), and MAT 095 (Developmental Algebra 1). These courses are offered through the Departments of English and Theatre and Mathematics and Statistics.

The University measures basic proficiencies in writing, reading, and mathematics by student performance on the ACT, SAT and EKU placement tests. Placement in, and successful completion of, these courses is required of students who do not demonstrate proficiency in the basic skill areas. Students taking developmental classes receive institutional credit for the courses. Credit hours earned in developmental courses do not apply toward graduation, but they do count toward the enrollment status for such purposes as financial aid eligibility and full-time student status.

The Developmental Education Director works closely with other areas to provide services for students with developmental needs. For example, the director works closely with the Office of Academic Testing to help ensure that students are placed into appropriate level courses. She collaborates with the Office of Academic Advising to help students define interests and links to academic majors. She works with the Division of Enrollment Management in providing a Transition to College course for students with developmental needs. And finally, she works closely with the Coordinator for Mentoring and Tutoring to provide services for EKU students.

First Step to College Success <http://www.developmentaleducation.eku.edu/firststep/>

The Developmental Education area also coordinates the *First Step to College Success* summer program. This program is designed to address the needs of students placed into developmental courses in mathematics, writing, and/or reading. The highly structured program provides intensive instruction by leading developmental educators. Students admitted to the program study together to form a collaborative learning community characterized by mutual assistance and encouragement. Upon successful completion of the program, students begin taking college level courses that will lead to the awarding of academic degrees while completing other developmental requirements, if they are needed.

The *First Step to College Success* program is specifically designed to address the needs of students with two or more developmental area requirements and for students entering the University in the Special Admissions category. This program has been very successful in helping students remediate developmental requirements and be retained at the University.

The *First Step to College Success* summer program provides an excellent opportunity for students to begin their college experience. The summer program is a Monday through Friday program with classes beginning June 25 and ending on July 27. Classes, tutoring, and guest lecture forums begin at 8:00 a.m. and end at 4:00 p.m. each day. Evening study tables and mentoring sessions are available Monday through Thursday from 4:00 p.m. to 8:00 p.m. Students participating in the program must attend an orientation session prior to June 25. The orientation will include placement testing, scheduling summer courses and registration for Fall 2007 classes.

The *First Step to College Success* program was established to address the needs of students admitted to EKU with identified developmental needs in the core areas of writing, mathematics, and reading. Developmental needs are defined by the university as an area in which the student has an ACT sub-score less than 18 for English, mathematics, or reading or students with SAT total scores (verbal/critical thinking and Mathematics) less than 870. Students who have participated in the *First Step to College Success* program have shown unprecedented success and have a significantly higher one-year retention rate and higher GPAs than students not participating in the program with similar needs. The program is noted for its importance in helping students build the academic skills needed for a successful college experience.

The program provides intensive instruction in writing, reading, and mathematics. All courses in the program integrate study and test-taking skills with an orientation to the resources offered by the University. Extensive tutorial support is an integral part of the program. Students admitted to the program study together to form a collaborative learning community characterized by mutual assistance and encouragement. Upon successful completion of the program, students begin taking college-level courses that will lead to academic degrees while completing developmental requirements, if they are needed.

Students are selected for the program based on developmental needs. The program has been specifically designed for students entering the University with two or more developmental requirement areas and students admitted to the University in the Special Admission category. Students take nine hours of course work that include a transition-to-college course, required developmental courses, and depending on developmental needs, an introductory level sociology course. Students are placed in courses based on their levels of proficiency in writing, reading, and mathematics as determined by the ACT, SAT and University placement test scores. Sample placement tests are available by going to the [Practice Placement Test](#) link.

Students participating in the program may qualify for financial assistance. Students are encouraged to participate in cultural and social activities available at the University. Financial aid, housing, and program cost information will be sent to all *First Step to College Success*

applicants. If you plan to attend the summer program, you must complete and return a program application or you may apply online for the summer 2007 program at www.developmentaleducation.eku.edu/firststep/application/. Applications for the summer 2007 program must be received by May 25, 2007. If you have been admitted to the University, you can complete and submit the application online by clicking on the above link.

12. Austin Community College- Texas

<http://www.austincc.edu/mathsci/deved/devedplan>

Helping Students Succeed: The Austin Community College Developmental Education Plan

Instructional Methods: Teaching methods vary according to the needs of learners. Research shows that adults learn from observing, practicing, and receiving feedback; respond better when material is presented through a variety of teaching methods on different sensory levels; expect conscientious instructors who can present information effectively; and vary greatly in their educational level, life experiences and motivations for achievement.

To meet the goal of reforming the curriculum to support student success in developmental education, the faculty engaged in an eighteen month review of the curriculum with a specific goal of assessing the quality of the instructional program to determine if and how courses could be revised to better meet the needs of students. During this period of review faculty benchmarked best practices and identified models that would improve student retention and success, strengthen the overall educational program, and provide needed student support services.

During the curriculum review and revision process, it was important to select teaching methods consistent with stated learning outcomes, to sequence learning activities to build a solid foundation of reading, writing and mathematics skills, and to structure opportunities to provide for student participation and feedback.

A principle of adult education supports that adult learners have a need for a diversity of instructional methodologies. With this as one of the guiding principles, the developmental education faculty developed courses using a range of formats, delivery modes, and innovative approaches such as workshops, seminars, tutoring, supplemental instruction, learning labs, distance learning, continuing education (test preparation workshops), linked courses, and computer mediated learning.

A number of pilot projects grew out of this review, many of which have been integrated into the curriculum on the basis of their appropriateness and student's level of success, and are identified below.

These options are available through a variety of regular and accelerated schedules to accommodate individual student needs and learning styles. These include but are not limited to:

- **Paired courses** - This combination of courses pairs a section of a developmental reading or writing course with a section of an introductory level content course
- **Flexible entry format** - These sections are designed for students who have difficulty scheduling a reading course that meets at a designated time and place through an entire semester. The instructor and the student plan a course of study that covers the same objectives as those in a traditional approach.
- **Fast Track** - Students register for eight-week or twelve week sessions for level 1 during the first eight weeks and level 2 during the second eight weeks. This arrangement allows student to complete their remediation in a single semester.
- **Test preparation Workshops** - Students may participate in a number of test preparation venues such as workshops, small group sessions, or individualized course work. In addition TASP and assessment preparations are scheduled prior to official testing dates.
- **Computer based Instruction** - Computer based instruction allows students to utilize the latest technology to improve their skills. This includes:
 - PLATO which covers Basic Math, Prealgebra, Elementary Algebra, Intermediate Algebra, Reading, Spelling and Grammar, ESL, Writing (tutorials and resources), TASP and study skills. PLATO is comprehensive in scope and sequence, spanning a broad range of subject areas, with each course targeted to specific competencies and skill levels.
 - Academic Systems pilots involving Prealgebra, Elementary Algebra, Intermediate Algebra, and Interactive English, consists of a series of lessons selected by the instructor which allows the student to individually determine the pace as they work through the stages of the learning activities.
 - Invest's Destination 2.0 software used in Reading Skills I, consists of a series of activities which allow students to improve their reading skills.
- **Web based instruction** - Students are able to complete their remediation in writing through the Internet.
- **Intensive instruction** - Students who enter college with the lowest levels benefit from additional time on task to succeed. This instruction requires students to take a lab course in addition to their regular course. The lab work provides supervised practice and concept application for students.

PATH FOR STUDENTS WHO NEED DEVELOPMENTAL COURSES

ACC concurs with Robert McCabe, who in a report on developmental education, recommended that an assessment program that is linked to educational prescriptions should be instituted. Assessment must go beyond identifying those who are deficient. It should also provide the basis for learning solutions and building a bridge program to other courses that address skill deficiencies.

Austin Community Colleges assesses, orients and advises students using intake and placement models designed by the College. Once students begin classes, they are advised based on ACC's Advising Model.

Required Orientation - ACC requires new degree-or certificate-seeking college-credit students to complete orientation. In addition to attending an orientation session before the start of classes, students who do not pass two or more TASP subtests or who score at the basic skill level on a TASP subtest must register for Human Development (HDP 1601), Developmental Study Skills (DSSK 0012), or Developmental Study Skills (DSSK 0013) during their first ten hours at ACC. If the College is unable to offer enough HDP 1601, DSSK0012, or DSSK 0013 sections during a specific semester to meet the demand, students are unable to register for HDP 1601, DSSK 0012, or DSSK 0013, then they must register for one of the courses in the next semester. However the intent is for students to take HDP 1601, DSSK 0012, or DSSK 0013 during their first term at ACC.

Required Assessment - ACC has implemented the Texas law that requires students to take the TASP test or a TASP alternative test before attending college credit classes or demonstrate that they are TASP exempt or TASP waived. Students in TASP waived certificate programs must take appropriate ACC placement tests if courses in their educational plan have basic skill prerequisites.

Required Counseling - Students whose assessment scores indicate they need two or more developmental courses must meet with a counselor before they register for their first term in order to develop an educational and a support service plan. These students will continue to meet with a counselor or a faculty advisor with experience working with developmental students until they complete their developmental course work. The student is required to have a counselor's approval of their proposed schedule before registering.

Mandatory Load Limits - Students whose assessment scores indicate that they need two or more developmental courses will not be allowed to take more than 10 hours in a sixteen week term and no more than 6-8 hours in an 8 week or a 5.5 week term. If two required developmental courses are Reading and Writing, the student is limited to 10 hours which must include a developmental course and 6 hours in an 8-week or a 5.5 week term.

Intent Information - ACC collects intent data the first time a college credit student registers each semester. This information assists the College to track student goals; it also reminds students why they are at ACC.

Early Warning Signs - The College implemented a Standards of Academic Progress System in Fiscal Year 2000. The system identifies students with low grade point averages or students who complete less than 50% of the courses for which they register and directs them to appropriate interventions. Students whose GPA and completion rates do not improve after one term must meet with a counselor before registering for additional classes and receive approval of the counselor for any proposed schedule before registering.

Degree Audit System- ACC will complete an automated degree audit system in Fy01 that will allow students to verify their progress toward their educational objectives. This system will help students taking developmental classes to track their academic progress and understand the next step.

Mandatory Advising for New Students - All new students must meet with a counselor or an advisor. In general, counselors work with new students who need two or more developmental courses, transfer students on probation or suspension from another institution, and students who have not selected a major. Advisors work with new students who need only one developmental course, transfer students in good academic standing at their previous institution, and students who have declared a major.

Advising Model for Returning or Currently Enrolled Students - Advisors monitor the progress of and advise students who need only one developmental class, usually mathematics. Faculty advisors who teach developmental courses monitor the progress and advise students who need two or more developmental courses and students who need one developmental course, if the students are referred by a faculty colleague or ACC advisor

SUPPORT FOR STUDENTS ENROLLED IN DEVELOPMENTAL COURSES

- Tutoring in all three developmental areas will be offered free of charge in the learning labs on campuses.
 - Task Forces will maintain coordination between the curricula and the tutoring services and Instructional Associates working in the tutoring labs.
 - The labs will meet certification standards of College Reading and Learning Association.
- Students who have been referred to developmental education for reading or writing deficiencies will remain in remediation unless they register only for college-level course/s not requiring basic skills in which they have been deemed deficient.
 - Students must remediate for at least one area of skill deficiency until they meet exit requirements for all areas.
 - Students who do not pass two or more TASP subtests or score at the basic skill level on a TASP subtest must register for Human Development (HDP 1601), Developmental Study Skills (DSSK 0012), or Developmental Study Skills (DSSK 0013) during their first 10 semester credit hours of course work at the College.

- Services provided by Retention and Student Services:
- **Career Counseling** - Through classes, small group activities, workshops and computer assisted counseling system, counselors assist students to clarify their career and educational goals.
- **College Student Inventory** - Developmental students in Human Development 1601 complete the College Student Inventory (CSI), the results of which are used to help students understand their strengths, weaknesses, and support service needs.
- **Crisis Counseling** - Counselors assist students to deal with unexpected crises that could prevent them from achieving their career and educational goals. Counselors must refer such students to community resources if the student requires continued counseling services beyond the single immediate crisis intervention.
- **Educational Planning** - Counselors and Advisors assist students who have selected a program of study to outline the courses they need to take each semester at ACC to reach their educational and career goals. Counselors assist students who have not selected a program of study to develop educational plans that keep their options open.
- **Referral to and Partnerships with Community Agencies** - Retention and Student Services Staff work with community agencies such as the Texas Rehabilitation Commission and the Travis County Mental Health Association to provide support services to students.
- **Support for Students with Disabilities** - ACC provides developmental students who are disabled, with reasonable accommodations that include, but are not limited to interpreters, note takers, taped or Braille books, and large screen monitors in learning

13. Camden County College – NJ

Faculty Strategies for Delivering a Comprehensive Developmental Mathematics Program

<http://www.umkc.edu/cad/nade/nadedocs/96conpap/bsecpap96.htm>

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Abstract Delivering a comprehensive developmental math program is a challenge for colleges and universities. Camden County College provides a model that maximizes faculty input and provides procedures for placement and exit testing utilizing the New Jersey College Basic Skills Placement Test, for monitoring the curriculum, for providing faculty and students with support services and workshops, and for meeting the needs of diverse populations.

Camden County College (CCC) is New Jersey's largest community college with an enrollment of 13,000 students. In 1978, New Jersey implemented the New Jersey College Basic Skills Placement Test (NJCBSPT) as part of a state mandated system that required all public colleges and universities to assess the basic skills of incoming students, offer remediation, and demonstrate the effectiveness of their remedial programs. In 1994, the governor abolished the Department of Higher Education that had developed and coordinated statewide testing and remediation. Since then, some colleges have relaxed or even eliminated many of the previous

state mandates for remediation. This inconsistency among colleges creates many problems for students transferring between institutions within the state. Camden County College has remained committed to offering its students the best opportunity to succeed in college and, therefore, has continued with its testing, placement, remediation, and program evaluation with very limited modifications.

At CCC, approximately 5,100 students are served by the developmental math department annually, enrolling in some 260 sections throughout the year taught by four full-time and sixty part-time faculty. The college offers a three semester remedial math sequence: Computation, Pre-Algebra (or Computation/Pre-Algebra for students whose reading and writing scores indicate potential success <http://www.umkc.edu/cad/nade/nadedocs/96conpap/bscpap96.htm> (1 of 5) <http://www.umkc.edu/cad/nade/nadedocs/96conpap/bscpap96.htm> in a combined course), and Elementary Algebra. For each of the math skills courses, a four-day review course is offered between semesters for those students who miss the cutoff score by one to four points. No tests or quizzes are given on these four 3 1/2 hour days. On the last day of class a different version of the NJCBSPT is given: a passing student moves to the next level course; a failing student must take the regular 15 week basic math skills course. Math review classes have a better than 90% passing rate, and students who pass are successful in the next math course at the same rate as directly placed students. Some students need only a quick review, and this course offers them the opportunity to move quickly into the next level of math.

Managing and delivering a comprehensive developmental math program is a challenge for any institution, and CCC has developed a unique, comprehensive method for delivering a math program that maximizes faculty involvement and management. A major task is to assure continuity and integrity among courses, sections, special populations, branch campus and off-site locations. We do this by managing the curriculum and its integrity, maintaining communications within the department, addressing student concerns, evaluating every aspect of the program, and working continually for improvements.

Managing the Curriculum and Its Integrity

To insure proper placement, a fifteen-minute twelve-question test is given the first day of class in all developmental math classes. Nine correct answers allow a student to move up in the math curriculum. Less than 2% of the students tested move up on the first day, confirming the reliability of the NJCBSPT placement. Tracking studies show that students who do test out the first day pass the next course in their math sequence at the same rate as students who place directly into that class.

The four day review course and the first day test are procedures insuring that no one remains in a developmental class who has the necessary skills to go on to higher level math courses. It also reinforces to students remaining in the class that they belong there.

Two workbooks written by the faculty are used as the texts for these review courses: *Math Fundamentals: A Review* and *Elementary Algebra Review*, both published by McGraw-Hill. These books contain carefully sequenced problems for students to use to prepare for mastery of the skills necessary to pass any entrance or placement test involving basic math skills. To assure continuity and integrity among courses faculty are given a first day packet which contains: a class list, course syllabus, sample day-by-day teaching schedule, semester calendar, grade book, first day placement verification test and answer key, drop-and-add form for students who test out, and instruction guide for computer software.

Final exam day packets are distributed approximately two weeks before the end of the semester. <http://www.umkc.edu/cad/nade/nadedocs/96conpap/bscpap96.htm> (2 of 5)
<http://www.umkc.edu/cad/nade/nadedocs/96conpap/bscpap96.htm>
Each packet contains: an end-of-course grading document that will contain class average,

NJCBSPT score, final course grade, and recommendation for four-day review course; NJCBSPT posttests and answer grid; departmental final exams; class lists; and blank envelopes for names and addresses of students who are recommended for the four-day review course.

Final exams are mandatory and standardized. They consist of a NJCBSPT posttest and a free response department final exam. A slight margin in score is allowed for teacher discretion, but if the desired score is not achieved, the instructor must document evidence of the student's knowledge of the material and sign a memo moving the student to the next level.

All new instructors meet with the chair of the department to turn in grades and discuss problems and exceptions, thus ensuring that all teachers understand and comply with course standards and the grading policy.

Maintaining Communication Within the Department

A variety of methods are used to maintain the highest level of communications among all faculty,

full-time and part-time. Some of these methods include:

1. Orientation--A presemester orientation is given for all faculty in August. New textbooks are distributed and discussed and teachers are introduced to support materials, including the software and videotapes accompanying each unit chapter.
2. Mentoring Program--All new faculty are assigned to one of the full-time faculty members.
3. Keeping in Touch--Monthly department meetings are open to all faculty where administrative updates are given and activities for the month and year are announced, and a meeting highlight is the presentation of a teaching tip.
4. Knowing Without Going--Comprehensive in-service reports on all off-campus conferences and workshops are written and distributed to all teachers, thus giving everyone who did not attend access to the heart of the conference and workshop activities. Some reports are followed by in-service workshops.

Addressing Student Concerns

Department faculty have particular specialties relevant to basic skills learning (e.g., alternative learning styles for adult learners, American Sign Language for students who are deaf, accommodations and adaptive teaching styles for students with learning disabilities). Course materials are geared to student success. There are review sessions prior to exams; workshops on study skills, test taking, and learning styles; four-day review courses; tutoring and computer labs; videotape and software companions to current textbooks; student evaluations studied and followed

up; development by the faculty of three textbooks--*Math Fundamentals: A Review*, *Elementary Algebra Review*, and *Alternative Methods for Beginning Algebra*. Other textbooks are in preparation.

<http://www.umkc.edu/cad/nade/nadedocs/96conpap/bscpap96.htm> (3 of 5) [11/11/01 2:53:06 PM]

<http://www.umkc.edu/cad/nade/nadedocs/96conpap/bscpap96.htm>

Evaluating and Improving the Program

The math skills department conducts a comprehensive yearly review and analysis of the program.

Each year the faculty revise final exams; revise course content; review textbooks; analyze course experiments; analyze student evaluations of teachers and courses; and consider major curriculum modifications.

The math skills department was evaluated most recently by consultants Dr. Lewis Hirsch of Rutgers University and Dr. Frank Cerreto of Richard Stockton College of New Jersey. Dr. Hirsch is past chair of an advisory committee that oversaw the annual evaluations of basic math programs in all New Jersey public colleges and universities. The consultants found:

1. There is a carefully delineated syllabus, including classroom policies and daily activities, to serve as a guide for content, level, and pace of the courses. Sample exams and department exams are also provided to ensure consistency and equity throughout sections. Texts are at the appropriate level; additional custom texts written by the faculty are provided for each level; and texts have accompanying software and videotapes.

2. The four-day review courses provide for students who need only a brief review, a useful alternative resulting in a more homogeneous grouping of students in the regular sequence of courses.

3. There is a good articulation between the math skills department faculty and the college math department faculty.

4. Faculty have special expertise in adaptive teaching styles and in teaching special populations.

5. There is mentoring for all new adjunct faculty.

6. Because course content and exit criteria and subsequent student performance are well documented, and teachers are mentored, trained, observed and evaluated, quality control is ensured.

7. Day and evening math labs are supported by professional tutors and study groups led by peer tutors. The computer lab uses textbook-based software for drill and practice, and additional tutoring is provided for special populations such as students with learning disabilities.

8. The pass rates for all levels are consistent with those of other county colleges. The pass rates are especially good because the higher performing students tested out of the four day review course and the lower performing students are left taking the full course. The course pass rates for Computation, Pre-Algebra, Computation/Pre-Algebra, and Elementary Algebra are 65%, 57%, 74%, and 54%, respectively.

9. The remaining question is, "Are students successful in college level math courses after completing basic skills?" Yes! After completing remediation, students entering college level math passed Concepts of Math, Elements of Statistics, and Intermediate Algebra at impressive rates. The pass rates are 86%, 71%, and 68%, respectively.

<http://www.umkc.edu/cad/nade/nadedocs/96conpap/bscpap96.htm> (4 of 5)

<http://www.umkc.edu/cad/nade/nadedocs/96conpap/bscpap96.htm>

10. In summary, the Camden County Math Skills Program is effective because of intensive faculty cooperation in the planning, development, execution, and evaluation of this fullservice remedial mathematics program. The curriculum is well sequenced, offers opportunities to students with a variety of needs, and students who complete their remedial math courses are successful in subsequent college-level math courses (Hirsch & Cerreto, 1995).

Conclusion

Finally, and not least in importance, our program is successful because remediation is one of the four academic divisions of the college. We have remedial departments consisting of full-time tenure track faculty and elected chairs who report to a dean who is very supportive of our efforts and who advocates for us in the college's administration, budgeting, and planning. Our hard work, our joint publications, our attention to detail, our focus on effectiveness have paid off: our students are well served, our reputation in the college is firmly established, and the future of our program is bright.

Reference

Hirsch, L. R., & Cerreto, F. (1995). A report of the basic skills mathematics program at Camden

14. University of Maryland College Park (UMCP)

Developmental Mathematics: A New Approach

By William W. Adams

We begin with a familiar story. A student, we call him Tom, arrives at the University, happy to begin his college adventure. Almost immediately he is confronted with the Mathematics Placement Exam, designed to see if he is ready to enroll in a general education mathematics course (or in a credit-bearing course required by his major). The results of the Placement Exam unfortunately indicate that Tom is not prepared for the course he wants, and he must instead take a Developmental Mathematics Course. The results: he faces a delay in completing the needed mathematics course, he must take (for no credit) a course that he feels he has already taken, and to add insult to injury, he must pay an extra fee for the developmental course. Unhappiness, frustration and despair set in, the course is treated as a lowest priority (and often failed because of it), and an angry and frustrated student emerges.

But what is the University to do? Without such a test, Tom would register for a course he appears to be unprepared for. Data show that the result is frequently failure in the course, which would slow his progress and perhaps lead to his dropping out of the college.

Like numerous other institutions in the nation, the University of Maryland, College Park (UMCP), has been faced with this problem for many years. So, in the Fall of 2000 the University formed a campus committee to investigate, among other things, the issue of remediation in mathematics. The goal was to devise a plan that could be implemented for a large number of students, that would reduce the extra semester of developmental mathematics for many of these students, would be reasonably cost effective, and would not compromise teaching effectiveness in preparing the students for the course(s) they needed.



Debra Franklin works with students in Math010/110

What emerged from committee discussion was a radical solution that completely cast aside the old Developmental Math program. It gained immediate strong support from the campus administrators, both bureaucratically and monetarily. With great effort (including building a new computer laboratory, creating a new curriculum, training mathematics teachers and training advisors campus wide), the new program was put into place in Fall 2001. Now in Fall 2003 we

see that the program has been very effective; the purpose of this article is to describe the various features of the program, and include data substantiating the claims of success.

In the new program, as before, all entering students are given the Placement Examination during orientation. About 20-25% of the entering freshman class (about 1000 students) are judged deficient in mathematics preparation for a general education math course. We now break up these students into two groups.

The lowest 40% are told, as before, to take a full semester of Developmental Mathematics. This course, called Math 003, is self-paced using a computer platform and meets for 6 hours per week in a specially designated computer laboratory. A professional mathematics educator assesses the students' needs and abilities. They progress through their program under the guidance of this person and another assistant. The students are placed into one of five modules, depending on the credit bearing course they are headed for, which is either the general education course or one that prepares them for a further course. In any case, the course grade (pass/fail) is based on written examinations, written (graded) homework, and attendance, in addition to success on the computer modules. It should be emphasized that the self-paced format of this course is critical for the implementation of the program for the other group of students to be discussed next.

The remaining approximately 60% are placed into a combination course. These courses correspond to credit bearing courses numbered 11x, so for the sake of this discussion we lump them together by calling them Math 01x/11x. The courses met 5 days a week, rather than the usual 3 days a week. The first 5 weeks of the course constitute Math 01x, which reviews the developmental mathematics topics (especially algebra) necessary for success in the credit-bearing course, Math 11x. Since the students enrolled in Math 01x were in the upper 60% of the students with deficient placement test scores, we felt that there was a good chance that an intense 5-week abbreviated form of the Developmental Mathematics course would suffice. However, to be sure, and to be legitimate about allowing the students to transfer to a credit-bearing course after 5 weeks, they were required to take the Placement Examination again at the end of 5 weeks. The same cut-off scores were required for a student to move into the Math 11x course as were required to enroll in Math 11x during orientation. If the student did not achieve such a score, then the student was placed back in the self-paced Math 003, with the good prospect of completing Math 003 by the end of the semester.

To our surprise and delight, we were able to let about 89% of the students proceed into the appropriate Math 11x course at the beginning of the 6th week. By continuing to meet 5 days a week until the end of the semester, the Math 11x course had approximately 45 sessions, which is about the number of sessions for the ordinary Math 11x course during the full semester. Moreover, the students in Math 11x continued in the same room with the same teacher as before. The re-registration from Math 01x to Math 11x was handled by the department, and the course Math 01x was erased from the student's record and was substituted by Math 11x. As far as the student was concerned, he/she had one 5 day a week course that met for the entire semester. Those who completed Math 11x successfully had completed their math requirement in one semester rather than two, as would have happened under the earlier regime.

Students in these courses were given exactly the same uniform final examination taken by the regular Math 11x students. As a result, our department could directly compare the results of the students who had to start with remediation with those who did not. Since the new program has now been running for a while, we are able to assess the results. We will concentrate on the Fall 2001 semester, but the results for further semesters are similar. We compared the grades of the students in 01x/11x with those who went into 11x directly and found that each had about the

same ABC rate. Moreover, the grades on the actual final exams taken by both groups were about the same and in fact were often higher for the students starting in Math 01x.

We also followed up on the students who completed the Math 01x/11x course successfully. Many of these students were only taking the course to fulfill their General University Mathematics requirement and thus had completed this requirement in one semester instead of two and went away very happy with the new program. Most of the rest of the students who succeeded with the Math 01x/11x course had to take the elementary calculus course or the engineering calculus course. The elementary calculus students who started in the combined course were successful — in fact, about 7 percentage points more successful than the regular students. In the engineering calculus the combined course students did quite a bit worse in some semesters and about the same in others. Of course, the engineering sequence is much more demanding and the scores reflect the difficulty of catching up in a science/engineering track after inadequate high school preparation.

It is also important to be sure that the students who had to take the reformulated MATH 003, with its self-paced computer platform, were at least as successful as they were under the old program. For the Fall semester immediately preceding the institution of the new program we had two Developmental Math Programs, roughly high school Algebra I and II. Those who had to take Algebra I had about a 30% ABC rate in their next course, while those who had to take Algebra II had about a 47% ABC rate in their next course. The students who took Math 003 had a 35% ABC rate in the next course. Since these students are in fact the lower 40% among students who took these courses in the past, this self-paced course did its job at least as well as the old program.

We also conducted surveys of the students. The students were generally positive about the new program. Those in the Math 01x courses were especially pleased with the possibility of obtaining academic credit in one semester for the combined courses. Those in Math 003 liked the “module” approach of the course, which they felt gave them more control over the pace and the outcomes for the course. We also heard from many of the advisors around the campus who reported a large decrease in frustration levels for students forced into Developmental Math.

The main expense in setting up the new program was in building two new dedicated computer labs for Math 003. The remaining costs were relatively small and mainly involved developing the curriculum for the new courses. As for the ongoing costs, they are comparable to the costs for running the old program. It should be noted that previously the students paid a fee for taking Developmental Mathematics, and that remained true for either Math 003 or Math 01x.

In conclusion we note that the new program prepared the students at least comparably well to the old one. But with the new program hundreds of students (373 students in Fall 2001 alone!) had completed their basic math requirement in one semester, rather than the two that all of these students would have needed under the old program. As a second measure of success of the new program, at the end of the Fall 2001 semester, 80% of the students placed in Developmental Math had either completed or were prepared to complete their math requirement at the beginning of Spring 2002. By contrast in Fall 1999 only 64% of these students were even prepared to move on to their Math requirement in Spring 2000 (and, of course, none had completed it). This is also a dramatic improvement.

William W. Adams has done work in Number Theory and, more recently, in Computational Algebra. He has been at the University of Maryland at College Park for 33 years. He spent many years as the Associate Chair for the Undergraduate Programs.

CONTENT - INNOVATIVE INTERVENTIONS AT OTHER COMMUNITY COLLEGES

1. **GLENDALE COMMUNITY COLLEGE (ARIZONA)- 2 CREDIT MATH TUTORIAL**
2. **LEWIS-CLARK STATE COLLEGE- MANDATORY MASTERY SKILL QUIZZES**
3. **FERRIS STATE UNIVERSITY- SLA- STRUCTURED LEARNING ASSISTANCE**
4. **CALIFORNIA CC'S- PATHWAYS THROUGH ALGEBRA PROGRAM**
5. **Indiana University at Bloomington-Education X101: Learning Strategies for Mathematics**
6. **NORTHERN KENTUCKY UNIVERSITY--Developmental Mathematics Courses Offered**
7. **SANTA BARBARA CITY COLLEGE- GATEWAY TO SUCCESS PROGRAM**
8. **AMERICAN RIVER COLLEGE- BEACON PROGRAM**
9. **TREISMAN'S MODEL Merit Workshop**
10. **SAN FRANCISCO STATE UNIVERSITY- CARP (COMMUNITY ACCESS AND RETENTION PROGRAM)**
11. **AMERICAN RIVER COLLEGE- Online Informed Self-Placement for Math**
12. **NASSAU CC- USE OF A+DVANCER AND ACCUPLACER FOR TUTORING**
13. **DAVIDSON COUNTY CC- STUDENT CENTERED ADVISING- FOUR TIER SYSTEM**
14. **MT. SAN ANTONIO COLLEGE- CALIFORNIA- MATH ACADEMY
BRIDGE PROGRAM- A LEARNING COMMUNITY**
15. **DE ANZA COLLEGE- CALIFORNIA- MATH PERFORMANCE SUCCESS PROGRAM (MPS)**
16. **FOOTHILL COLLEGE- CALIFORNIA- PASS THE TORCH PROGRAM**
17. **SAN JOSE UNIV. MASTERY LEARNING IN DE MATH BY SUSAM MCCLORY**
18. **SAN JOSE UNIV.- MULTI-FACETED PLACEMENT**
19. **UNIVERSITY OF MINNESOTO- RISING STARS COHORT PROGRAM FOR ELEMENTARY EDUCATION TEACHERS REQUIRING DE MATH COURSES**
20. **UNIVERSITY OF MEMPHIS- USING AN INTERNET MATH HISTORY TO SUPPLEMENT ALGEBRA INSTRUCTION**
21. **PHILLIPS EXETER ACADEMY- THE HARKNESS PROGRAM**
22. **PLATO LEARNING SYSTEM-**
23. **LAMAR COLLEGE- TEXAS**
24. **MODELS FOR USING INFORMATION TECHNOLOGY TO IMPROVE TEACHING AND LEARNING**
25. **ARAVAIPA COMMUNITY COLLEGE- LEARNING COMMUNITY WITH DE MATH COURSES**
26. **UNIVERSITY OF WASHINGTON- STOUT CAMPUS USE OF MY MATH LAB**

1. GLENDALE COMMUNITY COLLEGE (ARIZONA)- 2 CREDIT MATH TUTORIAL COURSE

- * Students pay for 2 credit tutorial course plus a \$25 fee
- * Class meets twice a week for one hour each
- * Course may be taken as many times as needed but must be taken concurrently with a math course
- * Students are put in groups of 4-5 who are in similar courses
- * Each group is assigned a tutor
- * Each student is given 3 sessions with the counseling department covering study skills, learning styles, test taking skills, etc.
- * The college went from 4 to 5 credit courses
- * Weekly quizzes are given versus chapter tests
- * Tutors are selected and screened by faculty and participate in tutor workshops
- * Tutors meet regularly with faculty members
- * Florida CC has adopted this model plus they use Enable Learning software for student prescriptions as an additional student aid

2. LEWIS-CLARK STATE COLLEGE- MANDATORY MASTERY SKILL QUIZZES

- * They use a mastery skill quiz program in all DE math courses
 - * Faculty identify a list of fundamental skills for each course
 - * Faculty write short 5 minute quizzes that require the students to perform the skill
 - * Each student is required to pass each and every quiz without error to pass the course
 - * Students retake quizzes in subsequent classes or during office hours
 - * All DE math faculty must do the skill quizzes
 - * Courses have a common final graded together

3. FERRIS STATE UNIVERSITY- SLA- STRUCTURED LEARNING ASSISTANCE

- * Program is oriented toward specific courses that are considered high risk
- * Students spend 3 hours of guided study workshops per week
- * Workshops are voluntary unless student's grade in the base course falls below 2.0, then the workshops become mandatory until the student grade is above 2.0
- * All students are required to attend the first two workshops
- * The first quiz determines if workshops become mandatory
- * Workshops stress course content and study skills
- * Facilitators/tutors attend each class session
- * Facilitators are upper level students who have taken the course previously
- * Facilitators meet with the faculty once a week
- * Workshops encourage cooperative learning among students
- * workshops include
 - * study guides
 - * practice quizzes and tests
 - * collaborative team learning
 - * time management skills
 - * anxiety reduction

4. CALIFORNIA CC'S- PATHWAYS THROUGH ALGEBRA PROGRAM

Improving student success rates in elementary algebra

- * Three interventions were tried
 - * Computer assisted learning (48.6% to 44.1% success)
 - * Math study center (39.2% to 60.3% success)
 - * Math study skills course (53.6% to 66.7% success)
- * Orange Coast CC
 - * Requires tutor lab hours
 - * CAI with traditional lectures
 - * Collaborative learning
 - * Two semester elementary algebra sequence
 - * Learning communities with study skills or English course
 - * Graphing calculators
 - * Reformed style curriculum

5- Indiana University at Bloomington-Education X101: Learning Strategies for Mathematics

Course Overview

2 credits, semester long, graded course. Open to all students as long as they are also enrolled in any section of Math M118: Finite Mathematics, during the same semester they are enrolled in X101.

Course Description

The long-term goal of this course is to support students in their Finite Mathematics M118 course. However, the course should not be viewed as re-teaching the "content" of M118. Rather, the course is designed to accomplish the above stated goal by helping students to become more *active, independent problem solvers interested in truly understanding the mathematical concepts* in contrast to a passive approach that relies on memorization, learning step-by-step procedures, and outside authority. In addition to the regularly scheduled X101 class meeting, students engage in several personal conferences with the X101 instructor and the Undergraduate Teaching Intern (UGTI), and are encouraged to attend M118 evening learning sessions with the UGTI at least once a week. The focus of these M118 evening learning sessions is on *problem solving and thinking about* how to do the problem solving necessary to solve M118 problems.

Course Structure

Course activities guide students to focus more on the thought processes being used rather than focussing entirely on finding the "right" answer to the problem. Students will be encouraged to become aware of, reflect upon, and consciously direct their thinking and problem-solving efforts. Another way to think about what is covered by this course is to think about success in M118 coming from not only "doing" math, but also "*thinking about doing*" math and "*questioning what you are doing*" in math. This is done primarily through expressing mathematical ideas orally and in writing as well as describing how they reached an answer or the difficulties they encountered while trying to solve a problem. In addition, students' beliefs about the nature of mathematics and themselves as learners are addressed, as well as math study skills and strategies for coping with math/test anxiety and various lecture styles.

Course Objectives

Students have the opportunity to develop skills in the following areas:

1. Understanding of Math Material

- Systematically and actively reading the math textbook so that one can recognize, understand, and remember the explicit and implicit main ideas and supporting details.
- Critically understanding and synthesizing the relationships between math ideas and the organization of the math text.
- Integrating one's lecture and textbook notes so that one can prepare for tests.
- Employing "questioning" and organized problem-solving techniques, which encourage one to become aware of, reflect upon, and consciously direct one's thinking and problem-solving efforts.
- Diagnosing and monitoring one's mental processes while reading and learning math material and then writing personal reflections based on one's learning.
- Engaging in the self-discovery of knowledge -- e.g. refining effective problem-solving techniques and rejecting ineffective ones.
- Working with others to develop collaborative learning skills

2. Communication of Math Material

- Taking lecture notes that effectively communicate to oneself and to others the material presented by a lecturer.
- Writing about mathematical concepts and relational ideas
- Orally presenting mathematical concepts and relational ideas in conversational language, i.e. to "speak" mathematics
- Explicitly explaining one's thought processes as one tries to solve math problems.

3. Math Behavior, Attitudes, and Beliefs

- Addressing one's own beliefs about the nature of mathematics and learning and oneself as a math learner, and if necessary, to change and develop behaviors and beliefs that facilitate mathematics learning.
- Persisting when having trouble understanding and figuring out something in one way and trying different problem-solving methods, i.e. remaining actively involved with the problem.
- Develop patience to employ to employ a step-by-step procedure to learn and solve math problems.
- Developing a faith in persistent systematic analysis.
- Developing a concern for accuracy and an avoidance of wild guessing.
- Managing time effectively to keep pace with academic demands.
- Feeling more comfortable with the format of objective and subjective exams.
- Coping more effectively with stress, test anxiety, and math anxiety.

Who Benefits from Taking Education X101

- Students that are likely to need to take more math classes beyond M118
- Students who never seem to do as well in math classes as they feel they are capable of doing
- Students who find themselves working harder in math classes than their other classes, but do not receive grades as high as they would like

- Students who likely will be enrolling in other quantitative classes like accounting, economics, statistics, chemistry, physics, computer programming.
- Students who would not be satisfied with a "C" in M118.
- Students who tend to rely on memorizing steps to solve problems rather than on understanding concepts.
- Students who tend to rely on calculators to solve math problems
- Students who would like to optimize their study skills.
- Students who would like additional help working in a small classroom with opportunities for more structured one-on-one math homework problem-solving.
- Students who want to know what it takes to do well at the college level.
- Students who tend to procrastinate and have poor self discipline.

Typically, over 50% of the students who complete X101 earn "A's" or "B's" in Finite Math, M118, and fewer than 10% receive "D's" or "F's".

6- NORTHERN KENTUCKY UNIVERSITY--Developmental Mathematics Courses Offered

MAH 080. Mathematics Assistance (1 credit) Supplementary instruction paired with selected developmental mathematics courses. May be repeated for credit when paired with different courses. Offered on a pass/fail basis. Not applicable toward graduation.

This course is a one-credit supplementary instruction course paired with selected developmental mathematics courses.

MAH 090. Basic Mathematical Skills (3 credits) Topics include. Signed numbers, fractions, decimals, percents, ratio and proportion, measurement, and introduction to algebra.

Recommended only for students who need a thorough treatment of these topics, which are discussed briefly in MAH 095. Does not apply toward any graduation requirement.

MAH 091. Elementary Geometry (3 credits) Topics include. Lines and angle relationships, parallel lines, constructions, similar and congruent triangles, polygons, right triangles, circles, areas and volumes. Does not apply toward any graduation requirements.

MAH 095. Beginning Algebra (3 credits) Topics include. Operations on real numbers, equations and inequalities in one variable, graphs of lines, integer exponents, operations on polynomials, and factoring with emphasis on applications. Does not apply toward any graduation requirements. **Also offered in one-credit modules as MAH 092, MAH 093, and MAH 094. See Module link for more information.**

PREREQ: A minimum ACT score of 15 (or SAT or COMPASS equivalent), C or better in MAH 090, or placement by Developmental Mathematics Program.

MAH 099. Intermediate Algebra (3 credits) Topics include. Rational expressions and equations; ratio and proportion; functions; equations of lines; systems of equations; compound inequalities; linear inequalities in two variables; radicals; graphs of lines, parabolas, and circles; and quadratic equations with emphasis on applications. Does not apply toward any graduation requirements. **Also offered in one-credit modules as MAH 096, MAH 097, and MAH 098. See Module link for more information.**

PREREQ: A minimum ACT score of 18 (or SAT or COMPASS equivalent), C or better in MAH 095 or placement by the Developmental Mathematics Program.

Structured Learning Assistance Sections

MAH 095-010 (TR 10:50 – 12:05 with SLA Workshop TR 9:25 – 10:40 #11590)

MAH 099-014 (TR 12:15 – 1:30 with SLA Workshop TR 10:50 – 12:05 #11628)

SLA provides free workshops for students led by a trained professional or student. All students who enroll in an SLA course section are required to attend all SLA workshops until the first assessment and thereafter only when their grade falls below a stated average (around 75%). Students must continue to attend all SLA workshops until their average grade is above the stated amount.

MODULE SECTIONS

The modules are 1-credit courses covering the content of MAH 095 and MAH 099. Students who are unsuccessful in a five-week module may be able to repeat that module immediately.

Beginning Algebra

MAH 092. Beginning Algebra Part I (1 credit) Operations on real numbers and linear equations in one variable.

MAH 093. Beginning Algebra Part II (1 credit) Applications of linear equations, linear inequalities, graphs of lines, and slope.

MAH 094. Beginning Algebra Part III (1 credit) Integer exponents, operations on polynomials, and factoring.

Intermediate Algebra

MAH 096. Intermediate Algebra Part I (1 credit) Rational expressions and equations, ratio, proportions, and variation.

MAH 097. Intermediate Algebra Part II (1 credit) Functions, equations of lines, and systems of linear equations.

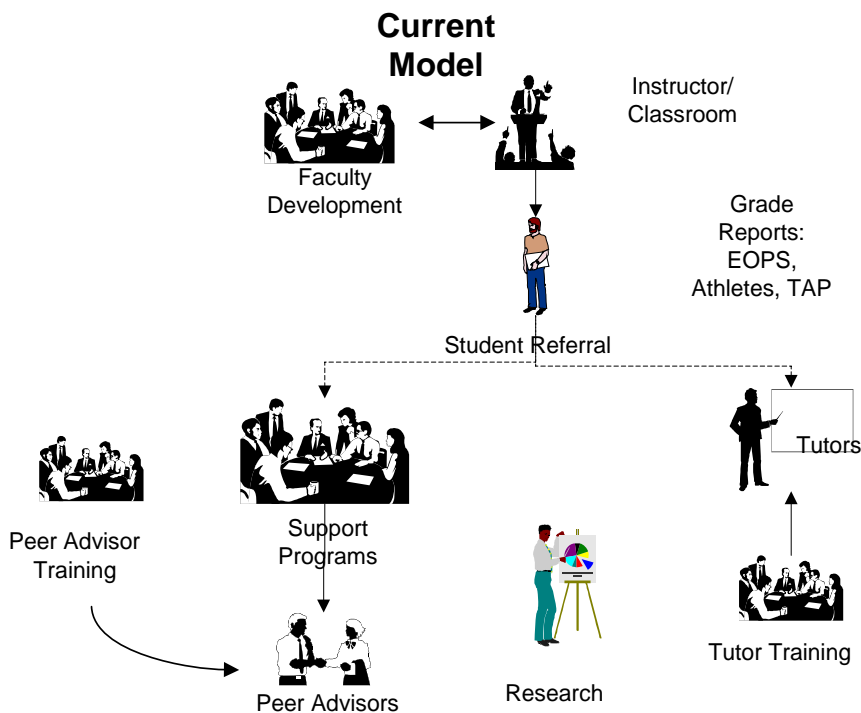
MAH 098. Intermediate Algebra Part III (1 credit) Radicals, graphs of parabolas and circles, quadratic equations, and their applications.

7- SANTA BARBARA CITY COLLEGE- GATEWAY TO SUCCESS PROGRAM

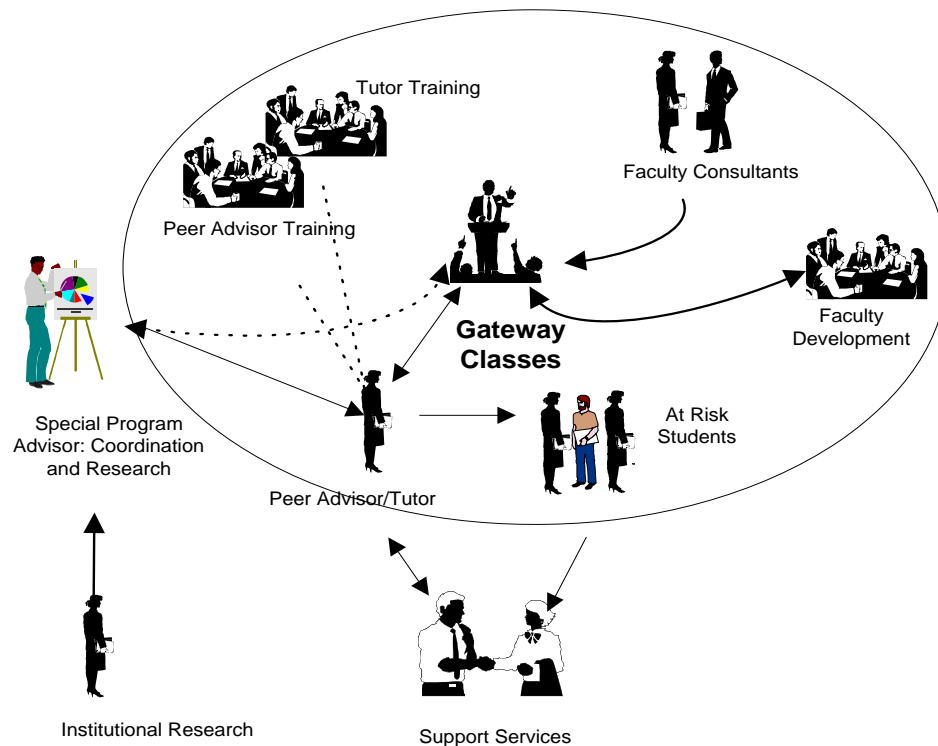
- The Gateway Program was designed on the concept of triangulated supplementary instruction that built a strong and complimentary relationship between the instructor, instructional aide and each student participating in Gateway.
- The faculty member who had attended the Gateway Training Institute in June 2001 incorporated certain student success strategies into their class and the instructional aide

(trained in the Tutor Training 199 class) learned strategies that they would subsequently use with each of the Gateway students.

- The instructional aide met regularly with the instructor and in some cases attended the professor's Gateway class section. Together they identified students who could benefit from the supplementary instruction, discussed the content of the instruction, and the aide worked with the students as a group at least once a week outside of class and also met with each student individually.
- The challenges of each individual student were assessed and the instructional aide, in consultation with the faculty member, found solutions to the barriers to success for each student.
- Our old way of dealing with individual student challenges in classes and the new way in the Gateway to Success Program are diagrammed on the following page



Proposed Model Gateway to Success Program



* What is new in the Gateway program is the weekly support from the instructional aide (much like the teaching assistant in graduate programs at four year universities) and follow up by these aides when students missed sessions or did poorly on exams. The aides are outstanding students having taken the professor's class or peers who are in graduate programs in the content area. They have been effective for at least three reasons. They have

- heightened credibility with the Gateway students because of their young age
- are well trained by the Tutor Training 199 class and the instructor and
- they are dedicated to the success of each student.

Goal of the Program: Improved Student Success in Gateway Courses

- Targeting students at risk in Gateway classes (2000 students with approximately 500-600 students at risk¹)
- Proactive involvement of faculty in tutoring practices to provide
 - consistency of content and approach between classroom and tutoring strategies and assignments
 - assessment and referral of at risk students²
 - tutors with problem solving, communication, time management, and learning skills
 - mentoring of tutors by faculty

¹ At risk students are those students likely to receive non-productive grades for a variety of reasons.

² Referral may be to counselor, special tutoring, instructional support, Health and Wellness, DSPS, College Success course, etc.

- triangulation of learning process in which teacher guides the tutor, the tutor assists students, and tutor reports back to teacher
- documentation of tutor process and effectiveness
- Cohort of Gateway course faculty will meet twice per semester in third and eighth week to
 - establish goals
 - share possible strategies for tutor usage
 - identify most significant student problem areas
 - review available student support services
- Faculty consultants in study skills and student success will provide strategies to Gateway faculty and peer advisors dependent on needs of students
- Clerical and coordinating assistance from an hourly Special Program Advisor
- Student and faculty satisfaction questionnaires and assessment of significance of any student performance improvement

8- AMERICAN RIVER COLLEGE- BEACON PROGRAM

The Beacon Program from 1993-2202 increased student success rates from 60.0% in non Beacon courses to 83.5% in Beacon courses over 62 different courses and 22 disciplines.

- A trained tutor (Student Learning Assistant- SLA) who has successfully completed a course works with a small group of students currently enrolled in the same course.
- The study group meets 2 hours a week outside of class.
- Students and tutor work together and learn from each other in a collaborative peer learning environment
 - SLA's also provide discussions about other related topics such as study skills, test preparation, test anxiety, etc.
- Students participating in the Beacon Program will automatically be enrolled in *Human Services 1000*, a no fee, no grade, no credit class.
- Students who participate in a Beacon study group...get better grades, understand the subject better, make new friends, pay nothing--it's free! earn extra credit
- Beacon Tutors will:
 - meet with your group two hours a week
 - meet with your Beacon instructor one hour a week
 - prepare for your weekly tutoring session
 - receive \$7/hour for your tutoring, meeting & preparation time.
 - Enroll in Indis 321-an online tutor training course
 - Attend the Spring 2006 orientation:
 - Attend monthly workshops
- Benefits to students:
 - Learn skills needed to be successful in college
 - Learn the benefits of belonging to a study group (many students have not previously worked in study groups in high school or college
 - Students are comfortable asking peers and SLA's course related questions where they might not be comfortable asking the professor
 - They become more comfortable asking professors questions over time based upon their experiences in the groups
 - Students feel more connected to their instructors and their courses as they become more skilled at participating in the courses

- Learning course material in groups was perceived as being more enjoyable
- Contacts with the study group extend beyond the class activities to social activities and provide emotional support and other academic stimulation beyond the scope of the course
- Students learn how to learn which carries over into subsequent courses

9- TREISMAN'S MODEL

<http://www.math.uiuc.edu/MeritWorkshop/uriModel.html>

In the late 1970's and early 1980's, graduate student Uri Treisman at the University of California, Berkeley, was working on the problem of high failure rates of minority students in undergraduate calculus courses. According to [Treisman \(1985\)](#), the African-American calculus students at Berkeley "were valedictorians and leaders of church youth groups, individuals who were the pride of their communities. ... Thus, these students had come to Berkeley highly motivated and under great pressure to succeed" (p. 21). Nevertheless, folklore blamed the high failure rates on the students' lack of motivation, lack of educational background, and lack of family emphasis on education ([Treisman, 1992](#)). Treisman's work ([Treisman, 1985](#)) challenged these hypotheses, and replaced the remedial approaches with an honors program that encouraged students to collaborate on challenging problems in an environment of high expectations.

Treisman's mathematics workshop recruited mostly African-American and Latino students having relatively high SAT Mathematics scores or intending to major in a mathematics-based field or both. Key elements of the workshop involved:

1. the focus on helping minority students to *excel* at the University, rather than merely to avoid failure;
2. the emphasis on collaborative learning and the use of small-group teaching methods; and
3. the faculty sponsorship, which has both nourished the program and enabled it to survive. ([Treisman, 1985](#), pp. 30-31)

Each of these elements is discussed in more detail below.

Collaborative learning.

In his initial investigation, Treisman "was struck by the sharp separation that most black students maintained---regardless of class or educational background---between their school lives and their social lives" ([Treisman, 1985](#), p. 12). He went on to compare these students with their Asian counterparts---who had a history of being very successful in the calculus courses---noting that most of the black students studied alone while the Asian students sought peers with whom to collaborate. More than merely studying together, the Asian students formed academic communities:

Composed of students with shared purpose, the informal study groups of Chinese freshmen enabled their members not only to share mathematical knowledge but also to "check out" their understanding of what was being required of them by their professors and, more generally, by the University. ...

[Treisman] observed Chinese students in their study groups ask each other questions ranging from whether one was permitted to write in pencil on a test to how one might circumvent certain University financial aid regulations. More important was the fact that these students routinely critiqued each other's work, assisted each other with homework problems, and shared all manner

of information related to their common interests. Their collaboration provided them with valuable information that guided their day-to-day study. ([Treisman, 1985](#), pp. 13-14)

Since "interactions like these were extremely rare among the blacks" ([Treisman, 1985](#), p. 16), the key then was to build a community based in the study of mathematics, to create a merging rather than a separation of academic and social lives.

Challenging mathematics and high expectations.

In partnership with collaborative learning strategies, the mathematics employed was challenging, engaging, and meaningful. [Treisman \(1985\)](#) explained, "Because of their participation in [a special high school program], these students saw themselves as an academic elite group. They were accustomed to being the tutors, not the ones in need of tutoring. ... Knowing the students' sensitivities, [he] took care that the Workshop not appear to be a tutoring session. The problem sets (called worksheets) were always difficult, with near-impossible problems thrown in frequently to protect the Workshop's non-remedial veneer. (p. 26) While "most visitors to the program thought that the heart of our project was group learning ... the real core was the problem sets which drove the group interaction" ([Treisman, 1992](#), p. 368). The best problems were not quick, procedural applications of formulas that had one right answer; rather they were deep, thought-inspiring problems (perhaps with multiple parts) that engrossed the students. Where remediation approaches worked to reduce deficiencies, Treisman's model built on the students' already existing strengths.

Faculty sponsorship.

Critical to the success of the Berkeley program was the faculty sponsorship aspect. "The traditional faculty response to minority students at that time was to hire someone to deal with them, create tutorial programs for them, and house them in a temporary building on campus somewhere" ([NSF, 1991](#), p. 4). By contrast, in the mathematics workshop model, "the significant points were to build a community around the courses and manage the courses by faculty, not tutors in temporary buildings" ([NSF, 1991](#), p. 7). Furthermore, "the faculty courted students, and students quickly chose mathematics as a major" ([NSF, 1991](#), p. 6).

Overview.

As described by [Gillman \(1990\)](#), the program at Berkeley is an intensive, demanding program for talented students, particularly minority students, who are planning career[s] in mathematics-based profession[s]. ... They are told that they are among the most promising freshmen and that the program is seeking students with a deep commitment to excellence. ... The emphasis is on students' strengths rather than their weaknesses ... the direct opposite of tutoring or other remedial programs. (p. 8)

The resulting model replaces regular calculus discussion sections with workshop-style discussion sections, in which the students collaborate on non-textbook, non-routine problems. During these work sessions (which meet for larger blocks of time than traditional classes), "[students] begin working the problems individually, then, when things get tough, in collaboration with one another. These experiences lead to a strong sense of community and the forging of lasting friendships" ([Gillman, 1990](#), p. 8).

The Berkeley program has been so successful that it has spread to other universities and colleges throughout the country. Modified versions have entered high schools, in forms designed to fit the particular environment and needs. As Treisman has stressed, the program is *not remedial*---nor should it be---and care is taken with replications that they do not revert to remedial programs.

10- SAN FRANCISCO STATE UNIVERSITY- CARP (COMMUNITY ACCESS AND RETENTION PROGRAM)

Mission Statement

The Community Access & Retention Program (CARP) provides tutorial and academic support services for all undergraduate students at San Francisco State University (SFSU), placing a special emphasis on working with first-generation and underrepresented students.

CARP also employs an all-student staff; through extensive training and practical experience, CARP employees develop the administrative, planning, and organizational skills needed to run an academic program.

Program Overview

The Community Access & Retention Program (CARP) has been providing tutorial and academic support services for San Francisco State University (SFSU) students since 1998. During this period, CARP has evolved into an important retention service, emphasizing the development and maintenance of pertinent academic support services tailored to the learning needs of all students attending SFSU.

CARP primarily serves undergraduates, placing special emphasis on working with first-generation students and students underrepresented in the university.

In order to address the demands and schedules of students, CARP has filled an important void in the spectrum of academic support services provided by the university. CARP is the only evening academic support program on campus. By establishing evening tutorial hours, CARP staff members have been able to help students who have commitments during the day and can only receive tutoring in the evening. CARP is also the only academic support program that provides services for students enrolled during the summer sessions.

CARP's tutors direct both one-on-one and group tutorial sessions to accommodate students' individual learning needs and styles. CARP also offers workshops and support sessions to help students prepare for standardized exams such as the Entry Level Mathematics test (ELM) and Junior English Proficiency Essay Test (JEPET). In addition, CARP collaborates with a variety of SFSU programs and departments to provide services for a wide range of students.

About our Student Staff

CARP has a unique design unlike most academic support programs at both SFSU and universities elsewhere. From our administrative staff, to our coordinators, receptionists, and tutors, we are all current undergraduate and graduate students. This allows CARP employees to develop their professional skills by operating a well-respected, full-fledged tutorial and academic support programs.

After a rigorous hiring and screening process, all tutors complete an initial training program of 15 hours, which includes among other things attending an orientation, attending workshops, participating in a mentorship program, observing veteran tutors, and completing mock tutorial sessions. In addition, after our tutors begin tutoring, they continue to participate in our on-going training program, which includes completing professional development projects, continuing to

observe fellow tutors, and preparing to give workshops and specialized tutorial sessions such as our ELM support sessions.

Study Skills Workshop- Build up your study skills! Come to one of our Study Skills workshops in HSS 347.

Some topics to be covered:

- * Time Management and Task Management
- * Study Environment
- * Nutrition & Health
- * Reading Strategies
- * Learning Styles and Preferences

11. AMERICAN RIVER COLLEGE- Online Informed Self-Placement for Math

Excerpts taken from an article by Jim Barr in the IJournal- Insight Into Student Services, Issue 10, Spring 2005

http://www.ijournal.us/issue_10/print_version/ij_issue10prt_08.htm

- On March 1, 2004 American River College (ARC) implemented an online student driven self-placement process for Math.
 - If we don't provide much information for students beyond the course catalog description, a questionable test score and the requirements for graduation or transfer, students don't have much on which to base a decision and, for that matter, neither do counselors. As result, from the instructor's viewpoint, it seems that poor placement decisions are often made. The self-assessment model offers the opportunity to take much of mystery out of the placement process because it asks students to weigh and consider information that is specific and relevant for a given course level and then to make a decision on what would be best for their degree of preparedness. For example, in providing examples of math problems that students should have mastered prior to a course provides a clear understanding of the background a student will need to be successful. Students report that in just viewing the difficulty level and type of math problems is often sufficient to provide them with the understanding of their readiness for a particular Math course.
- Almost one year and 8,000 math self-assessments later, with the exception of a few initial computer glitches associated with the online program, there is nothing remarkable about the placement process to report on other than it appears to be doing exactly what it was intended to do: Provide students with realistic and honest guidelines for placement decisions.
- Students were randomly selected within the online application after completing the math self-assessment process and were asked to evaluate the effectiveness of the process. With few exceptions, students overwhelmingly indicated they welcomed the opportunity to actively participate in their educational process and appreciated being provided with a realistic and clear understanding of the courses they could potentially enroll in.
- Moorpark Community College in California had successfully implemented a student driven self-placement process for English and Math in 1997, a process that is still in place at this time. Contra Costa Community College had also experimented with self-placement in the late 1980's with good success.
- In the early discussions with Math faculty and counseling about the potential for a student driven self-placement model, two main concerns had emerged: (1) both the faculty and Counseling areas had long suspected that students could not make good decisions, and as

a result (2) they believed that students would enroll in courses beyond their level of preparedness with the probability of not being successful. Yet our research of colleges that had implemented self-placement models indicated that neither of these two concerns were valid.

- For example, at Moorpark College, it was reported that many students had a tendency to initially consider taking lower level courses rather than higher. In addition, the proportion of sections and enrollments for the different levels in the Math and English sequences really did not change to any degree after self-placement was implemented. These same findings emerged from our research on the four-year colleges as well. The overall consensus was that self-placement worked as intended.
- Because self-placement is offered in an online format, it is accessible from anywhere such as the student's home, high school or even on campus in the assessment office. Because it is not a timed event, it offers the opportunity for students to discuss their options with other students, parents, or even instructors and counselors. Also, because the placement decision is the student's evaluation of their own skill levels, there is no incentive to cheat, unlike current assessment process, and therefore, no need for computer security measures. Perhaps the most compelling reason to consider self-assessment is that it supports and is aligned with the spirit of the collaborative learning environment that student learning outcomes should generate. And if our goal is for students to make solid critical decisions, at what point do we allow them to do so?

12.Nassau Community College- Use of *A+dvancer* and ACCUPLACER for prescriptions and tutoring

- Two tests are widely used to determine student readiness for college level courses. These are ACCUPLACER which is provided by the College Board, and Compass which is provided by ACT. These two tests have an excellent track record in identifying the probability of student success in college level classes as well as determining success in specific remedial classes. However, the utility of either test for determining the specific learning objectives for which students need assistance is weak according to many personnel surveyed in both community colleges and 4-year colleges. So, if students are to receive individualized assistance, determining the specific needs of the student is left largely to the discretion of instructors.
- Increasingly, electronic learning resources are more readily available to students. Nevertheless, the direction for the students is often minimal. *A+dvancer* is an online instructional system that is designed to provide individualized learning prescriptions. The prescriptions are generally developed as a result of brief criterion-referenced assessments within the *A+dvancer* system that are associated with specific learning skills identified by ACCUPLACER and Compass.
- *A+dvancer* then provides a skill deficiency report and individualized instruction to address the specific learning needs of the student.
- Students who did not qualify for entrance into one or more college level courses as a result of their ACCUPLACER test scores were offered the opportunity to take the *A+dvancer* prescriptive assessment and prescribed instruction. Following the completion of their *A+dvancer* prescription, students took the ACCUPLACER test a second time
- ACCUPLACER Elementary Algebra pre and posttest scores for 139 students who used the *A+dvancer* system to address Elementary Algebra were returned to AEC. **Students in this study used *A+dvancer* for an average of 6 hours and 37 minutes.**
- The findings of this small study are very encouraging. The statistical findings were very strong where the numbers were high, as in the Elementary Algebra intervention.

Findings with the smaller sample sizes were also positive but cannot be as conclusive because of the lower numbers involved. The gains were made in following a brief intervention, 6 and 1/2 hours and under three hours, respectively. Additionally, the findings show a strong trend indicating that students who use the study materials gain more than students who spend more of their time merely practicing doing problems.

- The gains over a short period of time are especially encouraging. For most students taking a college placement test such as ACCUPLACER or Compass, there is a short window between the test and enrollment in classes. Many students who cannot begin the college level classes simply walk away from enrollment. It has been the observation of this writer, that students completed the *A+dvancer* intervention at a much higher rate in institutions where students were permitted to re-take ACCUPLACER after completing the *A+dvancer* intervention and have the second ACCUPLACER score accepted for class placement. With the short window, an effective, brief intervention is critical to retention.
- The statistical trends show that students who use the study materials made greater gains. This is encouraging for two reasons. First, it is consistent with the premise that instruction is important to learning. It is also encouraging because the learning management system within *A+dvancer* allows controls that require the learner to use the study guide.
- It was noted early in the history of the implementation of *A+dvancer* that students who had not made cut-scores on ACCUPLACER often did not use the study guide and skipped right to test questions. They then proceeded to continue taking test questions repeatedly, without going to the study guide. Their performance did not change, nor did their study habits. Perhaps this was the reason many of these students were not able to attain the cut-scores required for college enrollment. It was after this observation that a requirement of some study time was included as a default setting in the *A+dvancer* program.
- Students do not always make up sufficient ground to be eligible for college level work, but nearly always improve to test out of at least one remedial course. This is an extremely powerful observation. Delaying entry into college level work most likely hinders retention. It has been thought of many that accelerating entry into college level material would enhance retention.
- In conclusion, it appears that *A+dvancer* is an intervention that is effective in raising ACCUPLACER scores. Users report that students who enter college classes based on improved scores after an *A+dvancer* intervention succeed at just as high a rate as those who had high placement scores in the first place. This pilot data supports the hypothesis that *A+dvancer* is an effective intervention.

13. Davidson County Community College- Student Centered Advising and Interventions- a four tier advising system plus student action alerts

The following information was taken from an article “Having New Eyes”: One College’s Cultural Journey In Addressing The Issue of Underprepared Student by Jennifer A. Labosky, Faculty, Paralegal Technology Davidson County Community College, and Bette McKinney Newsome, Dean, Information Systems and Planning Services, Davidson County Community College, in SACJTC occasional paper vol. 19, #5, Nov 2002

- For several years Davidson County Community College’s strategic planning focused on creating and maintaining a learning-centered, student-centered college.
- For many years, it has been clear that our College’s population of students is changing. Each year we have seen more under prepared students and students for whom English is a second language. Many of our students have full lives

outside the college. They work; they care for family members; they are active in their community. Many are first generation college students who lack strong basic skills in reading, math, and writing. As manufacturing has declined and unemployment has risen in our community in the past two years, it has seemed that more students come to us with an inherent distrust of systems and institutions, a serious lack of critical thinking and problem-solving skills, and a heightened sense of entitlement.

- A radical transformation did occur in the course of our study, but that transformation took place in our own thinking. The paradigm shifted gradually at first. Instead of talking about teaching and lecturing, we began to talk about learning. We had always been student-centered when it came to services for students, but now we were becoming student-centered in instruction as well. We began talking about learning styles, competencies, and critical thinking.
- To reflect our transformation, we stopped using the words “remedial” and “developmental,” which had negative connotations. Instead we begin to talk about “preparatory” studies. The College purpose statement focuses on *preparing* students for careers and for lifelong learning; therefore, *preparatory studies* would be an appropriate name for the program.
- Another breakthrough of sorts occurred in redesigning our admissions, assessment, and placement process. Previously we treated all students needing remediation as exceptions “pending” program placement until preparatory work was completed. If they persisted in this developmental limbo, they had little contact with their intended program of study and few program-related courses from which they could select.
- **Our study indicated that adjustments in assessment benchmarks and a four-tiered advisement and placement approach would better address the needs of our students. In the new system students who score below the minimum benchmark for preparatory courses on the assessment instrument are referred to Basic Skills for long term remediation. Students who fall well within the range of the preparatory benchmarks are referred to advising and student success services. Students who score one or two points away from the score required to enter curriculum courses are referred to Basic Skills for refresher courses and/or materials, followed by retesting. Students who meet the benchmark for their intended program of study are referred to program advisors.**
- Other improvements followed. Information flow to advisors moved from a purple notebook to a real-time advisement web page. Advisement issues were addressed in periodic “advisement summits.” Copies of high school transcripts were provided to advisors to assist in assessing a student’s interests, academic strengths and weaknesses, and high school background in disciplines such as math. Advisement and registration became almost continuous processes.
- Instructional processes were also improved to promote consistency and clarify expectations. A template for course syllabi was developed. Exit criteria were developed for all preparatory courses to better align exit competencies with entrance requirements for the next preparatory or curriculum course in the sequence. Professional development opportunities were provided for faculty in order to promote best practices.
- In response to evaluation results from its annual survey of current students, faculty and staff developed an academic progress alert form for preparatory students. **Students now receive an alert which indicated the steps they should take to improve their chance of success. The form includes suggestions for improvement and resource information.**

In the fall of 2001, the college's Learning Assistance Center (LAC) opened for students. Located in the building which houses preparatory courses and faculty, the LAC offers:

- Free tutoring
- Computer access
- A writing center staffed by English faculty several hours each weekday
- Advisement and counseling
- Special testing, particularly for students with disabilities who have an accommodation plan
- Supplemental instruction (beginning in the spring of 2002)
- Print resources on a variety of topics
- Staff in the LAC offers a variety of workshops, both in the center and in classrooms on topics such as study skills, reading texts for information, test anxiety, time management, and conflict management

14. Mt. San Antonio College- California, Math Academy

The Math Academy is a "learning community" program in which students complete both Beginning and Intermediate Algebra (Math 52 and Math 72) in one semester, with the addition of integrated learner support services. Students are divided into cohorts of 30 and are enrolled in the two sections of math coursework—the first 9 weeks, Math 52, followed by 9 weeks of Math 72. In addition, each section has a student peer advisor associated with it, a supplemental instructor providing individualized instruction, and regular periodic visits by an assigned counselor.

Further, the groups of 30 cohorts meet together once weekly in a community class, which is a 2-hour class team-taught by math faculty and counselors. This class teaches both math-specific and general college success strategies, and develops the critical relationships between students and faculty as well as between students. These students also extend their learning into real-world environments, and explore the relationship between mathematics and other courses across the curriculum. Group work is also encouraged, with students focusing on problem-solving strategies.

Table 1 provides the results of this program for the three-year period from 2002 to 2004. In addition to success improvements at the course level, the Math Academy has produced success rates in the two-course sequence that are 2.0 to 2.5 times higher than the traditional method. As the research report notes, the Math Academy population is also demographically at higher risk than those in traditional sequence.

Table 1. Math Academy, Mt. San Antonio College

Group	Traditional	Math Academy	Improve Ratio
2001-02			
Course Success, Math 52	47%	72%	1.5
Course Success, Math 72	41%	62%	1.5
Success in both Math 52 & Math 72	19%	45%	2.4
2002-03			
Course Success, Math 52	54%	80%	1.5
Course Success, Math 72	44%	64%	1.5
Success in both Math 52 & Math 72	24%	48%	2.0
2003-04			
Course Success, Math 52	45%	83%	1.8
Course Success, Math 72	52%	77%	1.5
Success in both Math 52 & Math 72	24%	61%	2.5
Total			

Note: Improve Ratio indicates the number of times higher the Math Academy rate is than the Traditional rate

The Mt. San Antonio research report also notes a higher rate of A and B grades included in the success rates than in the traditional courses. Student satisfaction ratings were also much, much higher in the Math Academy courses.

From a research standpoint, these results are clear and convincing. In response to these results, Mt. San Antonio is expanding the model in Fall 2004 to link pre-collegiate English and Math classes with integrated support services similar to those provided in the Math Academy. This developmental "package" is targeted toward entering freshmen, and is designed to advance them early on into college-level coursework. Math Academy success data also contributed to the hiring justification for a new counseling position established to provide coordination for this expanded program.

Bridge program- A learning community designed to increase students academic and personal success.

Targeted students

- New Students
- At Risk
- First Generation
- Academically Disadvantaged
- Economically Disadvantaged

The Bridge Program is a learning community designed to increase student's academic and personal success through the structuring of the learning environment. Bridge Students share particular educational goal, common interests, and similar backgrounds. Students participating in Bridge are enrolled in linked or clustered classes that are taught in cooperative environment between instructors. In addition, students are supported by Bridge Program staff and counselors, financial aid advisers, transfer and advising specialists. As part of the Bridge Program, students can choose to be part of Summer Academy (SA) and/or Freshman Experience.

The program expanded to include additional learning communities including the Math Academy, a math-only community providing students the opportunity to complete elementary and intermediate algebra in one semester (see separate listing on CSS website on this program); a combined learning community of developmental English, math and a counseling course.

Contact : Patricia Maestro

Email : pmaestro@mtsac.edu

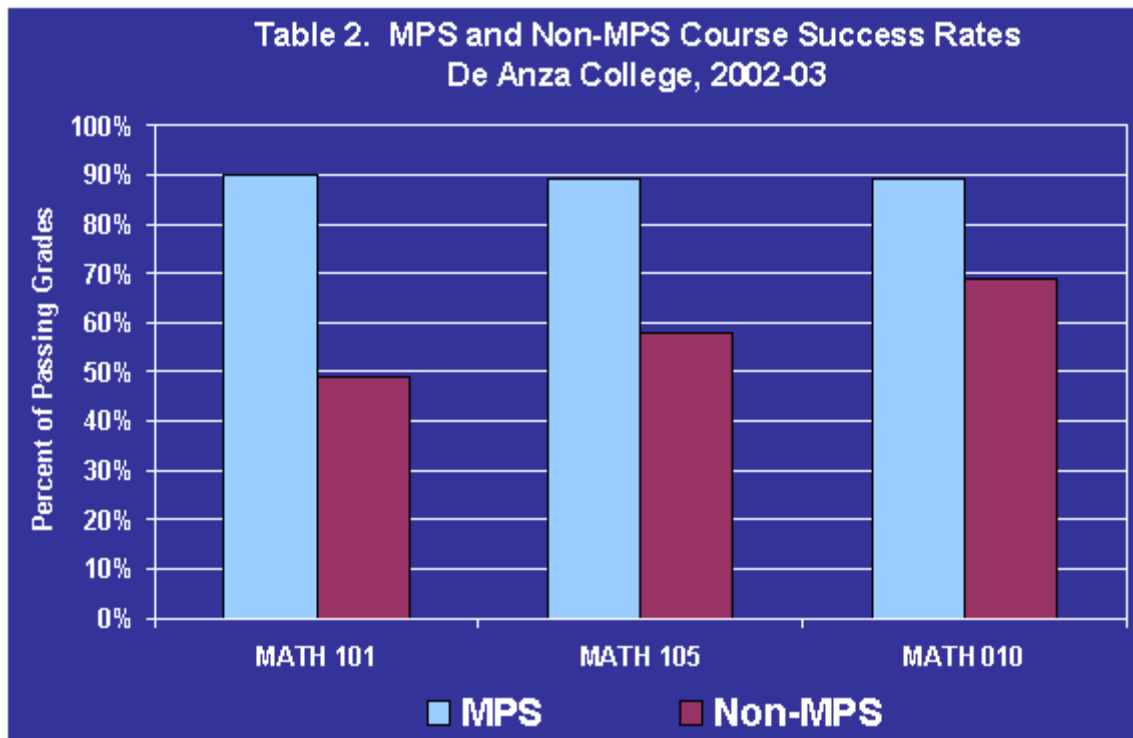
15. De Anza College- California, Math Performance Success (MPS) Program

The Math Performance Success program at De Anza College offers students a team approach to success, focusing on students who have had previous difficulty in pre-collegiate math courses. The program aims to move students through Elementary Algebra in the Fall quarter, Intermediate Algebra in the Winter quarter, and a Collegiate Math course in the Spring quarter. A focus is made on recruiting students groups where research has determined that they have historically performed poorly in these courses.

The traditional one-hour-per-day, five-day-a-week math class is transformed into a two-hour-a-day, five-day-a-week hybrid course focusing on collaborative group work—comprising as much as 50% of the instructional time. A counselor also sits in on *every* class session, and works closely with the instructor to ensure student success. The team of MPS instructors and counselors meet weekly to plan program activities and discuss individual students' progress in the course. Group peer tutoring is also offered to students outside of class, and study groups are also encouraged—often with tutors attending.

Another key component of this program is the inclusion of guest speakers from technical fields in the work-world, and consequently, classroom learning is tied to real-world problems that may be of particular interest to the students.

A De Anza research report examined the grades of students in the MPS program compared to the grades for students not in the program, and also compared persistence rates through to success at higher-level math courses. Table 2 provides the course success rates of students in the MPS program and those not in the program: the MPS rates are 40 points higher in Math 101 (Elementary Algebra), 30 points higher in Math 105 (Intermediate Algebra), and 20 points higher in Math 010 (College-Level Statistics).



Comparing persistence rates, the study found that the MPS group had a 78% persistence rate compared to a 46% rate for non-MPS students progressing from Elementary Algebra through Intermediate Algebra within two years.

Program staff and administrators at De Anza utilized the research to demonstrate that MPS is achieving more than the desired results, justifying the continuation and expansion of the program. In addition, program staff are using the success rates as benchmarks to measure improvement over time.

16. Foothill College, California- Pass the Torch

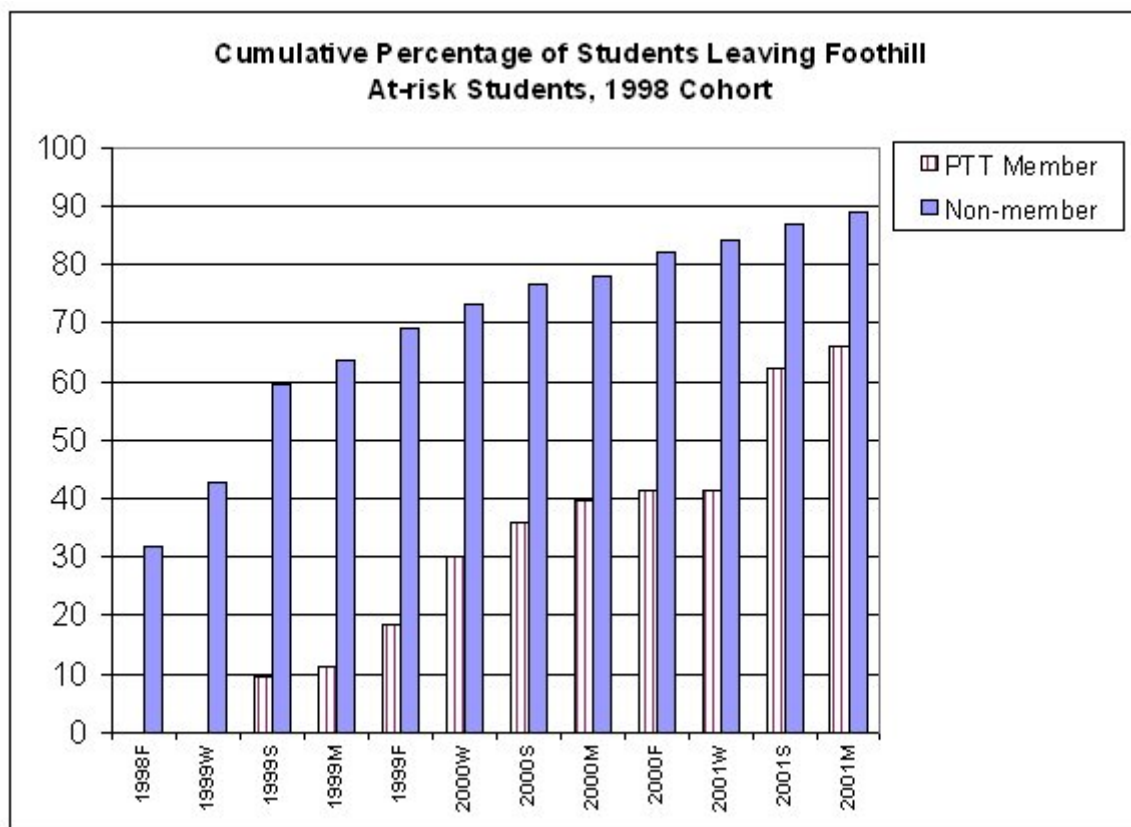
Pass the Torch, established at Foothill College in 1996, focuses on improving achievement in pre-collegiate and collegiate English and Mathematics for at-risk students—particularly African-American, Hispanic, and American Indian students. The key component of the project is the pairing of at-risk students with academically successful former students from the core courses in question, providing resources to both members of the pairing to be successful. Since the project's inception in 1996, Pass the Torch has served more than 1,000 students.

An evaluation of the Pass the Torch project was conducted by the Foothill-De Anza CCD research office, in conjunction with a final grant report to FIPSE. The evaluation relied upon a variety of analyses, including descriptive statistics as well as hierarchical regression analyses to assess the desired outcomes of the program.

Key findings included:

- Pass the Torch members were more likely to succeed in their courses than non-members. Differences of 8 to 15 percentage points were noted in Mathematics, and 7 to 22 point differences were noted in English.

- Regression analyses determined that the contribution of Pass the Torch to success and retention rates was independent of students' previous knowledge. A common complaint about specialized programs is that the better students simply select them, thus guaranteeing success improvements. This particular analysis determined that although previous knowledge is clearly important, Pass the Torch was making a statistically independent contribution.
- To elaborate on the previous point, the analyses determined that Pass the Torch members had lower levels of previous academic achievement than did their non-PTT counterparts in related courses.
- Finally, and perhaps most impressively, Table 3 below demonstrates that Pass the Torch members were much less likely to leave the college early than non-members of similar at-risk status. The graph shows that for students starting in Fall 1998, nearly 63% of the non-PTT members had left Foothill by the following fall quarter. For Pass the Torch members, the number was 11%—a significant difference. Intriguingly, the far right end of the graph shows an increasing number of Pass the Torch members leaving the college after about three academic years—which was determined to be because they were receiving degrees and certificates!
- **Table 3.**



The impressive results of this program cited by the research evaluation helped Foothill receive a second FIPSE grant in September 2003 to expand the Pass the Torch program to four-year universities. UC-Berkeley and UC-Davis have agreed to help extend the programs from Foothill to baccalaureate institutions.

More information on the Pass the Torch program can be viewed at <http://www.foothill.edu/services/torch.html>.

17. San Jose State University- Mastery Learning in Developmental Mathematics by Susan McClory,

* At San José State University (SJSU), mastery learning was first introduced in the spring of 2001 with a group of students who had failed their first semester developmental math course. Because the California State University system allows students only two semesters to complete any required remediation, students who fail the first semester are at high risk of being disenrolled from the university at the end of their second semester.

* Prior to introducing mastery learning, this group of students had a pass rate of only 30%. Under

mastery learning, the pass rate for that group of students in the spring of 2001 was 66%. These results were so dramatic that mastery learning is now used throughout the program, with an average of 73% of the students passing each semester.

* The concept of mastery learning can be a great asset in developmental mathematics. The underlying

premise is that students must “master” each unit before moving on to the next unit or before passing the

course. What makes this a particularly useful approach in developmental math is that it directly addresses several of the main complaints that instructors have while ensuring that the students have a thorough knowledge of the concepts they need to take with them into their future studies. In a traditional developmental math class, students are given several tests

* In a traditional developmental math class, students are given several tests and a final exam. The

results of these tests are averaged to determine the final grade for each student. The problem with this system is that the material becomes increasingly more challenging as the course progresses. Yet, the easier material at the beginning of the course is weighted equally with the more difficult material at the end. This can produce an uneven distribution of knowledge and even the possibility that some concepts can be completely unlearned. By adopting a mastery learning approach, the linear nature of mathematical learning is reinforced.

* Another problem that is directly addressed by mastery learning is the lack of student motivation. It

is often the case that students in developmental math classes have become accustomed to failure. In a

traditional grading system, when students take and fail a test there is no recourse but to try to do better on the next one in order to average out the scores for a passing grade. This can result in a self-defeating spiral of failure because the new material often depends on a thorough understanding of the previous material. When that understanding is lacking, there is little hope of acquiring it while also tackling new concepts.

* In SJSU’s developmental math courses, all students take a common test on each chapter of a combined introductory and intermediate algebra curriculum. A score of at least 70% on each test is required for mastery. There are two options for students who fail to achieve mastery on any given test – multiple versions of the paper and pencil test or a web-based testing program. Each instructor determines the criteria for retaking exams. While some prefer to give the first retake during a subsequent class period, others have students complete all retakes in the computer lab. Instructors are encouraged to set deadlines for retaking a test. Most instructors allow students only one or two weeks after a test is returned so that students can get caught up before the class gets too far into new material.

* With mastery learning, students who fail to master a unit receive additional instruction or help from

a variety of sources. At SJSU, there is a university-wide tutoring center and another dedicated to

developmental math. In addition, students are encouraged to use a free web-based tutorial program that comes with their text. Many of the instructors also hold special review sessions for those who must retake a test. For students, this means that instead of giving up once a failing grade is earned, they are encouraged, instructed and mentored until each concept is mastered. This gives them a success to build upon rather than a shaky foundation. Each of the more difficult topics then becomes a manageable hurdle as the students learn that success is possible. Students are thus encouraged to keep working toward mastery and therefore become more motivated. At the end of the semester, students also have a final opportunity to demonstrate mastery in the form of final exams on

* All of the classes use common exams and we are now using a text that I recently had published. It is a short and to the point review of the skills they need because students tend to not read a text that has too much information. Prior to developing the curriculum, I survey the faculty teaching the next level courses. I asked them to check off the topics needed by students in their classes from a laundry list of topics and built the curriculum around their responses. The book also sells to the student for under \$25 which makes it attractive to them to keep it for future reference.

18. San Jose State University- Multi-faceted Placement by Susan McClory,

The SJSU placement process identifies student skill levels, creates relatively homogeneous groups of students based upon those skill levels, and tailors different instructional formats to different groups of students

* The placement program at San Jose State University (SJSU) has several elements which distinguish it from most other programs. Students at California State Universities are required by state mandate to complete developmental course work within their first two semesters of study. SJSU has responded to this mandate by developing a single course curriculum that is offered in four different instructional formats. Through a multi-faceted placement process, SJSU not only determines developmental needs, but also matches students to different instructional formats according to ability level.

* Initially, the university uses scores from standardized tests such as the SAT or ACT to exempt qualified students from mandatory placement testing. Students who are not exempt take the Elementary Level 15 Mathematics (ELM) test administered by ETS.

* Following testing, the lowest two-thirds of the students are enrolled in a two-semester developmental algebra sequence.

* The upper third is placed into a course that covers the same material in a single semester.

* Within the lower group there are two instructional formats. The lowest quartile of students meets four days per week in classes of no more than 25; the rest of the lower group meets two days per week in lecture classes (200 students) and two days per week in discussion groups (25 students). The upper third of students meets three days per week in lecture classes and two days per week in discussion groups, covering the material in half the time.

* The top 10% of students are also given the option of completing the course work by independent study.

19. UNIVERSITY OF MINNESOTA- RISING STARS COHORT PROGRAM FOR ELEMENTARY EDUCATION TEACHERS REQUIRING DE MATH COURSES

Rising Stars by Irene M. Duranczyk, University of Minnesota, General College and Barbara Leapard, Joanne Caniglia, and Elaine Richards, Eastern Michigan University.

* Can you envision students applying for and enrolling in a developmental mathematics course that

meets two extra hours a week for possibly two semesters? Can you envision these students committing to develop as a cohort in mathematics for elementary education the subsequent three semesters? Eastern Michigan University (EMU), along with Henry Ford Community College and Schoolcraft College, implemented an Emerging Scholars Program (ESP) for students interested in becoming elementary education majors.

* The students recruited and selected for the Emerging Scholars Program for Teachers entered college without the basic mathematical skills needed for success in college-level mathematics courses, yet had the career goal of being elementary school teachers which requires conceptually strong mathematics skills. While these students deeply desired to be teachers, many had mathematical histories embedded with feelings of inadequacy or failure. After receiving National Science Foundation Funding (NSF-#9950679), the program was featured in local newspapers. This began the recruitment process. After advertising the program through campus newspapers, fliers, and academic advisors at all three campuses, students self-identified and voluntarily completed a special application form with a letter of commitment. They also participated in an interview prior to their selection and enrollment in the three-semester, pre-service teachers' learning community centered on mathematics. One special ESP group was organized within a Freshman Interest Group (FIG) at Eastern Michigan University. This article highlights the program design that enabled these at-risk students to reach for the stars.

Theoretical Base

Henry Ford Community College and Schoolcraft College are two of EMU's largest feeder colleges. Mathematics education faculty from these colleges, along with select mathematics education and developmental mathematics faculty at EMU, engaged in a year-long study group. The faculty researched, read, and reflected on how to assist college students who were interested in becoming elementary teachers, but were entering the college system without adequate preparation for college-level mathematics. The faculty explored mathematics in an "Emerging Scholars" format based on Uri Treisman's workshop model. The ESP project was formed on two basic principles: all students can learn mathematics despite inadequate pre-college preparation and learning communities can facilitate the preparation of elementary mathematics teachers. When EMU embarked on establishing Freshman Interest Groups in Fall 2001, this additional feature allowed a cohort of 25 freshmen interested in pursuing a degree in elementary education to spend one semester taking developmental mathematics and two additional college level classes blocked together.

* The theoretical bases of mathematics education reform, the Emerging Scholars Program, and Freshmen Interest Groups have much in common. The following descriptions highlight their overlapping and complementary natures.

Mathematics Education Reform

When students can see the connections across different mathematical content areas, they develop a view of mathematics as an integrated whole. As they build on their previous mathematical understandings while learning new concepts, students become increasingly aware of the connections among various mathematical topics. As students' knowledge of mathematics, their ability to use a wide range of mathematical representations, and their access to sophisticated technology and software increase, the connections they make with other academic disciplines give them greater mathematical power (National Council of Teachers of Mathematics, 2000, p. 353). That elementary teachers need mathematical power is delineated in the NCTM Standards. The ESP program was designed to assist students in developing this power by reconceptualization of ideas rather than through review and remediation. Non-routine problems were the backbone of the ESP for Teachers, as well as a test of the students' mathematical power. The faculty utilized reform-based mathematics curricula to incorporate constructivist, discovery methods of instruction. Through the learning community established by the program, students also developed increased confidence in exploring mathematical ideas.

Emerging Scholars Program

All the Emerging Scholars Programs involve building a social environment that enables students to see themselves as math people (Garland, 1993). An ESP is place where students can build into their identity the idea that they are associated with a group of people based on a need for and interest in learning mathematics. So what is unique about an ESP? ... "First, more time to work on challenging problems. Second, informal time to learn the cultural stuff about math and about math careers" (U. Treisman, personal communication, June 14, 2001). This quote by Uri Treisman emphasizes the need for students to develop community within mathematical settings while doing the work of mathematicians. It

is in community that students learn the informal information that is so important for non-traditional mathematics students to learn about: a) mathematics careers, b) the human side of people who are mathematicians, and c) mathematics culture. Doing mathematics is not doing problems that have known answers. It is exploring mathematical ideas and relationships. It is becoming comfortable with uncertainty, persisting without knowing quick answers and processes, exploring alternative strategies, and being open to new relationships and connections between the known and unknown. Treisman's workshop model provides the forum for developing mathematical power.

Freshman Interest Groups

The Freshman Interest Group model allowed EMU to enhance the Emerging Scholar Program with the components of block scheduling and social activities. Although the FIG component was only established for the fall semester for freshmen, it created the opportunity for students to bond and to begin a two-year commitment to learning together. Students who enrolled in a developmental FIG during the fall semester enrolled together in the subsequent mathematics classes for elementary education majors, forming a sort of volunteer learning community.

Program Design

Weaving the three theoretical frameworks together, EMU institutionalized a model mathematics program for pre-service elementary education. Course content from all three colleges was coordinated to ensure that students could easily transfer among the colleges and receive an equivalent educational preparation in mathematics. The coordination involved three levels of course work – developmental mathematics, mathematics for elementary teachers, and methods for elementary teachers.

Creating opportunities for purposeful, voluntary participation

Students volunteered to participate in special sections of pre-algebra, beginning algebra, Mathematics for Elementary Teachers I and II, and Methods for Elementary Teachers (pre-student teaching). The role of faculty was to develop a recruitment strategy to attract freshmen who were unsure of their mathematical abilities, but were attracted to a package of increased attention, responsibility, and camaraderie centered on mathematics. Working with academic advisors, the admissions office, and the advising department, 30-50 students per semester were attracted to the program.

Helping students excel, not just avoid failure

Students were involved in challenging mathematics problems created to deepen their understanding of the key mathematical concepts. Students voluntarily attended mathematical workshops for two additional class hours per week, during which they did challenging, non-routine, problem-solving activities. Students were provided support as they viewed mathematics from a meaningful and conceptual approach. Faculty and tutors were available to assist students in sustaining interest and a desire to excel. At EMU, a yearly awards program for students excelling in Mathematics had been previously instituted. A certificate and lapel pin(s) for all the Emerging Scholars who participated in the program for three or more semesters was incorporated into the yearly awards ceremony.

Emphasizing collaborative learning and small-group teaching methods

Each course in the series was designed around collaborative learning strategies. Faculty modeled teaching strategies that students could use when they began their teaching careers. Many of the activities in the developmental mathematics courses were activities that could be used in elementary classes. For example, a body ratios activity was used to review fractions, ratios, and proportions. The activity was extended, encouraging students to interpret results and construct tables, graphs, or algebraic representations of their data. Students worked in groups, reported findings to the class, and presented lessons. Faculty integrated content and pedagogy as students built mathematical skills and positive mathematical teaching strategies.

Merging students' academic and social lives

The FIG model allowed EMU to add the component of block scheduling, implement small class sizes in traditionally large freshman survey courses, and increase tutorial support, academic advising, planned social activities, and common housing. These additions allowed EMU to institutionalize a program that began with National Science Foundation funding and continues today with local administrative structures. The mathematics faculty held social gatherings on workshop days three times each semester. The social activities included a luncheon, team-building games, Halloween-dress in a math theme, valentine origami, and other seasonal themes. The goal was simply to create a sense of community by offering enjoyable activities while at the same time breaking down the barriers between students and faculty. At EMU, a Calculus ESP was

operating at the same time as the ESP for Teachers. Joint social functions were held, allowing the elementary education majors to interact with budding mathematics majors. While these two student groups would rarely interact on the college campus, both benefited from this experience by sharing career aspirations and struggles along the way.

Summary

These students, placed at risk because of their mathematical preparation prior to college, were a challenging yet rewarding group of students to encourage to “reach for the stars.” The faculty energy that this program engendered benefited the faculty both professionally and personally. Students were able to see that the mathematics faculty cared about their individual growth and mathematical power.

Through programs such as the Emerging Scholars Program for Teachers, faculty can encourage and create opportunities for under prepared mathematics students to become rising stars, to change their majors to incorporate more mathematics-related careers, and to envision themselves as competent mathematics students and teachers. Because of the program, those students continuing on their career paths in elementary education will have the care, empathy, and skills to prepare the next generation of elementary students to enjoy and benefit from their mathematics preparation.

20. UNIVERSITY OF MEMPHIS- USING AN INTERNET MATH HISTORY TO SUPPLEMENT ALGEBRA INSTRUCTION

Students tend to think of mathematics as a static set of facts to be learned, but math has been developed over thousands of years in hundreds of cultures all over the world and is still being developed today! By incorporating into the regular algebra course work an Internet-based, math history component that involves reading and writing activities, students can process the topics studied in more depth and can see them as part of the entire framework of the history of mathematics from 3000 BC to the present.

Reading biographies of people who developed mathematics helps to humanize the subject, which many students consider uninteresting and dry. Students may also recognize the valuable contributions made by their own ethnic group as they see the diversity of people and cultures from which mathematics has developed.

To implement this component, a personal web page was constructed covering the six broad time periods in the history of mathematics. Using this as a home page from which other linked web sites could also be accessed, students were required to submit a one-page report from each time period and two others on topics of their own choosing. They were asked to concentrate on topics studied in class or the people who helped develop those topics. Biographies of mathematicians were the easiest to write, but many good reports on a variety of topics were submitted. These included the history of algebra, the first use of zero, the uses of geometry in early building projects, Pythagoras and the use of the Pythagorean Theorem, the development of the first computer, and many others.

The reports counted 10 points each. A 20-point group project was also assigned, making a total of 100 points for the math history component. In the group project, each group interviewed a math professor on campus using a list of questions suggested by the teacher and various students. The goals were to show that mathematics is still being developed and to show how it is used. (One professor had just discovered a new statistics formula!) These reports were also placed on the web page.

While the math history component has not necessarily raised or lowered student grades, it has added a different dimension to the class. Students and teachers from all over the world use the web site and e-mails are received every semester from as far away as Hong Kong and Africa, making the experience even more satisfying. The web page can be viewed at <<http://www.people.memphis.edu/~brveteto>>.

21. PHILLIPS EXETER ACADEMY- THE HARKNESS PROGRAM

* The Harkness Classroom -All classes are conducted in a discussion setting around a table with an average of 12 students. In mathematics classes this allows for a unique learning environment and Exonians are exposed to problem solving in a very student-centered,

discussion-based classroom. Students are held accountable for attempting solutions to homework problems and the class as a whole decides on correct solutions.

** Our Problem-Based Curriculum The department does not use traditional text books. We decided that the most appropriate way to teach mathematics with the Harkness method was to write our own materials, consisting simply of books of problems. There are problem sets for each of the four levels of the mathematics curriculum. These problem sets are continually evolving; they are edited after each school year based on the feedback from teachers and students over the year.*

* What is Harkness?

You could say it's a table, oval, with enough room to seat 12 students and a teacher...It's a way of learning: everyone comes to class prepared to share, discuss, and discover, whether the subject is a novel by William Faulkner or atomic and molecular structure. **There are no lectures.**

It's a way of being: interacting with other minds, listening carefully, speaking respectfully, accepting new ideas and questioning old ones, using new knowledge, and enjoying the richness of human interaction. You see the Harkness philosophy played out on our dorms, in our theater productions, on our playing fields. It's fun, it's exhilarating, it's the way to be.

* The goal of the Mathematics Department is that all of our students understand and appreciate the mathematics they are studying; that they can read it, write it, explore it, and communicate it with confidence; and that they will be able to use mathematics as they need to in their lives.

* We believe that problem solving (investigating, conjecturing, predicting, analyzing, and verifying), followed by a well-reasoned presentation of results, is central to the process of learning mathematics, and that this learning happens most effectively in a cooperative, student-centered classroom.

We see the following tenets as fundamental to our curriculum:

- that algebra is important as a modeling and problem-solving tool, with sufficient emphasis placed on technical facility to allow conceptual understanding;
- that geometry in two and three dimensions be integrated across topics at all levels and include coordinate and transformational approaches;
- that the study of vectors, matrices, counting, data analysis, and other topics from discrete mathematics be woven into core courses;
- that computer- and/or calculator-based explorations be an integral part of our courses;
- that all topics be explored visually, symbolically, and verbally;
- that developing problem-solving strategies depends on an accumulated body of knowledge.

* Our intention is to have students assume responsibility for the mathematics they explore—to understand theorems that are developed, to be able to use techniques appropriately, to know how to test results for reasonability, to use calculators and computers effectively as tools for investigation, and to welcome new challenges whose outcomes are unknown.

* To implement this educational philosophy, members of the PEA Mathematics Department have composed problems for nearly every course that we offer. The problems require that students read carefully, as all pertinent information is contained within the text of the problems themselves—there is no external annotation. The resulting curriculum is problem-centered rather than topic-centered. The purpose of this format is to have students continually encounter mathematics set in meaningful contexts, enabling them to draw, and then verify, their own conclusions.

* As in most Exeter classes, mathematics is studied seminar-style, with students and instructor seated around a large table. This pedagogy demands that students be active contributors in class each day; they are expected to ask questions, to share their results with their classmates, and to be prime movers of each day's investigations. The benefit of such participation in the students' study of mathematics is an enhanced ability to ask effective questions, to answer fellow students' inquiries, and to critically assess and present their own work. The ultimate goal is that the students, not the teacher or a text-book, be the source of mathematical knowledge.

22. PLATO LEARNING SYSTEM-

According to recent statistics, more and more students are leaving high school unprepared for college level courses. These students require developmental education to remediate the skills they need to succeed in higher education.

PLATO Developmental Education Solutions provide online supplemental and full-course instruction that is accessible anytime/anywhere to help your students review and/or remediate skills. Our on-campus and distance learning solutions help make it possible for your students to achieve post-secondary success.

As a self-paced learning tool, technology provides students with the means to work at their own pace to learn the material. Students pass into credit courses more quickly, increasing pass rates, retention, and persistence.

The instruction is individualized to each student's needs, which helps faculty facilitate teaching larger classes with diverse students.

Our supplemental instruction allows you to implement one, two, or all of the content libraries you choose, and combine them as needed. This courseware is customizable, providing academic freedom and supporting individualized learning. The large breadth and depth of courses allows for use across many campus programs/labs.

Our full-course instruction provides consistent instruction by faculty and adjuncts alike. The comprehensive online materials allow for increased distance learning offerings. While the cost-recovery model makes this courseware economical and efficient, it can be implemented in an on-campus, distance learning, or hybrid model to accommodate your institution's needs.

A Customized Solution

Keith Hensley, dean of workforce development and executive director of the Center for Business and Professional Development at Holyoke Community College, discovered PLATO Learning in 1996 after researching options and evaluating a variety of programs. They have been expanding their use of PLATO® software ever since. "PLATO software fit the versatility more than any other product I viewed," Hensley said. "It is easily customized and covered all the bases. It is

user friendly and interactive.” HCC accomplishes their mission through a variety of innovative and entrepreneurial programs that use PLATO Learning software for assessment, instruction, and reporting. Some of these programs include: On-Campus Developmental Studies Only 37 percent of incoming students score sufficiently on the Computerized Placement Test (CPT) to take college-level credit courses at HCC. A faculty member designed a PLATO® developmental mathematics course for students who didn’t score sufficiently on the CPT. This credit-granting course gave students the opportunity to choose between self-study courses delivered entirely with PLATO Learning software or an instructor-led course supplemented by PLATO Learning content. The mathematics faculty and students have been extremely receptive and pleased with the program and its results. “In the PLATO lab, I had students actively involved in the material—it was impossible for them to work on the PLATO software and not be actively learning,” said Victor Thomas, HCC mathematics instructor.

23. LAMAR COLLEGE –TEXAS

Mission

The Lamar State College-Orange mission includes developmental education as one of its primary purposes. The corresponding purpose statement reads:

"To provide developmental programs for students not ready for college-level work."

Developmental Education

When? A student who does not pass all sections of the THEA test or approved alternative test is required to enroll in a developmental course.

A student is required to be in continuous remediation, except during mini-session terms, until passing the THEA test.

What? A student who does not pass one/any section of THEA or an approved alternative test is required to enroll in at least one of the corresponding developmental courses based upon placement scores.

Completion? A student who enrolls for a second time in a developmental course, after failing the first time, must enroll in a study skills course concurrently. If a student fails a developmental class twice, the student is required to meet with a tutor on a weekly basis during his/her third enrollment. If a student fails a developmental class a third time, he/she will not be allowed to enroll again. Students are free to pursue THEA-waived coursework.

A student is not required to enroll in a developmental course after passing the THEA test. Students who have successfully completed the developmental sequence but have not passed THEA may enroll in a "B" or better course.

A student must place into a college-level course or successfully complete the developmental sequence that precedes the required college-level course before enrolling in that course.

Attendance? Students enrolled in developmental courses are expected to attend regularly and complete all assignments and testing. Students who are absent 6 (six) times within one semester will be dropped from the course and risk dismissal from LSC-O. In addition to the attendance policy, instructors may drop a student from a developmental course for failure to do assigned work and/or testing.

Mathematics Placement

A diagnostic placement test in mathematics is required for all students who are THEA required and/or enrolling in math for the first time to determine the course most appropriate for the individual's skill level. Results of this test are used for placement into the appropriate level math course. While most students will take only one exam, it is possible that a few may need to take additional exams to determine placement. The math tests take 60 minutes each, and test results will normally be available immediately. Although maintained in records for student advising, scores do not appear on the student transcript.

Successful completion of THEA requirements does not eliminate the requirement for math placement testing. Students who have received passing grades in a math course may continue with the next course in the sequence. Students who have failed or dropped math will re-enroll at the level indicated previously. Math faculty or the division chair can provide additional information about math placement.

Developmental Writing and Reading Courses

College policy requires that all full-time students register for freshman English until credit for six (6) semester credit hours is earned. This rule also applies to students who take DWRT classes. A student who does not successfully complete a DWRT class must repeat the course until a satisfactory grade of "A," "B," or "C" is earned before enrolling in the next course in the sequence.

In addition to placement in developmental writing, some students will be placed in developmental reading (DRDG) as well. All THEA-required students will be required to take reading placement tests upon entry to Lamar State College-Orange.

Courses

The following constitute developmental courses at LSC-O:

DMTH 111	Developmental Math
DMTH 1300	Pre-Algebra
DMTH 1301	Introduction to Algebra
DMTH 1302	Intermediate Algebra
DRDG 111	Individualized Instruction in Reading
DRDG 1301	Developmental Reading
DWRT 111	Individual Instruction in Writing
DWRT 1301	Developmental Writing
EDUC 1310	Study Skills

Developmental Grading

Students who enroll in developmental reading, writing or mathematics courses will receive grades as follows:

- "A," "B" or "C" if they successfully pass the class;
- "U" or "F" if they are unsuccessful in the class;
- "W" if they withdraw from the college completely; and
- "Q" if they are THEA exempt and choose to drop the class prior to the penalty date.

No grade points are awarded for developmental courses. The grade of "F" will be calculated as part of the grade point average.

24. Models For Using Information Technology To Improve Teaching and Learning

NATIONAL CENTER FOR ACADEMIC TRANSFORMATION

NCAT is an independent non-profit organization dedicated to the effective use of information technology to improve student learning outcomes and reduce the cost of higher education. NCAT provides expertise and support to institutions and organizations seeking proven methods for providing more students with the education they need to prosper in today's economy.

Five Models for Course Redesign

http://www.center.rpi.edu/PlanRes/R2R_Model_Rep.htm

<http://www.center.rpi.edu/R2R/R2R%20PDFs/Five%20Models%20for%20Course%20Redesign.pdf>

<http://insidehighered.com/news/2007/03/15/ncat>

<http://www.educause.edu/ir/library/pdf/erm0352.pdf>

The following summarize the characteristics of the five course redesign models that emerged from the Program in Course Redesign.

The Supplemental Model

The supplemental model retains the basic structure of the traditional course and a) supplements lectures and textbooks with technology-based, out-of-class activities, or b) also changes what goes on in the class by creating an active learning environment within a large lecture hall setting.

The Replacement Model

The replacement model reduces the number of in-class meetings and a) replaces some in-class time with out-of-class, online, interactive learning activities, or b) also makes significant changes in remaining in-class meetings.

The Emporium Model

The emporium model eliminates all class meetings and replaces them with a learning resource center featuring online materials and on-demand personalized assistance, using a) an open attendance model or b) a required attendance model depending on student motivation and experience levels.

The Fully Online Model

The fully online model eliminates all in-class meetings and moves all learning experiences online, using Web-based, multi-media resources, commercial software, automatically evaluated assessments with guided feedback and alternative staffing models.

The Buffet Model

The buffet model customizes the learning environment for each student based on background, learning preference, and academic/professional goals and offers students an assortment of individualized paths to reach the same learning outcomes.

What do these projects have in common? To one degree or another, all thirty projects share the following six characteristics:

1. *Whole course redesign.* In each case, the whole course—rather than a single class or section—is the target of redesign. Faculty begin the design process by analyzing the amount of time that each person involved in the course spends on each kind of activity, a process that often reveals duplication of effort among faculty members. By sharing responsibility for both course development and course delivery, faculty save substantial amounts of time while achieving greater course consistency.
2. *Active learning.* All of the redesign projects make the teaching-learning enterprise significantly more active and learner-centered. Lectures are replaced with a variety of learning

resources that move students from a passive, note-taking role to an active, learning orientation. As one math professor put it, “Students learn math by doing math, not by listening to someone talk about doing math.”

3. *Computer-based learning resources.* Instructional software and other Web based learning resources assume an important role in engaging students with course content. Resources include tutorials, exercises, and low stakes quizzes that provide frequent practice, feedback, and reinforcement of course concepts.

4. *Mastery learning.* The redesign projects add greater flexibility for when students can engage with a course, but the redesigned courses are not selfpaced. Rather than depending on class meetings, student pacing and progress are organized by the need to master specific learning objectives, which are frequently in modular format, according to scheduled milestones for completion.

5. *On-demand help.* An expanded support system enables students to receive assistance from a variety of different people. Helping students feel that they are a part of a learning community is critical to persistence, learning, and satisfaction. Many projects replace lecture time with individual and small-group activities that take place either in computer labs—staffed by faculty, graduate teaching assistants (GTAs), and/or peer tutors—or online, enabling students to have more one-on-one assistance.

6. *Alternative staffing.* By constructing support systems consisting of various kinds of instructional personnel, the projects apply the right level of human intervention to particular student problems. Not all tasks associated with a course require highly trained, expert faculty. By replacing expensive labor (faculty and graduate students) with relatively inexpensive labor (undergraduate peer mentors and course assistants) where appropriate, the projects increase the person-hours devoted to the course and free faculty to concentrate on academic rather than logistical tasks.

25. ARAVAIPA COMMUNITY COLLEGE- LEARNING COMMUNITY WITH DE MATH COURSES

The Aravaipa Learning Community Coming Together Where the Waters Meet

Cultural and Historical Geography and

**MAT 081 or MAT 091 or MAT121
3 credits social science and 4 credits math**

**Instructors are
Shay Cardell and Maren Wilson**

Any student who needs these classes is welcome. Students will earn 7 credits of Social Studies and Mathematics.

For students who are planning to transfer to a state university or who are seeking an AA, AB, AS, AAS, or AGS degree, these classes fulfill degree requirements.

Students Say:

"I like it that if I speak out and it isn't the answer you are looking for, you don't make me feel stupid."

"Work is not ordinary school work. It's like learning without the work though we are working."

"I like the diversity and group participation in the class."

"There was always someone to help. The instructors all would make sure you knew what you were doing."

"I learned a whole lot more than I do in a stand-alone class."

"I understood more things when I worked with others."

The way research shows you learn best:

- Participate in your own learning.
- Discover connections between subjects.
- Experience hands-on applications.
- Make friends and study together in groups.
- Meet your neighbors and learn about community history and environment.

How Does It Work?

Earn 7 credit hours through activities and hands-on experiences.

- **Grades based on activities, including field trips, films, guest speakers, and simulations.**
- **Convenient schedule. Only two days each week.**
- **Career and counseling services.**
- **Friendly, experienced teachers in the classroom to help you succeed.**

Explore our community through learning activities. Some of our activities include archeological dating, surveying local plant life along the San Pedro River and playing the FishBanks ecological simulation game.

Aravaipa Learning Community General Objectives

Students will

1. Develop critical thinking and writing skills.
2. Understand college procedures and bureaucracy.
3. Acquire good study skills.
4. Understand subject areas and making connections between them.
5. Develop an appreciation for life long learning.
6. Construct their own knowledge and reality.
7. Experience hands-on and real world applications.
8. Understand systems thinking: interdependence, long-term results, and unintended consequences.
9. Extend knowledge horizons beyond their immediate community.
10. Feel valued as individuals.

11. Develop mutual respect and value diversity.
12. Increase self-awareness.

Math Objectives

Students will:

1. Communicate using meaningful and relevant mathematics.
2. Use multiple approaches to solve mathematics problems.
3. Experience math as a laboratory discipline.
4. Use technological tools to solve math problems.
5. Analyze system behavior using mathematical models.

Study Skills Objectives

Students will

1. Develop critical and analytical, and creative thinking.
2. Read and take notes of texts effectively and efficiently.
3. Take notes of oral discourse.
4. Increase vocabulary skills to better understand oral and written discourse.
5. Manage time well.
6. Improve goal setting and planning.
7. Discover most effective personal learning methods.
8. Develop interpersonal skills for productivity and well-being in teams, communities, family, friendships, and work.
9. Identify personal purpose for completing college and set appropriate academic goals.
10. Identify classes needed to reach goals.
11. Identify and develop habits of mind that lead to academic/work/personal success.
12. Learn about additional study skills to prepare for future classes.

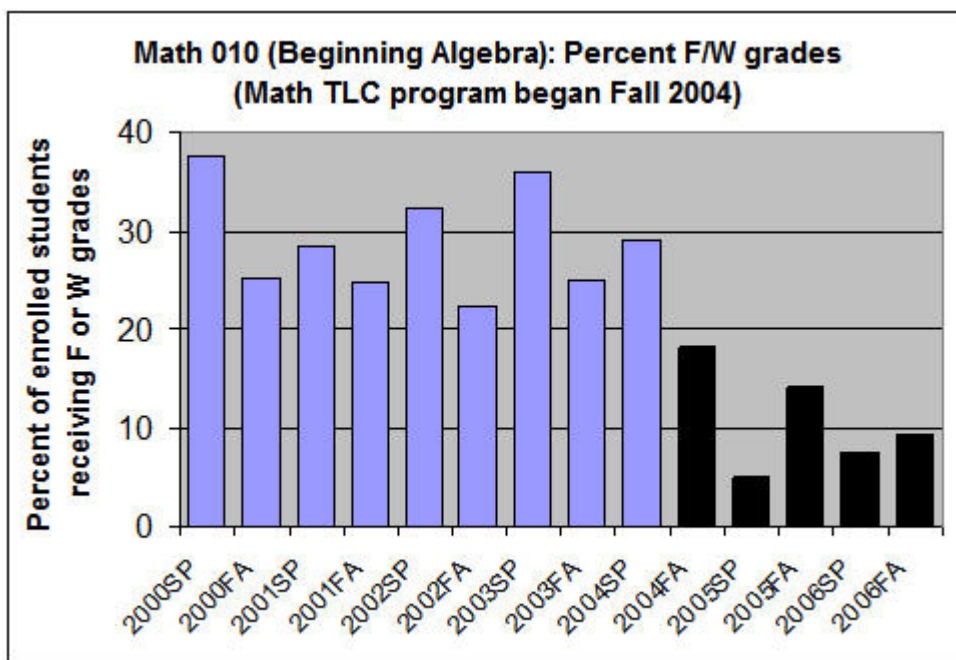
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26. University of Washington- Stout campus

The **Math TLC** is where UW-Stout students learn basic math skills in a people-oriented, technology-enhanced environment. Teachers start daily classroom sessions with a short lecture, then students begin online homework assignments with help from teachers and specially trained peer tutors.



Since the program began in Fall 2004, failure and withdrawal rates have dropped by more than 60% in Fundamentals of Algebra (Math 010) and by over 30% in Intermediate Algebra (Math 110). (More results available in attached [report](#).)

University of Wisconsin–Stout

The University of Wisconsin–Stout was founded in 1891 and serves roughly 8,000 students from its Menomonie, Wisconsin, campus. Most students live on campus and follow the national trend: 5 to 10 percent of a typical incoming class of 1,500–1,700 first-year students place into Math 010, a remedial algebra course, and another 35 percent place into Math 110, an intermediate algebra course and prerequisite to courses satisfying the university’s general math requirement. Over the eight semesters prior to fall 2004, failure/withdrawal rates in these courses averaged a combined 29 percent (beginning algebra) and 29.2 percent (intermediate algebra). Because studies indicate that success in first-year math courses is a strong predictor of retention into the second year of college, UW-Stout had strong incentive to invest resources in a program designed to decrease its failure/withdrawal rates. “If we can get kids through math, they’ll stay in school and stay at UW-Stout,” says Dr. Jeanne Foley, director of UW-Stout’s Math Teaching and Learning Center (Math TLC). The Math TLC was created via a special allocation by the chancellor’s office in fall 2004 to develop a comprehensive approach combining online work with required daily classroom sessions and a new tutoring service devoted specifically to introductory algebra courses. During the past two and a half years, the center has served more than 1,600 students and achieved a 62 percent reduction in failure/withdrawal rates in beginning algebra, and a 32 percent reduction in intermediate algebra.

Prior to 2004, beginning algebra and intermediate algebra were taught in the traditional style by using class-room lectures, daily take-home problem sets, and paper tests and quizzes. A departmental task force identified students’ failure to regularly complete homework assignments as the primary cause of the low success rates in these two courses. Students’ poor attendance at class sessions and limited use of office hours and free tutoring services were also cited as major obstacles to success. To remedy the problem, the mathematics department (1) capitalized on UW-Stout’s E-Scholar initiative— which has provided laptop computers, all-campus wireless Internet access, and comprehensive integration of technology across curricula for all incoming students since fall 2002—and (2) implemented MyMathLab as a cornerstone of Math TLC. Every day, MML automatically grades homework that counts significantly (about 25 percent) toward the course grade. MML’s Grade-book and reporting features also enable instructors to monitor student progress and actively intervene the moment a student shows signs of trouble. “This keeps students from falling behind,” says Foley. “We know on a daily basis what is happening and can get them help immediately.” MML also helped the faculty at UW-Stout standardize their classes. Each class within a course has the same syllabus, homework assignments, tests, and quizzes; offers the same content; and enforces the same grading standard and level of passing. “This has promoted collaboration among the instructors, which has been a very good thing,” says Foley. “More

collaboration and more communication bring our talents together, maximize the talent pool of teachers, and ensure that every student is going to learn and be taught the same objectives at the same high level of quality.” Classes are hybrids of online homework and tests and required daily classroom sessions in a technology-enhanced classroom/tutor lab complex, and section sizes are small so as to facilitate personal interaction among students, instructors, and tutors. Another integral component of the program is a tutoring service dedicated exclusively to supporting students in these two courses and in which teaching staff are actively positioned as partners in learning and advocates for success. Foley creates special MyMathLab review and training courses with weekly assignments for her undergraduate peer tutors to prepare them to answer both content and soft-ware questions that the students taking the two courses are likely to have. This approach has required committing more resources to lower-level courses than is typical, but evidence shows that the investment is paying off in improved student success—and is thus likely to improve retention rates.

The Math TLC program has served 1,603 students since fall 2004. The combined failure/withdrawal rate for Math 010 students under the new system has plummeted 62 percent—from an average of 29 percent over the four years prior to the advent of the Math TLC program—to an average of 11 percent since that inception. Results for Math 110 showed a less dramatic but still significant, 32 percent reduction in failure/withdrawal rates: from 29.2 percent to 19.8 percent. Note that the improvement was achieved despite elevated passing standards; the minimum changed to requiring a grade of at least C (versus D) to pass the class. In addition, the amount of required homework was increased, and the testing and grading standards made more rigorous. The administration at UW-Stout wasn’t initially targeting any specific student population, “but as time passed, I noticed that the students who were benefiting the most from the new approach were the nontraditional and minority students,” says Foley. “Minority students generally make up a relatively small portion—about 6 to 7 percent—of our student population, and increasing the diversity of our student body is a priority goal. Before the new program started, the minority student subgroup was failing these two introductory math classes at a rate even higher than that for the general student population.

We get a lot of nontraditional students—single parents and others who’ve been out of the educational system for a time. Initially, they’re terrified by the computer aspect. Within a week, they’re hooked.

—Jeanne Foley

General suggestions for improving student retention and success

- **Noel Levitz Article suggestions**
- **Weber State Univ. Ogden Utah- DE Math task force**
- **Pre-collegiate math research in California**
- **Strengthening Mathematics skills at the Postsecondary Level: Literature review and Analysis**
- **Developmental Education: Demographics, Outcomes, and Activities By Hunter R. Boylan Harvard Symposium 2000: Developmental Education** *Reprinted from the [Journal of Developmental Education](#), Volume 23, Issue 2, Winter, 1999.*

GENERAL SUGGESTIONS FOR IMPROVING STUDENT RETENTION AND SUCCESS

1. From Noel-Levitz article

1. Place students in courses with appropriate content via appropriate placement systems
2. Improve student's study skills
3. emphasize homework and/or time on task
4. Implement mastery-based learning
5. Provide academic support programs and learning assistance
6. Focus on math self-efficacy to overcome past negative experiences
7. Use math refresher sessions
8. Develop freshman orientation program in math
9. Create learning communities of students, mentors, tutors, faculty, etc.
10. Integration of technology solutions into math programs

2. Weber State University, Ogden Utah---Developmental Math Task Force Position Statement and Recommendations 9 December 2004

The developmental math task force is an assembly of faculty from across campus working together to evaluate the issues which make developmental mathematics as problematic as it is for a large number of students at Weber State University, and suggest possible innovations in how and what we do in educating our students towards quantitative literacy.

The task force identifies the following issues impeding developmental math progress for many students:

1. As an open-enrollment institution, all students, regardless of background (providing a HS diploma or GED) can enter at the college tier. This diversity of students provides us with a challenging breadth of habits and aptitudes to address.
2. Students often do not have study skills necessary for university level work. This is especially apparent in mathematics courses in which study skills are particularly crucial.
3. Developing proficiency in mathematics for remedial students requires a disproportionate amount of university resources, including tutoring, testing, facilities, instruction, and (as we can attest to) faculty service.
4. There is little incentive for students to pass developmental math courses and attain quantitative literacy requirements in a timely and efficient manner.
5. Students have low motivation and low self-efficacy in mathematics learning. Similarly, students largely do not see the need for mathematics in the curriculum nor in their lives.
6. Instruction for developmental math courses is left largely unsupported. Adjuncts and other instructors have little in the way of training, supervision, and evaluation. This is especially notable given the tremendous challenges that many students traditionally have with these courses.
7. Mirroring much of the greater society, many faculty have poor attitudes towards mathematics, encouraging similar attitudes in students.

The task force also identifies possible innovations in developmental mathematics. These come in three levels, the first of which is a prerequisite for the others, and that should and can take place in the immediate future. Other levels of innovation require long term commitment and effort, but should be thoroughly considered and pursued in order to promote the authentic learning of mathematics at our university.

Innovation level 1: Structural change

Currently, students are given unlimited opportunity to pass developmental coursework. This paradigm does not necessarily provide any real incentive for the student to complete this coursework in a timely or purposeful manner. We feel that this level of flexibility on the university's part is actually a disadvantage to students overall; for students who do not seriously engage in the developmental coursework distract instructor attention and university resources from students who are more highly committed to fulfilling university requirements. To alleviate this problem (perhaps *the* problem of developmental math),

the task force sees an immediate need for the following:

1. Students must view developmental mathematics as an immediate priority and as an essential foundation to their university education. This prioritization would include the following:
 - a. Require all entering students to take a placement test (e.g., COMPASS) or equivalent (e.g., ACT score) upon entrance to the university, before registration.
 - b. Based on placement testing, students requiring developmental math courses must be immediately placed into necessary courses.
 - c. Students must consecutively enroll in developmental math courses until completion.
2. Students must value and be accountable for their progress towards meeting quantitative literacy requirements. Regardless of initial placement, students will have 2 years to complete developmental math courses before registration privileges are revoked.
3. Advising agencies on campus should make clear to students of the above policies and continually reinforce them. It should be made clear to students upon entrance that the educational mission of the institution is to assist students in developing the skills to do university level work. Communication throughout the university and beyond (to the public school system) should be an assigned responsibility.
4. Students who are not ready for developmental coursework (i.e., students whose math skills are at a level below the high school level) could be referred to other services that, with the appropriate level of student dedication, could allow the student to prepare adequately for such coursework. This could be facilitated with diagnostic tools available with placement exams.
5. Increased motivation for passing developmental coursework could be promoted by charging students a fee for taking developmental classes. Such a fee could be totally or partially reimbursed if a student earns a C or better.
6. As the issues for learning mathematics at the developmental level are largely foreign to many developmental math instructors, support for professional development and evaluation should be made available. The current system of self-support for funding these courses is inadequate. Such support could be in the form of reassigned time for the developmental math coordinator, supplemental pay for instructors' professional development, and funding for materials.

Innovation level 2: Pedagogical and other long term change Once structural changes are in place, the following possible innovations should be more deeply considered and researched. The task force suggests and will lead a continual effort to investigate the following:

1. Develop a professional development and evaluation program for developmental math instructors. Maintain an ongoing commitment towards improving and enhancing instruction at the developmental level.
2. Initiate conversations between the developmental math and FYE programs. As these programs serve a similar subset of our students, there are likely compatible issues and cooperative work that could be done.
3. Reduce class sizes, and encourage and investigate multiple and innovative modes of instruction (laboratory, etc.).
4. Rethinking of course pedagogies, so that courses could possibly:

- a. Incorporate laboratory and other modes of instruction. Integrate preservice teacher training. Be integrated with other disciplines
 - b. Be “self-paced”/”drop-in” and/or have the flexibility to be challenged at different points.
 - c. Be taught in different capsules, rather than as entire semester courses. Allow students to “challenge” a course at any time by passing a final assessment.
 - d. Innovative assessments of math learning, so that students are accountable for the “why” of mathematics, rather than algorithmic processes.
5. Consider alternate structures for the organization of developmental math in order to better support instructor training and other new initiatives.
 6. Create a method by which a faculty could propose innovations to developmental math curricula, have them approved, and given the chance to teach such a class, providing it meets all standards for a particular course.
 7. Build SI time into the course as part of the time spent in class. Change the structure of class meetings, possibly including number of meetings per week, etc.
 8. Evaluation and reconsideration of tutoring programs, possibly incorporating the program with courses (for labs, problem solving sessions, etc.)
 9. Sustained research programs in mathematics learning at the developmental level. Further research into programs at other open enrollment institutions. Continual evaluation and assessment of current program. (Would this require a special faculty hire?)
 10. Improve advising with regards to math requirements and expectations of students.

Innovation level 3: Expanding responsibility

1. Efforts to improve quantitative literacy should extend to the public schools, in the hopes of improving math literacy before students arrive on campus.
2. Improve image of mathematics throughout every vein of campus, including faculty, staff, and students.
3. Promote the use of mathematics in all subject areas (numeracy across the curriculum). Promote mathematics as a fundamental component of the educational mission of the university.
4. Promote the possibility of university faculty across campus teaching developmental math courses.

3. Pre-collegiate math research in California

http://www.ijournal.us/issue_09/ij_issue09_08_RobertJohnstone_01.html

Evaluation of College Success/Retention Programs

The approaches at the four institutions described above share some common attributes:

- They shift the traditional educational delivery model to a more learner-centered model. The relationship between instructor and student is clearly modified to a model that is producing better results.
- Most of these programs integrate delivery of instructional and student services to students.
- The majority of the programs utilize cohorts in which relationships among peer groups are developed more so than in traditional courses. These peer groups become mutually invested in each other's success, certainly contributing to the overall improvements that have been noted.
- There is also a focus on developing study skills early in the course sequences, which can then be drawn upon in later courses.
- Additional student time on task is clearly a prerequisite in these courses as well, which has been noted by some to present difficulty in terms of recruiting students into these programs.

- Finally, these programs promote student self-confidence.

It is important to note that nearly all of these programs (14-16 above) require a significant investment of resources and a concomitant commitment to modify the traditional lecture-based course system. Support for this paradigm shift is not new. Hunter Boylan, and others studying and evaluating developmental pre-collegiate education have identified the attributes of successful practices in pre-collegiate programs. In addition, a great deal of attention is now focusing on changing the model in higher education from instruction to learning. Barr & Tagg in their seminal article in *Change* magazine (1994) argued that higher education needs to shift their focus from providing instruction to producing learning, the implications being a greater investment in practices promoting greater levels of student understanding and learning. It is clear that the traditional Instructional Paradigm is especially not working in pre-collegiate developmental coursework in Math, English, and ESL.

It should not be particularly surprising that the traditional system isn't effective. Reducing the whole developmental education issue to its core, what we have is an enormous cadre of students who have experienced significant difficulty in the disciplines of Math and Language Arts throughout their K-12 education. Regardless of whether you believe the responsibility for this lack of success lies with the student, the family structure, the K-12 education system, or a combination of factors, these students are simply not succeeding.

So what, as colleges, have we traditionally done when these students arrive on our community college campuses seeking to redress their deficiencies? We attempt to teach them in the exact same manner in which they have failed for years—in perhaps an even more formalized lecture-based classroom. It is arguably true that our college instructors may be better qualified, but this is apparently not enough to overcome historical college practices of the delivery of education.

As Guskin (1994) pointed out around the same time as the Barr/Tagg article, "the primary learning environment for undergraduate students, the fairly passive lecture-discussion format where faculty talk and most students listen, is contrary to almost every principle of optimal settings for student learning." This statement is clearly supported by the data reviewed in Section 1, and is further supported by the observation that the programs described below, to varying degrees, add some fundamental structural changes and are reaching extremely encouraging results. It is true that nearly all these programs require financial investment—an issue that we will discuss at the end of this section.

4. STRENGTHENING MATHEMATICS SKILLS AT THE POSTSECONDARY LEVEL: LITERATURE REVIEW AND ANALYSIS

Prepared for: U.S. Department of Education, Office of Vocational and Adult Education
Division of Adult Education and Literacy-- Prepared by: The CNA Corporation

The U.S. Department of Education Office of Vocational and Adult Education (OVAE) contracted with The CNA Corporation (CNAC) and its partners to identify promising strategies within community colleges, businesses, organized labor, and the military that enable adult learners to strengthen their math skills and abilities and to transition into higher-level math courses or work assignments requiring higher-level mathematics.

What constitutes adequate math preparation?

- A number of studies indicate the need to have a good foundation in arithmetic, geometry, trigonometry, and algebra I and II. Emerging work also indicates the increasing need for basic statistics and the ability to analyze data.
- the need to think critically, to solve problems, and to communicate mathematically. Both businesses and postsecondary institutions that were surveyed as part of large curriculum reform

efforts indicate that they want people who can identify a problem, determine whether it can be solved, know which operations and procedures are required to solve it, use multiple representations (such as graphs and words) to describe problems and solutions, and understand and apply mathematical modeling. However, these are the skills that are the most difficult to teach and to assess (American Diploma Project 2004).

- the majority of two-year colleges require incoming students to take and pass an assessment test before they are allowed to enroll in college-level math courses. Given their prevalence, this may be the most relevant benchmark for whether a student can successfully transition to college-level mathematics.

Best instructional practices

* Among the recommendations in the literature are: greater use of technology; integration of classroom and laboratory instruction; giving students the option to select from among different instructional methods; use of multiple approaches to problem solving; project-based instruction; low student to faculty ratios; assessment and placement of students into the appropriate mathematics courses; and integration of counseling, staff training, and professional development.

* Underscoring these recommendations, our review found that a number of studies sought to evaluate the impact of various teaching delivery methods on student success, including traditional lecture, computer-assisted courses, self-paced instruction, Internet-based courses, and accelerated programs. No clear consensus of the effectiveness of technology-based delivery methods emerged.

* There is general consensus that technology should be a supplement to, as opposed to a replacement of, more traditional delivery methods.

* Finally, we have found research that indicates that the types of problems used in teaching the material is important. In particular, it is important to use activities that engage students in the learning process, particularly in small collaborative group processes, most of which reflect the real-world problem solving done in businesses. These activities should require the student to actively plan, design, research, model, and report findings for projects or case studies. Some argue that students require contextual learning and real-world problems to help make coursework and training relevant and meaningful.

We summarize key components of best practice approaches to postsecondary developmental mathematics programs below:

- **Instructional and pedagogical:** adjuncts to traditional instruction; multiple delivery options from which students may choose; computer-assisted instruction; Internet-based; self-paced; distance learning; calculators; computer algebra systems; spreadsheets; laboratories; small group instruction; learning communities; contextual learning; linkages to and examples from the workplace; and career pathways.
- **Curriculum content:** nonstandard topics covered in developmental math courses or topics that vary by career path; length of instruction; and types of activities used to reinforce the material.
- **Professional development:** faculty training and development; full-time versus part-time instructors; and proportion of faculty that are adjuncts.
- **Supporting strategies:** counseling, assessment, placement, and exit strategies.

- **Learner and institutional characteristics:** full-time versus half-time community college student; socioeconomic attributes of learner; workplace versus academic learner; and having private or military employment versus preparing for a new career.

What Skills and Knowledge Do Students Need to Pursue College-level Mathematics?

Crossroads in Mathematics: Standards for Introductory College Mathematics Before Calculus (hereafter referred to simply as *Crossroads*), published in 1995 by the American Mathematical Association of Two Year Colleges, established goals and standards for preparation for college-level mathematics that are the most oft-cited of any study of developmental mathematics at the postsecondary level (American Mathematical Association of Two Year Colleges 1995). AMATYC developed on six guiding principles upon which it based its standards:

1. All students should grow in their knowledge of mathematics while attending college.
2. Students should study mathematics that is meaningful and relevant.
3. Mathematics must be taught as a laboratory discipline.
4. The use of technology is an essential part of an up-to-date curriculum.
5. Acquiring mathematics knowledge requires balancing content and instructional strategies recommended in the AMATYC standards along with the viable components of traditional instruction.
6. Increased participation in mathematics and in careers using mathematics is a critical goal in our heterogeneous society.

The standards are divided into three categories: intellectual development, content, and pedagogy. Because *Crossroads* is the seminal work in this area, we summarize its standards, which provide goals for introductory college mathematics and guidelines for selecting content and instructional strategies for accomplishing the principles.

Intellectual development standards

Students will:

- Engage in substantial mathematical problem solving;
- Learn mathematics through modeling real-world situations;
- Expand their mathematical reasoning skills as they develop convincing mathematical arguments;
- Develop the view that mathematics is a growing discipline, interrelated with human culture, and understand its connections to other disciplines;
- Acquire the ability to read, write, listen to, and speak on mathematics subjects;
- Use appropriate technology to enhance their mathematical thinking and understanding and to solve mathematical problems and judge the reasonableness of their results; and
- Engage in rich experiences that encourage independent, nontrivial exploration in mathematics, develop and reinforce tenacity and confidence in their abilities to use mathematics, and inspire them to pursue the study of mathematics and related disciplines.

Content standards

Students will:

- Perform arithmetic operations and will reason and draw conclusions from numerical information;
- Translate problem situations into their symbolic representations and use those representations to solve problems;
- Develop a spatial and measurement sense;
- Demonstrate understanding of the concept of function by several means (verbally, numerically, graphically, and symbolically) and incorporate it as a central theme into their use of mathematics;
- Use discrete mathematical algorithms and develop combinatorial abilities in order to solve problems of finite character and enumerate sets without direct counting;

- Analyze data and use probability and statistical models to make inferences about real-world situations; and
- Appreciate the deductive nature of mathematics as an identifying characteristic of the discipline; recognize the roles of definitions, axioms, and theorems; and identify and construct valid deductive arguments.

Pedagogy standards

Mathematics faculty will:

- Model the use of appropriate technology in the teaching of mathematics so that students can benefit from the opportunities it presents as a medium of instruction;
- Foster interactive learning through student writing, reading, speaking, and collaborative activities so that students can learn to work effectively in groups and communicate about mathematics both orally and in writing;
- Actively involve students in meaningful mathematics problems that build on their experiences, focus on broad mathematical themes, and build connections within branches of mathematics and other disciplines so that students will view mathematics as a connected whole relevant to their lives;
- Model the use of multiple approaches—numerical, graphical, symbolic, and verbal—to help students learn a variety of techniques for solving problems; and
- Provide learning activities, including projects and apprenticeships that promote independent thinking and require sustained effort and time so that students will have the confidence to access and use needed mathematics and other technical information independently, to form conjectures from an array of specific examples, and to draw conclusions from general principles.

Standards for Success

Because the Standards for Success included the knowledge and skills necessary, which goes beyond the Crossroads standards, it is important to include the full set of standards in this report. However, because they are so detailed and lengthy, we provide the full list in Appendix A. In summary, the standards established by this group indicate that before pursuing college-level mathematics, students should have the following knowledge: basic arithmetic, including fractions and exponents; basic algebra, including manipulation of polynomials and solutions for systems of linear equations and inequalities; basic trigonometric principles; basic pictorial and coordinate geometry, including the relationship between geometry and algebra; and statistics and data analysis. Further, the standards stipulate abilities similar to those in Crossroads, under mathematical reasoning. For instance, they state that students should have the ability to: (a) use inductive reasoning and a variety of strategies to solve problems; (b) use a framework or mathematical logic to solve problems that combine several steps; and (c) determine mathematical concept from the context of a real-world problem, solve the problem, and interpret the solution in the context of a real-world problem.

What Instructional Methods Work Best for Adult Learners?

According to *How People Learn: Bridging Research and Practice* (Donovan et al. 2000), because students have certain preconceived notions, they will fail to grasp new concepts if their initial understanding is not engaged. Further, students need a deep foundation of factual knowledge and a strong conceptual framework if they are to develop competence in a particular area, and they need to monitor their own understanding and progression in problem solving. If learners are able to make analogies to what is known when confronted with new material, they can better advance their understanding of new material.

The National Research Council has developed a notion that there are four perspectives on learning environments. These seemingly separate perspectives, however, should be interconnected to mutually support one another (Brown and Campione 1996). Specifically, the perspectives are as follows:

1. **Learner-centered environment.** Accounting for the perspective of the adult learner requires paying careful attention to the learner's knowledge, skills, attitudes, and beliefs. Adult learners need to be treated as adults who are responsible for their own lives and who are capable of self-direction (Knowles 1989). Also, adults acquire knowledge about things they need to know—that is, to cope effectively with their real-life situations. Postsecondary programs for adults should be designed with the understanding that adults undertake most learning efforts in response to life transitions (Aslanian and Brickell 1980).

2. **Knowledge-centered environment.** Adult learners require a well-organized structure of concepts, such as those defined by AMATYC (1995), that organize the presentation of subject matter and help students: (1) develop substantial mathematical problem-solving abilities; (2) learn to develop models involving real-world situations; (3) expand their mathematical reasoning skills; and (4) use technology. Students need help to become metacognitive by expecting new information to make sense and asking for clarification when it doesn't (Palinscar and Brown 1984; Schoenfeld 1983, 1985, 1991). Students should learn to compute, but they should also learn other things about mathematics, especially the fact that it is possible for them to make sense of mathematics and to think mathematically (Cobb, Yackel, and Wood 1992).

3. **Assessment-centered environment.** Postsecondary programs should have clear learning goals and assessment methods, procedures, and items that are congruent with those goals. The primary element of importance is that assessment be used for feedback and revision of the program, including teaching and learning. In many classrooms, opportunities for feedback appear to occur infrequently, resulting in grades on tests, papers, worksheets, homework, and final reports that

4. **Community-centered environment.** The extent to which students, teachers, or even administrators feel connected in several aspects of community is reflected in classrooms as communities, institutions as communities, and even larger communities such as those within the military and businesses. The importance of communities in learning cannot be emphasized strongly enough with adult learners. In the development of higher mental functions, such as planning and numerical reasoning, "internalization" of self-regulatory activities first takes place in the social interaction between adults and more knowledgeable others (Vygotsky 1978). Studies of mathematical problem solving, for example, by Noddings (1985), Pettito (1984a, 1984b), and Schoenfeld (1985), indicate how useful dialogues among mathematics problem solvers can be in learning to think mathematically. Small group dialogues prompt disbelief, challenge, and the need for explicit mathematical argumentation; the group can bring more previous experience to bear on the problem than can any individual, and it highlights the need for an orderly problem-solving process. In addition, computers can serve to enhance communities of learning by functioning as mediational tools that promote dialogue and collaboration on mathematical problem solving.

Learner-centered environment

Higbee and Thomas also explore the relationship between noncognitive variables and success in a two-quarter developmental algebra sequence designed for high-risk students at the University of Georgia. The two-quarter sequence covered the same material as a one-quarter course, except at a slower pace.

One day per week a counselor taught with the math instructor and introduced special learning-promotion topics, such as relaxation exercises and metacognition strategies, as well as strategies for solving word problems in collaborative groups. Students also were required to attend the mathematics laboratory weekly to take computer tests that paralleled those administered in the core algebra course. The results indicated a significantly lower test anxiety and an increase in students' confidence to succeed in learning math as measured at the beginning and end of the two-quarter class sequence. In terms of course outcomes and affective variables, they found negative correlations between pretest scores on general test anxiety and math test anxiety. They note that there was no relationship between posttest scores on tests of anxiety and any of the test, homework, or final GPAs. In other words, on average, students experienced a reduction in math and test anxiety over the two-quarter sequence, but the reduction in anxiety was not correlated with greater math competency, as measured by a variety of course outcomes.

Consistent with these findings and with a learner-centered classroom approach in general, Boylan and Saxon (2002) conclude that remediation programs require counseling as an integral part of the program. They find that remediation programs with counseling that is integrated into the entire remediation program have better results. They report that counseling should be based on stated goals and objectives of the program and undertaken early in the program. The counseling should use sound principles of student developmental theory, and should be carried out by counselors who are trained to work with developmental students.

Small-group instruction

The results indicated that those taking the course via small- group instruction had statistically higher confidence in their mathematical ability, as measured by the Fennema-Sherman Mathematics Attitude Scales. Improvements were greatest for students who have been traditionally underrepresented in mathematics: Hispanic, Native American, and female students. Further, students who received the small-group instruction were more likely to complete the course than students in the instructor- led course. However, Depree did not find any difference in achievement between the two teaching methods. Even so, the fact that students increased their confidence and were more likely to complete the course when administered by small- group instruction led the author to conclude that a larger number would ultimately be successful in this type of class.

Contextual learning

Consistent with other literature that we have cited concerning the need for adults to have contextual learning experiences, Mazzeo, Rab, and Alssid (2003) describe the efforts of five community colleges that have created bridges between basic skills development and entry-level work or training in high-wage, high-demand career sectors. Mazzeo and his colleagues argue that contextualized basic skills instruction is often more successful than traditional models of adult education for engaging disadvantaged individuals and linking them to work. Each program they describe uses contextualized teaching and learning experiences, which means that courses incorporate material from specific fields into course content, and employ projects, laboratories, simulations, and other experiences that enable students to learn by doing.

The five programs that Mazzeo and his colleagues reviewed also exhibited these additional characteristics:

- Integration of developmental and academic content.
- Development of new curriculum materials and provision of professional development to learn to teach in a new way.
 - Maintenance of active links with employers and industry associations.
 - Identification of resources to fund the programs, at least in the short run.
- Production of promising program outcomes, especially in terms of job placement and earnings.

Accelerated courses

Lastly, we note an interesting approach that is not based on any of the other strategies or theories that we have covered so far but may be a new strategy that holds promise. The University of Maryland, College Park (Adams 2003) began a program in the fall of 2001, in which students who required math remediation (representing 20 to 25 percent of entering freshman, or about 1,000 students) and scored in the top 60 percent of the placement tests were placed into a combination course that met five days a week and covered the material for both the developmental mathematics and the introductory college-level course. At the end of the intensive first five weeks of the course, in which all of the developmental material was completed, students retook the placement test. If they passed the test, they continued in the course, which had as many contact hours during the remainder of the semester as those students who enrolled in the regular college-level course. Students successful in the latter part of the class were then able to complete both their developmental and first college-level math requirement in just one semester. Those who did not pass, only 11 percent, were placed into the regular developmental course, which is a more traditional six hours-per-week self-paced course, using a computer platform

5. Texas Association of Community Colleges Study

Affirmation and Discovery: Learning from Successful Community College Developmental Programs in Texas By Hunter R. Boylan & D. Patrick Saxon

http://www.ncde.appstate.edu/reserve_reading/TACC_Study.htm

Findings

The emphasis of this report is on the identification of practices that contribute to effective developmental education. Consequently, site visit findings focus on each institution's developmental education activities rather than on the institution in general.

The findings of this report are presented in two categories: research-based best practices and promising practices. The research-based best practices section describes the major consistent findings of this study generated from site visits. These findings meet the following criteria:

- they are grounded in research and have been cited in at least three previous studies,
- they are present at the majority of the institutions visited, and
- they are considered by campus faculty and administrators to be important factors in the campus developmental education effort.

Promising practices are those not well-grounded in research but, nevertheless, appear to contribute to program success. There is a minimal amount of previous research support for some of these practices. There is no previous research to validate others. However, these practices are considered by campus faculty and administrators to contribute to effective developmental education. Promising practices meet the following criteria:

- they are considered by campus faculty and administrators to be important factors in the campus developmental education effort,
- they are supported by some sort of local data, either anecdotal or statistical, and
- they resonate with the previous experience and observations of the researchers.

Research-based best practices

There was remarkable consistency in the organizational patterns, leadership styles, and support for developmental education encountered at the institutions studied. Each of the study institutions had a relatively flat organizational structure. Their administrators expressed considerable confidence in their faculty, considered them to be professionals, and avoided micromanaging their efforts. These administrators also expressed a high degree of commitment to developmental education and the success of developmental students.

Flat organizational patterns

Generally, the key academic administrative officers at the institutions studied were the president, the dean of instruction or its equivalent, and three or four division chairs. There were few vice presidents or deans or program directors.

As a result of this flat organizational pattern, there were fewer layers of bureaucracy to deal with before one reached the president's office. At most, a faculty member would have to go through one level of administration to get a hearing from the dean of instruction. This contributed to clear communication from developmental educators to administrators, to faculty perceptions that their opinions were valued, and to a cooperative work environment. All of these characteristics have been cited in the literature as characteristics of successful organizations (Boylan, Bonham, Keefe, Drewes, & Saxon, 2004).

This flat organizational pattern allowed administrators to be quite responsive to the needs of developmental education. As one faculty member put it, "We know that if we have a serious concern, it will either be addressed or be on the president's desk within forty eight hours." Another stated, "We don't always get what we want but we always feel that we've had a fair hearing."

It is possible that this organizational pattern contributes to successful developmental education by enabling the concerns of developmental educators to be brought to the attention of those who can do the most to address those concerns. It is also likely that this pattern allows key administrators to have a better grasp of the problems and issues confronted by faculty on the "front line." Finally, it is likely that this flat organizational pattern promotes better communication throughout the institution.

Servant leadership styles

All the campuses in this study were lead by presidents and vice presidents or deans whose characteristics exemplified servant leadership as described by Greenleaf (1991; 1996). These characteristics included collaboration, trust, listening, and ethical behavior (Greenleaf, 1991). Research indicated that such leadership characteristics were associated with successful organizations (Kezar, 1998; Schuetz, 1999).

The leaders of these institutions emphasized collaboration by working directly with individuals and groups of faculty members to solve problems. They considered faculty and staff of the institution to be colleagues as well as employees. As the president of one institution stated, "We believe that we get better solutions to our problems when we work collaboratively. There are no 'lone rangers,' everyone here is part of our team... including me."

The leaders of these institutions listened to what faculty had to say and acted upon it. When questioned about why faculty felt they had responsive leadership at one institution, a vice president said, "They can see it in our actions. We usually do what our faculty recommends, and they can see the results for themselves."

These leaders also inspired the trust of faculty and administrators by talking and acting consistently. Their actions and their words were consistent. One president was described by a faculty member as a man who “not just talks the talk but also walks the walk.”

Strong leadership support

The characteristics of flat organizational patterns and servant leadership all came together in support of developmental education at the campuses studied. All of the presidents, vice presidents, deans, and division chairs indicated that developmental education was a major priority for the institution. As one senior administrator stated, “Most of our students are developmental. It would be foolish for us not to see their needs as a top priority for the college.” Another said, “We are here to provide developmental education. That’s why we exist.”

As Robert McCabe points out, “developmental education is one of the most important services provided by the community college” (2003, p. 13). Apparently the leaders of these campuses agree with this statement and have acted accordingly. Leadership support is recognized in the literature as one of the keys to successful developmental education (McCabe & Day, 1998; McCabe, 2003; Roueche & Roueche, 1999).

At study institutions, leadership support for developmental education is exemplified by the following:

1. Developmental education is housed in facilities that are among the best on campus.
2. Campus leaders are involved in the interviewing and hiring of developmental educators.
3. Campus leaders regularly offer public praise of developmental educators before faculty and civic groups.
4. Developmental education has a budget that is at least equal to that of comparable units on campus.
5. Developmental education is built into the resource allocation process.
6. Developmental education faculty is accorded the same status, salary, and privileges of other college faculty.

These characteristics were consistently found at the institutions studied. Furthermore, the leaders of these institutions made it very clear that these characteristics were present because they valued developmental education.

Required assessment, placement, and advising

Texas has had a strong commitment to assessment in its colleges and universities since the late 1980s when it implemented the Texas Academic Skills Program (now known as the Higher Education Assessment). It was no surprise, therefore, that all of the institutions visited had well-organized assessment procedures.

The NES instrument, THEA, and the ETS instrument, Accuplacer, were the most common assessment instruments used for initial placement. It was also interesting to note that every institution in

the study also had some additional assessment, either cognitive or affective, to validate or improve placement decisions.

Most of the faculty members interviewed believed that the THEA did the best job of measuring college level skills. However, they felt that other instruments were easier to administer. Content from the THEA was also used at two campuses for exit testing or to validate instructional objectives.

In addition to well-organized assessment procedures, the campuses in this study also had strong advising and placement processes. During the 1999-2003 period from which data was drawn, each of these campuses put a great deal of emphasis on personalized student advising. Each entering student at these campuses spent half an hour or more with an individual advisor before registering for classes. During this time, student scores were interpreted, educational goals discussed, and options for placement considered.

Each campus had written rubrics to guide placement decisions. Each campus made special efforts to train advisors, particularly with regard to placement of students in developmental courses. Faculty and administrators generally considered the training of academic advisors to be an essential feature of successful developmental courses. As one administrator stated, "We want all of our advisors to be positive about placement in developmental education so students understand that it's an investment in their success." The importance of advisor training is validated by a substantial amount of research (Boylan, 2002; Casazza & Silverman, 1996; McCabe, 2000; Maxwell, 1997).

Learner centered philosophy of operation

Developmental educators at each of the study institutions had an intensely learner-centered philosophy that governed their interactions with students. They were not simply student-centered but learner-centered. Instructional, policy, and administrative decisions were made based on the decision's potential impact on student learning. Decisions ranging from the arrangement of tables in classrooms to the type of software used in laboratories were made based on the question, "How will this help or hinder student learning?"

This philosophy appeared to be pervasive at the study institutions. Faculty interviewed frequently expressed their commitment to student learning and were able to back this up with examples of how they put the learner first in making classroom decisions. As one faculty member put it, "We do whatever is necessary for our students learn." Another said, "When I ask my dean for something... 'How will this help students learn better?' is what he always says." At the study institutions faculty were held accountable for student learning rather than just being accountable for teaching.

The use of such a learner centered philosophy is supported by the research on developmental education. This research consistently indicates that outcomes are improved when a learner centered philosophy is central to program operations and decision making (Boylan, 2002; McCabe, 2000; Silverman & Casazza, 1996).

Consistent formative evaluation

Each of the study institutions placed a great amount of emphasis on data collection and analysis. They also put great emphasis on formative evaluation. Formative evaluation takes place when faculty and administrators use data to find out how well they are doing, to identify ways of improving what they are doing, and by using data to see if the changes implemented have worked or if modification is needed. Formative evaluation has frequently been found to contribute to successful developmental education (Boylan, Bliss, & Bonham, 1997; Casazza & Silverman, 1996; McCabe, 2000).

At study institutions with institutional research offices, these offices frequently worked with developmental educators to identify data necessary to make decisions. Most of the faculty teaching developmental courses had at least a general knowledge of pass rates and retention rates for developmental students and were aware of any campus studies done on developmental education. Several of the faculty interviewed kept their own records on student persistence, grades, and pass rates in developmental courses which they used as a baseline to evaluate their own performance. One faculty member said, "I try to get as much information as I can about my students' performance... that helps me evaluate my own teaching."

Data and evaluation reports were regularly shared with developmental educators who were also asked for their opinions in analyzing this data. One department chair made sure that everyone received data on their students' grades and pass rates and then had a discussion with faculty individually and in groups at the end of each year to help everyone understand the meaning of this data.

Careful hiring of developmental educators

Every administrator interviewed emphasized that careful hiring of developmental educators was a critical element in the success of developmental education at their campuses. As one administrator put it, "Most people think that anyone with a college degree can teach developmental courses. I think that if we hire someone who can teach developmental courses well, they can teach anything well." This sentiment was echoed by faculty members who served on hiring committees.

There was a rigorous hiring process at the study institutions. At most of these institutions prospective faculty members were asked to give a demonstration presentation as part of the hiring process. They were also frequently asked to direct this presentation to a hypothetical audience of developmental students. Usually the president or the dean of instruction would attend this presentation.

Candidates for developmental education faculty positions were always interviewed by the president or the dean of instruction. They were also interviewed by a panel that included developmental educators. During interviews, candidates were regularly asked about their views of developmental education and developmental students and their experiences in teaching these students.

Careful hiring of developmental educators has support from the literature. A benchmarking study by the Continuous Quality Improvement Network (2000) suggested that only those who were interested in teaching developmental students should be assigned to do so. Roueche & Roueche (1999) argue that community college developmental programs must "Recruit, develop, and hire the best faculty (p. 32)" if they are to be successful.

Ongoing communication among developmental educators

At each of the institutions studied, there was a great deal of communication among those who taught developmental courses. This was true in spite of the fact that most of the study institutions had decentralized developmental programs.

The lack of centralization at these campuses is more than compensated for by the fact that all those teaching developmental courses have regular communication with each other. Such communication is essential to successful programs (Boylan, 2002; McCabe & Day, 1998; Casazza & Silverman, 1996). This communication takes place through formal and informal meetings, email, and hallway discussions. At each study institution there are regular formal meetings of developmental education faculty within and between disciplines.

Faculty at these institutions also appeared to be genuinely interested in communicating with each other about students and about teaching and learning issues. Consequently, there was not only strong communication between developmental educators; there was strong communication between developmental educators and other campus faculty.

The emphasis on collaboration exemplified by the leaders of these institutions also characterized the developmental education faculty and staff of these institutions. There were many instances of interdisciplinary programming and innovations at study institutions. Such collaboration would be unlikely to take place if good communication were not present to begin with.

Limited use of adjuncts

Two of the institutions studied used adjuncts to teach developmental courses only sparingly. At one institution, the president proudly affirmed that, “Ninety percent of our developmental courses are taught by full-time faculty.” It appeared that, to the extent possible, the study institutions tried to staff developmental courses with experienced full-time faculty.

Although all the institutions in this study employed adjuncts to teach some developmental courses, they made very serious efforts to orient and train these adjuncts. Each of the institutions had either a formal or an informal mentoring program for adjunct faculty. In these programs, adjunct faculty members were paired with experienced full-time faculty who served as their mentors. These mentors met regularly with adjuncts, visited their classes, provided constructive feedback, and were available to answer questions.

The study institutions had both formal and informal orientation programs for adjunct faculty. Most of these institutions also had manuals available for adjunct faculty that described the institution’s teaching philosophy, provided guidelines for instruction, and explained campus policies and procedures.

The research is consistent in recommending that adjunct faculty not be the primary providers of developmental education (Boylan & Saxon, 1998; McCabe, 2000). It is also consistent in recommending that adjunct faculty teaching developmental courses be carefully trained (Boylan, 2002; Grubb and associates, 1999; Neuburger, 1999). The institutions in this study have taken these recommendations seriously and acted accordingly.

Aggressive professional development

Professional development for developmental education personnel is generally considered to be one of the most important characteristics of successful programs (Boylan, Bliss, & Bonham, 1997; Grubb, 1999; McCabe, 2000; Roueche & Roueche, 1999). All of the institutions in this study emphasized professional development for developmental educators in particular and for faculty and staff in general.

Each institution made funds available for developmental educators to attend professional conferences. Almost all of them had sent faculty to participate in one or more professional training institutes. Each institution sponsored regular professional faculty development workshops that emphasized innovative instructional methods. These institutions also used local faculty to run mini-workshops for developmental education instructors.

One institution had a “Developmental Education Update” each semester describing issues, trends, and techniques in the field. Another institution established a local email network to discuss instructional issues, methods, and techniques. As one developmental educator explained, “The dean has

always found resources to support our (developmental educators') professional development." Another said, "Training counts here. We get supported and rewarded for it."

The institutions in this study were very serious about developing the professionals who worked with developmental students. They used a wide variety of techniques, invested institutional funds in conference and workshop attendance, and rewarded participation in professional development. As noted earlier, they also paid a substantial amount of attention to orientation and training for adjunct faculty teaching developmental courses.

Promising Practices

Connecting with high schools

Although Rainwater & Venezia (2003) have described several approaches to improved high school/college collaboration, there is little evidence as yet to suggest that these result in improved student performance. Faculty and administrators at many of the institutions in this study, however, believe that making connections with high schools can reduce the need for remediation. As one administrator put it, "We may not completely eliminate the need for recent high school graduates to take developmental courses but we can at least try to make sure they place into the highest levels of developmental education."

Institutions in this study had various sorts of liaisons with local high schools that were designed to clarify college requirements and reduce the need for developmental education. At one institution, developmental education faculty met with high school faculty from "feeder schools" to discuss college-level requirements in English and mathematics. The objective of these discussions was to insure that high school students would not be "surprised" by college level requirements. Another institution sponsored meetings of high school and college faculty in an attempt to promote better alignment between the high school and college curricula.

Some institutions in the study allowed high school students to take the college placement test in their sophomore or junior years. The results pointed out student's academic shortcomings in time for them to take advanced mathematics or composition courses during their high school years, thus insuring they were better prepared for college.

Limiting class size in developmental courses

There is at present little research indicating that smaller class sizes in developmental courses contribute to better student performance. However, many of the faculty and administrators interviewed believed that smaller classes do contribute to the success of developmental students. As a Dean of Instruction explained, "Having lower class sizes in developmental education allows our faculty to give more individual time to the students who need it most. That's a priority for us." As a result, many of the institutions in this study made it a point to deliberately limit the enrollment in developmental courses.

Typically, enrollment in developmental reading and English classes at these institutions ranged from fifteen to twenty students. Enrollment in mathematics courses were often higher, usually around twenty-five. These enrollment numbers are three to five students lower than reported by Schultz (2000) as the national average for community college developmental courses. It is also worth noting that the enrollments for developmental writing classes at these institutions are also consistent with the recommendations of the Conference on College Composition and Communication. An association position paper states specifically that, "No more than 20 students should be permitted in any writing

class. Ideally, classes should be limited to 15” (Conference on College Composition and Communication, 1989).

Using values to drive operations

The developmental programs at institutions participating in this study were typically driven by values. By this, we mean that the programs had a clearly articulated set of student and learning centered values that were not only understood by all personnel but also used consistently to make decisions. In some cases, the programs had written values statements designed to guide operations. In others, these values were simply understood by all parties and reinforced verbally on a regular basis. One faculty member stated that, “We see that part of our responsibility is to inculcate our institutional values into new faculty members.”

As a result, policies and decisions tended to be guided by the values of the program rather than having the values of the program guided by policies. Typically, these values were learning centered and emphasized such things as:

- committing to student success,
- honoring students’ worth as individual human beings,
- accepting students where they are and moving them as far as they can go,
- emphasizing the importance of student attendance and participation in class,
- utilizing active learning techniques in classrooms,
- encouraging students to become autonomous,
- respecting colleagues and students,
- treating students holistically, and
- creating a safe environment for learning.

Several of these principles were part of the values driving operations at each of the participating institutions.

Establishing baselines for formative evaluation purposes

Two of the institutions in this study developed baseline data to guide formative evaluation and program improvement activities. They collected data from the most recent three-year period on such things as: (a) student completion rates in developmental courses, (b) students completing developmental courses with a C or better, and (c) semester to semester retention for developmental students. The averages for all courses and students during the three year period were then calculated and presented in a simple format. This was then shared with all developmental faculty members. As one department chair explained, “We pride ourselves on making data driven decisions, and using baseline data is one of the best ways for us to do it.”

Faculty might then use this information as a way of evaluating their own performance in teaching developmental students by comparing it to the performance baseline. These baselines also

served as a target for improvement from year to year. Each year, faculty would review the data and determine what actions or changes might contribute to improving upon baseline performance.

It also is important to note that none of the formative evaluation activities of participating institutions were undertaken for punitive purposes. To the extent possible, data was anonymous and faculty and administrators agreed that it would only be used to improve program performance.

Building valued activities into the reward system

Grubb, et. al. (1999), point out that although community colleges ostensibly value teaching, they rarely build good teaching into the reward system of the institution. This shortcoming was not discovered at any of the institutions participating in this study. Almost all of them had systematic processes in place for promoting and rewarding quality instruction at some level. One of the administrators interviewed pointed out that, "We don't leave good teaching to chance. We try to put our money where our mouth is by rewarding people for doing things right."

These institutions not only provided frequent professional development opportunities, they also encouraged those who had participated in these activities off campus to mentor others upon their return. At one institution, instructors who participated as volunteer assistants in the learning center in order to understand student problems first hand were later rewarded with their choices of courses and schedules. Another institution highlighted the successful teaching practices of individual instructors in a campus newsletter. Another developed a teaching techniques web site for adjunct faculty while another established a "best practices" web site for developmental faculty. In some cases, showing evidence of using best practices or recommended techniques were built into the salary, tenure, and promotion system.

A key characteristic of these activities was that they were systematic. They were undertaken on a regular basis, they were reviewed at the end of each year, and they were part of an overall campus program for the improvement of instruction.

Encouraging students to take college level courses immediately following completion of developmental courses

One institution placed a great deal of emphasis on encouraging students who completed the highest level of developmental mathematics to take the first college level mathematics course immediately. This was based on the reasonable assumption that mathematics skills atrophy faster than other basic skills because they are less likely to be used in everyday life.

In support of this, instructors of the highest level developmental mathematics course would explain to students that their chances of passing college level mathematics increased if they took it the semester following completion of developmental mathematics. The college had data to validate this point and this information was shared with students on a regular basis. The data was also used by college advisors to encourage students to follow up completion of developmental mathematics with college level mathematics courses. Instructors, advisors, and administrators worked together on a systematic basis to encourage students to do this. As an academic advisor at one college stated, "We want our students to be successful and we have data to show them that if they take these courses right after remediation, they're more likely to be successful."

The available data suggests that such actions contribute to an improved passing rate among developmental students who take the first college level mathematics course. It seems reasonable to assume that encouraging early completion of the first college level course for those who complete developmental courses would also work on other developmental subject areas as well.

Providing aggressive mentoring for new developmental faculty

Most of the faculty and administrators interviewed were in agreement that proper orientation of new developmental faculty was essential to the success of the developmental program. The prevailing opinion was that it was far easier to get new developmental faculty started off in the right direction than to attempt to change their behavior later on. As one senior faculty member noted, “We consider mentoring new faculty to be a basic part of our job. Why let them make the same mistakes we did?”

Consequently, the institutions in this study put a great deal of emphasis on the orientation of new developmental faculty. The most common way in which this orientation was delivered was through structured mentoring programs.

Typically, every new developmental instructor was assigned to a senior faculty member with experience in teaching developmental courses. The senior faculty member met with the new faculty member at the beginning of each academic year to provide initial orientation. The senior faculty member subsequently visited with the new faculty member on a regular basis throughout the semester to discuss problems and issues and to provide guidance. In addition, the senior faculty member also observed classes and provided feedback for the new instructor. At the institutions in this study, this process was typically supervised by either a department chair or by another individual appointed specifically for this purpose. It did not happen randomly, but as part of a planned, consistent, and systematic mentoring program.

6. Developmental Education: Demographics, Outcomes, and Activities **By Hunter R. Boylan, Harvard Symposium 2000: Developmental Education**

Reprinted from the [Journal of Developmental Education](#), Volume 23, Issue 2, Winter, 1999.

The Successful Developmental Program

Unfortunately, not all developmental programs are equal. Some are run more effectively than others. Some use better methods and techniques than others. Some are staffed by more highly trained people than others. Some obtain better results than others.

One of the topics I've been asked to address is what successful developmental programs do to enhance student performance. And it should be noted that a great deal of what successful programs do is not that expensive. Good developmental education does not cost much more than bad developmental education.

Good developmental education results from an institutional commitment to the concept of educational development. Developmental education professionals operate most effectively in an environment that values what they do. In such an environment, developmental education is explicitly stated as part of the mission of the institution. Developmental education courses and services are highlighted in institutional publications. Developmental education is seen as an integral part of the campus academic community and is considered as part of any campus planning effort (Kiemig, 1983; Roueche & Baker, 1987; Roueche & Roueche, 1993).

Good developmental education is, first and foremost, delivered by well-trained people. There is a great deal of literature, theory, and research describing good practice in developmental education. Successful developmental programs are staffed by professionals who know, who understand, and who base their actions on that body of research and literature (Boylan, Bliss, & Bonham, 1997; Maxwell, 1997; Roueche & Roueche, 1993). Not anyone can teach developmental courses just because they have

an advanced degree. It takes more than subject knowledge; it also takes knowledge of developmental students and how they learn.

Good developmental education is student oriented and holistic. It places the student at the center of the learning experience. It values what students bring with them and it encourages them to use present knowledge to build further knowledge. It recognizes that all students are developing personally as well as academically: that students have are not only taking classes, they are also working, experiencing relationships, parenting, and living. In short, good developmental education looks at students as total human beings, not just students in the classroom. It attends to both their cognitive development in the classroom and their affective development through counseling, advising, and other enrichment activities that help them become part of the college environment (Casazza & Silverman, 1996; Cross, 1976; Starks, 1994).

Good developmental education connects with the collegiate curriculum. It does not operate in a vacuum. The goals and objectives of a strong developmental program are consistent with the goals and objectives of the institution. The exit standards for developmental education are consistent with the entry standards for the mainstream college curriculum. The best developmental programs are integrated into a seamless progression of academic standards enabling students to easily make the transition from one level of content to the next level of content (Keimig, 1983; Korn, 1979; Roueche & Roueche, 1993).

Good developmental education is well coordinated. The people who teach developmental courses meet regularly. They share the problems they encounter and discuss the solutions they have implemented. The people who run learning labs synchronize their efforts with the faculty teaching whatever courses the labs support. The academic advisors communicate regularly with the instructors of developmental courses. In the best developmental programs, everyone sings from the same sheet of music regarding academic requirements and expectations of students (Boylan, Bliss, & Bonham, 1997; Keimig, 1983; Roueche & Roueche, 1993).

Good developmental education is based on explicit goals and objectives. If the professionals in these programs are to sing from the same sheet of music, the lyrics must be clearly articulated. They must specify what the program wants to accomplish; what it expects from faculty, staff, and students; and what outcomes are desired. Furthermore, these goals and objectives are shared with all those involved in the program: faculty, staff, and students (Boylan, Bonham, Claxton, & Bliss, 1992; Donovan, 1973; Keimig, 1983).

Good developmental education incorporates critical skills into all of its activities. Critical thinking, metacognition, and study skills and strategies are not taught in isolation in a good developmental program. They are an integral part of all courses and are integrated into all program activities. The best developmental programs make it hard for a student to sit in any class or participate in any service without learning how to learn, how to think critically, or how to study effectively (Boylan, Bonham, Claxton, & Bliss, 1992; Boylan, Bliss, & Bonham, 1997; Starks, 1994).

Finally, good developmental education is evaluated. The professionals in successful programs place an emphasis on evaluating the outcomes of what they do. They do this in part because they are willing to be accountable for outcomes. But they also do it because they want to improve what they do. They use a combination of formative and summative, qualitative and quantitative evaluation methods. The best developmental programs use evaluation data not only to demonstrate what they do but to constantly revise and improve what they do (Boylan, Bliss, & Bonham, 1997; Casazza & Silverman, 1996; Maxwell, 1991; McCabe & Day, 1998).

Promoting Excellence in Developmental Education

Thus far, this paper has described the extent of the developmental education endeavor in American higher education, defined the developmental students, identified who provides developmental education, and described the characteristics of good developmental education. All of these things have been carefully documented and fully supported by the research and the literature of the field. If any of this is to have an effect, however, it must also be translated into action. In essence, the professional community of developmental educators must take a stand.

The National Association for Developmental Education and the National Center for Developmental Education as well as other professional agencies in the field support the following concepts and stand willing to work with any other professional organization, government agency, advisory body, accrediting body, or citizens' advocacy group to promote these concepts.

1. Underprepared students have every right to the opportunity for higher education at the institution of their choice.
2. Underprepared students are not second class citizens in academe. They pay the same amount of tuition, attend the same courses, participate in the same activities, and share the same aspirations as any other college student.
3. Those who serve underprepared students as faculty, staff, or administrators are professionals. They deserve and demand the same respect, the same salary, and the same benefits as any other academic professional.
4. Developmental education supports the mission, goals, and objectives of American higher education. It is, therefore, an integral part of the academic endeavor in higher education.
5. Developmental education is based on sound theory and research. It should be supported and practiced accordingly.
6. Developmental education is necessary at all levels of higher education. The specific courses, services, and activities undertaken in support of it may vary depending upon the mission and characteristics of the institution in which it is housed.
7. Developmental education is necessary in a variety of business, industry, community, and government settings. Its philosophy and methods are applicable whenever and wherever the development of human talent is a goal.

The Characteristics of Developmental Students

We know that developmental education is a very widespread endeavor in American higher education as well as in a variety of other settings. We know that millions of students participate in one form or another of developmental education. We also know that this participation contributes to their success in higher education as well as their subsequent viability in the work force.

Let us consider just who these students are who participate in developmental education. As we have already noted, they share the characteristic of being under prepared for college. This characteristic is usually measured by SAT and ACT tests as well as by local institutional assessment instruments. Typically, developmental students fall into the bottom half of score distributions on these instruments. There are exceptions to this, however. According to the American Council on Education (Knopp, 1996), 18% of those taking remedial courses have SAT scores above 1000 and about 5% have scores above 1200. About two thirds of those participating in developmental education attend community colleges. Only one third attend universities.

Most of the students participating in developmental education attend college with the intention of attaining either an associate or a baccalaureate degree (Knopp, 1996). According to the National Study of Developmental Education, 77% of the developmental students at 2-year institutions and 98% of those at 4-year institutions have expressed the intention of obtaining a college degree (Boylan, Bonham, & Bliss, 1994b; Boylan, Bonham, Claxton, & Bliss, 1992).

The vast majority of developmental students are white (Boylan, Bonham, Claxton, & Bliss, 1992). Fewer than one third are minorities. Of this one third, the largest group is African American and the next largest is Hispanic. Slightly more than half of the developmental students (estimates run from 52% to 57%) are women (Boylan, Bonham, Claxton, & Bliss, 1992; Knopp, 1996). Well over 80%, of those participating in developmental education are United States citizens. As might be expected, non-citizens are most likely to participate in developmental reading and writing courses and services (Knopp, 1996). Frequently, they participate in developmental education to attain the skills necessary to become citizens.

About one of five developmental students is married (Boylan, Bonham, & Bliss, 1994b). Two out of five receive some form of financial aid; almost 1 in 10 is a veteran (Knopp, 1996). About one in three work 35 hours or more per week (Knopp, 1996). According to the National Study of Developmental Education, their age ranges from 16 to 60 years old (Boylan, Bonham, & Bliss, 1994b) with almost three in five being 24 years old or younger (Knopp, 1996).

So, who are the developmental students? They are, in most respects, typical college students. Some are talented artists who have trouble in math. Some are outstanding in math and have trouble writing. Some were once good students who have simply been out of school for a long time. Some are just average students and, since college represents a difficult academic challenge, being average is simply not good enough. Developmental education helps them become stronger students. Developmental education helps them make better use of their talents. Developmental education gives them the opportunity to be successful.

Contrary to some public opinion, developmental students are not some vandal hoard that has invaded higher education from a hostile foreign country. They are absolutely not, as one misguided politician called them, "the welfare mothers of higher education." They are our sons and daughters, our mothers and fathers, our friends, and often our coworkers. They are the working poor, the middle class, and occasionally the wealthy classes. They do not attend our institutions as part of some affirmative action initiative. They attend our institutions because they seek educational opportunity. And, educational opportunity is still promoted as a priority for this country and its higher education institutions.

Who are the developmental students? They are the parents of our public school children, they are the people who fight our wars, they are the citizens who vote in our elections, they are the workers who pay their taxes. All they want is the opportunity to go to college and have a chance for success. In essence, they are a lot like the rest of us.

Math Web sites

Constructivism and education: A shopper's guide

Moses A. Boudourides mboudour@duth.gr <http://www.duth.gr/~mboudour/>
<http://www.math.upatras.gr/~mboudour/articles/constr.html>

***Developmental Mathematics: A New Approach* By William W. Adams**

<http://www.maa.org/features/112103devmath.html>

Mathematics Classroom Resources- The National Science Foundation

<http://www.nsf.gov/news/classroom/mathematics.jsp>

Physical therapist assistant students and developmental mathematics: An integrative curriculum approach to teaching mathematics

http://www.findarticles.com/p/articles/mi_qa3950/is_200310/ai_n9340715

Resources for Teachers of Developmental Mathematics Developmental Programs That work

<http://bluehawk.monmouth.edu/~bgold/programs>
<http://www.etsu.edu/devstudy/spin/links.htm#teachideas>

Promoting Reading Strategies for **Developmental Mathematics Textbooks,**

Anne E. Campbell, Pima Community College, Ann Schlumberger, Pima Community College, Lou Ann Pate, Pima Community College

For further information contact: Anne E. Campbell, Pima Community College-
aecampbell@pimacc.pima.edu

<http://72.14.209.104/search?q=cache:ENdfxaVa7cJ:www.nade.net/documents/SCP97/SCP97.2.pdf+developmental+mathematics+articles&hl=en&gl=us&ct=clnk&cd=40>

<http://www.nade.net/documents/SCP97/SCP97.2.pdf>

Texas Math Initiative--

<http://www.tea.state.tx.us/math/index.html>

Innovative Instructional Strategies

<http://www.tea.state.tx.us/math/InovStrat.htm>

Applied math problems

<http://www.keycollege.com/catalog/titles/devmap.html>

article on dev math at physical therapy program

http://findarticles.com/p/articles/mi_qa3950/is_200310/ai_n9340715

Plato system

<http://www.netschools.com/downloads/implementations/pasadena.pdf>
<http://www.plato.com/research/implementations.asp>

jstor- THE TWO-YEAR COLLEGE MATHEMATICS JOURNAL -

[http://links.jstor.org/sici?sici=0049-4925\(197021\)1%3A1%3C14%3ASDMPAK%3E2.0.CO%3B2-8](http://links.jstor.org/sici?sici=0049-4925(197021)1%3A1%3C14%3ASDMPAK%3E2.0.CO%3B2-8)

Summer Developmental Mathematics Program at Kalamazoo Valley Community College Fred Toxopeus Two-Year College Mathematics Journal, Vol. 1, No. 1 (Spring, 1970), pp. 14-16
doi:10.2307/3027108

ERIC article- ED172894 - Developmental Mathematics. Junior College Resource Review.

http://eric.ed.gov/ERICWebPortal/Home.portal?_nfpb=true&_pageLabel=RecordDetails&ERICExtSearch_SearchValue_0=ED172894&ERICExtSearch_SearchType_0=eric_accno&objectId=0900000b8011c26d

COMAP brochure

http://www.keycollege.com/downloads/DevMap/DevMap_Brochure.pdf

Math sites list

<http://surfaquarium.com/newsletter/math2001.htm>

more math sites- from NSF

<http://www.nsf.gov/news/classroom/mathematics.jsp>

MARS program

<http://www.mccli.dist.maricopa.edu/mlx/slip.php?item=1505>

article- strengthening math skills

<http://www.ed.gov/about/offices/list/ovae/pi/hs/factsh/litreview905.doc>

<http://www.cna.org/domestic/education/studies.aspx>

<http://72.14.209.104/search?>

q=cache:RBrdXLWnchUJ:www.ed.gov/about/offices/list/ovae/pi/hs/factsh/litreview905.doc+innovative+developmental+mathematics+programs&hl=en&gl=us&ct=clnk&cd=28

Best Practices- SPIN

<http://www.etsu.edu/devstudy/spin/bestpractices.pdf>

4 credit course study by pansy Waycaster

<http://www.vccaedu.org/inquiry/inquiry-spring98/i21wayca.html>

Just-in-Time Teaching- G. Novak, gnovak@iupui.edu

Just-in-Time Teaching (JiTT for short) is a teaching and learning strategy based on the interaction between web-based study assignments and an active learner classroom. Students respond electronically to carefully constructed web-based assignments which are due shortly before class, and the instructor reads the student submissions "just-in-time" to adjust the classroom lesson to suit the students' needs. Thus, the heart of JiTT is the "feedback loop" formed by the students' outside-of-class preparation that fundamentally affects what happens during the subsequent in-class time together.

Retention Articles

1. **Best Practices in Developmental Mathematics- Published by the National Association for Developmental Education**

Members of the MathSPIN (and some members of AMATYC as well) have put together two volumes of articles on teaching developmental mathematics. We are pleased to announce that both volumes of *Best Practices in Developmental Mathematics* are now available for free from this website as a PDF file.

<http://www.etsu.edu/devstudy/spin/bestpractices.htm>

If you are interested in a hard copy of *Best Practices 2*, please e-mail Diane Martling, Math SPIN co-chair, at dmartlin@harpercollege.edu. There should be some copies available at cost (approximately \$5 plus postage of about \$2).

Best Practices in Developmental Mathematics, volume 1 (2002) (PDF File, 236 KB)

<http://www.etsu.edu/devstudy/spin/bestpractices.pdf>

Best Practices in Developmental Mathematics, volume 2 (2003) (PDF file, 424 KB)

<http://www.etsu.edu/devstudy/spin/bp2a.pdf>

2. **Student Should Spend Sufficient Time on Developmental Mathematics** by Pansy Waycaster from *Inquiry*, Volume 2, Number 1, Spring 1998, 26-31© Copyright 1998 Virginia Community College System

<http://www.vccaedu.org/inquiry/inquiry-spring98/i21wayca.html>

Abstract Based on comparisons of students' success rates in developmental math courses and results of a VCCS survey, math faculty at SWVCC increased the number of credit hours for developmental mathematics courses, allowing students more time to master fundamental concepts before enrolling in college-level math courses.

3. Baker College, MI

Baker College Developmental Education Appreciative Inquiry
Dr. Chris Davis, Director of Effective Teaching and Learning, Baker College System

chris.davis@baker.edu

<https://www.baker.edu/departments/etl/resources/AIProjectv2.pdf>

Action Project idea #2: Improving learning of under-prepared students

<https://www.baker.edu/aqip/Action%20Project2.pdf>

Over 80% of all entering, first-time students test into one or more developmental education courses, and 11% of these students test into all three developmental education areas. The Development Education Quality Improvement Project (DEQIP) initiatives help our students learn by focusing on the needs of academically under-prepared students. This project would establish a minimum-competency level in reading, writing, and math before students could advance from developmental education. Where needed,

new courses would be created for students who passed the course but do not meet the competency requirements. These courses would allow the students to focus on their particular learning needs. Students would be required to take developmental education courses first in their programs to ensure that they have these skills prior to the bulk of their studies. Opportunities for increasing teaching and learning effectiveness in these courses will also be investigated and integrated into instructional delivery.

4. Resources for Teachers of Developmental Mathematics: Developmental Programs That Work

At the national joint meetings in San Diego in January, 1997, and in Baltimore in January, 1998, there were contributed paper sessions on Developmental Programs That Work, sponsored by the Developmental Mathematics Subcommittee. The programs discussed below were chosen from those presentations. They appear in alphabetical order, by speaker's name.

<http://bluehawk.monmouth.edu/~bgold/programs.html>

Resources for Teachers of Developmental Mathematics Assembled by the ad hoc Subcommittee on Developmental Mathematics of the Mathematical Association of America. This Subcommittee is a joint subcommittee of the Professional Development Committee and the Committee on the Teaching of Undergraduate Mathematics. <http://bluehawk.monmouth.edu/~bgold/DvMthIn.html>

5. UMKC- Video Supplemental Instruction

<http://www.umkc.edu/cad/vsi/campus/homepage.htm>

VSI courses contain a video taped lecture component, much interaction with a facilitator and other students, much feedback on homework, and extensive exam preparation. The focus is on learning how to learn the content in a way that would transfer to other classes.

Students are expected to work at their highest level and attend class every day and participate. VSI course included VSI Chemistry 211 (General Chemistry I), VSI Math 110 (College Algebra), VSI Math 100 (Intermediate Algebra) , VSI Math 210 (Calculus I), and VSI History 201 (Western Civilization.)

VSI classes meet for more time than a non-VSI course. VSI classes teach students how to learn while they are learning difficult content. They earn credit for the regular class and for most classes (with the exception of Calculus I) earn credit simultaneously for Arts and Sciences 103: Critical thinking.

Additional Resources This webpage features links to resources for SI Staff around the world.

<http://www.umkc.edu/cad/si/resources.htm>

6. A Report on the Effectiveness of the Developmental Mathematics Program M.Y. Math Project - Making Your Mathematics: Knowing When and How to Use It by Vasquez, Selina

http://www.findarticles.com/p/articles/mi_qa3950/is_200404/ai_n9353345/print

M.Y. Math Project is a developmental mathematics program that is aimed at:

(1) fostering fundamental and problem-solving skills in developmental mathematics students by helping them to learn when and how to create and use algorithms, and

(2) providing on-the-job training for developmental mathematics instructors through an instructional framework that requires them to develop and incorporate non-traditional instructional techniques.

Project Description

The M.Y. Math Project targets two populations, the developmental mathematics instructors and the developmental mathematics students. The primary change agent is an instructor handbook, created by project faculty members at Texas State University (Vasquez, McCabe, and Dorman), consisting of a complete set of lesson plans grounded in the Algorithmic Instructional Technique [AIT] (Vasquez, 2003). Moreover, the four-part handbook is a workbook in nature containing opportunities for developmental mathematics instructors to journal classroom events, reflect on pedagogical decisions, and include supportive samples of student work.

7. An integrative curriculum approach to developmental mathematics and the health professions using problem based learning by Shore, Mark A, Allegany College of Maryland

http://www.findarticles.com/p/articles/mi_qa3950/is_200301/ai_n9184954/print

Purpose of the Project

The main objective of our project is to transform the developmental mathematics curriculum from a thirty year-old non-applied passive learner environment to a curriculum which engages students in active learning situations, rich in meaningful health-related applications using Problem Based Learning (PBL). With problem-based learning the students actively, and often collaboratively, pursue knowledge and gain problem solving and critical thinking skills. Problem-based learning is an approach, which stresses the importance of placing learning within a meaningful, problem solving context. To that end, problem based learning emphasizes the importance of interdisciplinary connection and finding and using appropriate learning resources, and provides a vehicle for drawing together instructor goals and student needs with an eye toward employers' demands.

At Allegany College of Maryland, faculty and administrators have begun the process of launching a learner-centered college. Many of the personnel for this Fund for the Improvement of Post-Secondary Education (FIPSE) project have been involved with the learning community project at the college. The major focus of the learning community project at Allegany College is to create a learning model that promotes connections (interpersonal, interdisciplinary, school-to-work), a positive climate, and a competency-based curriculum which challenges students and teachers to take risks to promote life-long learning. There are currently learning communities in developmental mathematics, science, information literacy, and other critical areas in which statistics have shown students to be at a high risk of failing. Some of the goals of the Allegany College learning communities are to increase personal responsibility in the students as well as their problem solving and communication skills, and increase communication between the various departments. This project was the next logical step in the continuation of a true learning community.

8. Student Assessment Through Portfolios [Alan P. Knoerr and Michael A. McDonald](http://www.maa.org/saum/maanotes49/123.html) Occidental College <http://www.maa.org/saum/maanotes49/123.html>

Reflective portfolios help students assess their own growth. Project portfolios identify their interests and tackle more ambitious assignments.

Background and Purpose

We discuss our use of portfolio assessment in undergraduate mathematics at Occidental College, a small, residential liberal arts college with strong sciences and a diverse student body. Portfolios are concrete and somewhat personal expressions of growth and development. The following elements, abstracted from artist portfolios, are common to all portfolios and, taken together, distinguish them from other assessment tools:

- work of high quality,
- accumulated over time,
- chosen (in part) by the student.

These defining features also indicate assessment goals for which portfolios are appropriate.

Our use of portfolios is an outgrowth of more than six years of curricular and pedagogical reform in our department. We focus here on two types of portfolios — reflective portfolios and project portfolios — which we use in some second-year and upper-division courses. We also describe how we integrate portfolios with other types of assessment.

9. Assessing Expository Mathematics: Grading Journals, Essays, and Other Vagaries, [Annalisa Crannell](http://www.maa.org/saum/maanotes49/113.html), Franklin & Marshall College
<http://www.maa.org/saum/maanotes49/113.html>

This article gives many helpful hints to the instructor who wants to assign writing projects, both on what to think about when making the assignment, and what to do with the projects once they're turned in.

Background and Purpose

This article will attempt to illuminate the issues of how, when and why to assign writing in mathematics classes, but it will focus primarily on the first of these three questions: how to make and grade an expository assignment.

10. How People Learn: Bridging Research and Practice

<http://newton.nap.edu/html/howpeople2/index.html>

M. Suzanne Donovan, John D. Bransford, and James W. Pellegrino, editors Committee on Learning Research and Educational Practice, Commission on Behavioral and Social Sciences and Education, National Research Council

NATIONAL ACADEMY PRESS
 Washington, DC

Summary

In December 1998, the National Research Council released *How People Learn*, a report that synthesizes research on human learning. The research put forward in the report has important implications for how our society educates: for the design of curricula, instruction, assessments, and learning environments. The U.S. Department of Education's Office of Educational Research and Improvement (OERI), which funded *How People Learn*, has posed the next question: What research and development could help incorporate the insights from the report into classroom practice? Responding to that question is the focus of this report.

To address OERI's question, the Committee on Learning Research and Educational Practice first considered how research and practice are generally linked. A small number of teachers are engaged in design experiments with researchers or explore research on their own. They constitute a direct link between research and practice. But for the most part, the influence of research on practice is filtered through educational materials, through pre-service and in-service teacher education, through public policy, and through public opinion--often gleaned from mass media reporting and from people's own experiences in schools.

11. Promoting Reading Strategies for Developmental Mathematics Textbooks,

Anne E. Campbell, Pima Community College, Ann Schlumberger, Pima

Community College, Lou Ann Pate, Pima Community College

For further information contact: Anne E. Campbell, aecampbell@pimacc.pima.edu

<http://www.nade.net/documents/SCP97/SCP97.2.pdf>

Abstract. This article presents three reading and study strategies designed to facilitate student comprehension of and learning from developmental mathematics textbooks. It also includes a review of pertinent research and briefly describes our experiences teaching these strategies to students.

The National Council of Teachers of Mathematics has recommended that "students have an opportunity to read, write, and discuss ideas in which the use of the language of mathematics becomes natural" (1989, p. 6). Many developmental mathematics students, however, continue to lack strategies for academic reading (McIntosh & Draper, 1995). The purpose of this article is to discuss three strategies selected from a methodology designed to teach developmental students to read mathematics textbooks. The methodology reflects research in reading (Nist & Diehl, 1994), mathematics (Borasi & Siegel, 1990; Polya, 1957), and cognitive psychology (Janvier, 1987). The discussion includes a preview, predict, read, and review reading strategy; concept cards; and a Question Answer Relationship technique. These strategies were designed to enable students to read and study effectively mathematics textbooks and concepts. In 1996, they were introduced in one math-specific and two general developmental reading classes. All three classes consisted of 90 to 100% minority students who were concurrently enrolled in developmental mathematics courses.

12. STRENGTHENING MATHEMATICS SKILLS AT THE POSTSECONDARY LEVEL: LITERATURE REVIEW AND ANALYSIS

<http://www.cna.org/documents/IPR11659.pdf>

Prepared for: U.S. Department of Education, Office of Vocational and Adult Education
Division of Adult Education and Literacy

Prepared by: The CNA Corporation

Contributors:

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Will Jordan, The CNA Corporation, Alexandria, VA

Darrell Hull, Center for Occupational Research and Development, Waco, TX

Monya Ruffin, American Institutes for Research, Washington, D.C.

Executive Summary

Background

The nature of America's workforce has changed dramatically in the past several decades, due in large part to the infusion of rapidly changing technology. This trend has resulted in an increased need for workers with greater mathematical skills and higher education.

The U.S. Department of Education Office of Vocational and Adult Education (OVAE) contracted with The CNA Corporation (CNAC) and its partners to identify promising strategies within community colleges, businesses, organized labor, and the military that enable adult learners to strengthen their math skills and abilities and to transition into higher-level math courses or work assignments requiring higher-level mathematics.

This literature review is the first step in this process. In order to establish a baseline understanding of postsecondary developmental mathematics programs we examine the following three issues:

1. What is the definition, or skill threshold, of adequate student preparation in mathematics at the postsecondary level?
2. What institutions provide developmental math education, and how does the education provided differ across these institutions?
3. What approaches and strategies appear to hold promise for enabling adult learners to strengthen their mathematical skills and to progress into college- level math courses or work assignments requiring higher- level mathematical abilities?

Strategies identified in this review will provide the basis for the second phase of this project, the purpose of which is to identify math programs in community colleges, business, labor organizations, and the military that have supporting evidence that such strategies are, indeed, successful.

13. Student Success in Developmental Math Strategies to Overcome a Primary Barrier to Retention

https://www.noellevitz.com/NR/rdonlyres/B4148B72-C135-4AD4-A04C-2F66821C872C/0/ENABLEMATH_paper_0706indd.pdf

I. Summary of the Issue

Once admitted to college, why don't more students go on to earn their two- or four-year degrees, thereby immeasurably enhancing their opportunities for economic and social advancement?

Studies show that the failure to pass developmental math courses before progressing to college-level study presents one of the greatest single stumbling blocks to educational persistence and success.

Conversely, increasing the percentage of students who pass developmental mathematics courses offers the potential for a marked improvement in postsecondary graduation rates, especially among minority and low-income students. This paper considers the nature of the problem

14. A Bibliography¹ of Recent Research and Practice on Student Retention compiled June 2006

<https://www.noellevitz.com/NR/rdonlyres/2BA62226-B0E5-4456-9E31-C92E318AE721/0/Retention06.pdf>

Developmental Math Courses Offered In Module Format

1. BERKSHIRE CC
2. SPRINGFIELD TECHNICAL CC
3. MASSASOIT CC
4. LANE CC
5. COLLIN COUNTY CC DISTRICT
6. NORTHERN KENTUCKY UNIVERSITY
7. CALIFORNIA STATE UNIVERSITY- Dominguez Hills
8. VALENCIA CC

BERKSHIRE CC

- * 3 credit courses offered as math labs where 3 one credit modules are covered.
 - + Module classes have 1 faculty for 16-25 students
 - + Class covers all modules needed by students during each class
 - + About half the students pick lectures and then some switch to lab format
- + Modules use 4-7 quizzes, 10 questions each, 80% to pass- mastery approach with 3 versions of each. quiz
- * Students may elect to take a 3 credit course. C+ required to pass.
- * No letter grades in DE math

SPRINGFIELD TECHNICAL CC

- 1 credit modules in a self paced approach are also offered (algb 099)
- o Use the same text in both courses
 - o Tests can be done in a test center or class at instructors discretion
 - o Students may work alone/with a tutor/with teacher in class.
 - o All students are assigned a class time with a teacher available
 - o Tests are scored immediately
 - o Students may transfer from lecture to self paced at any time and get credit for exams taken in the lecture class.

MASSASSOIT CC

- Modular- 3 one credit modules for each course
 - o 3 sections/ 3 instructors/ 1 time period
 - o Students take same exams at same times (2 in each five week module)
 - o After 5 weeks students who are failing start over (same after 10 weeks)
- Self Paced
 - o 2 instructors or instructor plus tutor
 - o Students work at their own pace
 - o Mastery approach is used with an 80% competency rate required to pass
 - o Offered in combination with either prerequisite arithmetic or next algebra sequence
 - o Intended for well motivated students who score well on cpt, but not enough to move ahead
 - o Students can complete two courses in one semester

LANE COMMUNITY COLLEGE- FLEXIBLE SEQUENCE ALGEBRA

- Courses are offered for 5 credits as lecture and by modules
- Module offering consists of five 2-week modules
 - o **Sample syllabus** (<http://teach.lanecc.edu/~hillb/fsasyllabus.htm>)
 - o When a student passes a module they earn one credit
 - o If a student passes fewer than 5 modules they modify their schedule online to reflect the number they passed
- **Course Description:** MTH 095 Intermediate Algebra (FSA) is identical to MTH 095 but is delivered in five 2-week modules, each worth 1 credit. This approach provides

students the option of repeating modules in which they have been unsuccessful instead of repeating a whole term of MTH 095. Students will take a computer-based module test every two weeks. Those who pass every module will complete 5 credits of MTH 095 in 10 weeks. Students who do not pass a module will retake the module the next two weeks, finishing the fifth module in the following term. Retaking a module will establish a new grade for the failed module. The repeated class sessions will be at the same time of day but with a different instructor and on different days.

- Class format for each module is interactive lecture with some class activities
 - Class activities will be integrated into each module to increase understanding of concepts
 - Class activities will be done in groups but submitted individually
- Attendance is required in class and credit toward the grade will be given or a quiz will be used to take attendance
- Students need to pass an exam on each module before taking the next module. End-of-module exams will be computer-based, so that the results are obtained in time to assign students to the correct next module. After the Thursday/Friday review students will take the module exam in the Math Resource Center, which has a 30-station computer testing area. The multiple choice module exams will be created by a computer program which generates non-repeating questions in random order. Bill Griffiths of the Lane Math Division has used the program successfully for exams in beginning and intermediate algebra. Students who do not pass the module exam will retake the same module in a trailing section. Trailing modules will be held at the same time of day, so students will not have to readjust their schedule.
- testing- a computerized test will be given at the end of each module and may be repeated 2 times. Rules for testing are as follows:
 - You cannot stop a test and then come back to it after leaving the room.
 - You may not take the test more than once on the same day.
 - You may not have a review conference to go over a previous exam and then take the exam following the review conference *on the same day*. A review conference following an exam and taking the exam the next day is OK.
 - To take the test the first time you must have completed the module review handout given in class. Bring it with you to testing.
 - If you take the test twice, only your best score will count. You must receive 70% or better on each module test in order to go on to the next module. However, the grade you receive for the module will include class performance. See the grades information.
 - Modules must be tested in order; for example a student cannot take a test for module D without first passing the module C test.
- **Some details on exams:** The module A exam contains 25 questions. The module B, C, and D exams are 20 questions long and contain 2 or 3 review questions from previous modules. The Module E exam is 10 questions long, all on module E. The final exam, which is written — not on computer— contains 9 review questions from modules A through D and one graphing question from module E. Together the Mod E exam and the written final exam total 20 questions; the minimum score to pass module E is 70%, on the basis of all 20 questions from both the “Mod E exam” and “final”.

COLLIN COUNTY CC DISTRICT- MATHEMATICS PASSPORT PROGRAM

- This math program allows students to receive condensed, intensive instruction in the specific segments of math needed to advance to the next level without having to complete the entire math course.
- The students begin the program from their individual current mathematical competence point, rather than from the points at which the traditional curriculum is designed to begin. This point is determined through a combination of testing and instructor assessment.
- The Passport Program, designed for high school graduates, current CCCCD students and adults returning to college, is delivered in a five-week format that runs from June 2 - July 3. Students will meet from 8:30 - 11:30 a.m., Monday through Friday. The program fee is \$75 plus tuition.
- The unique aspect of the Passport Program is that students study only the math areas in which further instruction is needed. Students are not required to work through an entire textbook if they only need help in one or two chapters. With the help of instructors, they learn what they need to learn to move on to the next level. This individualized math curriculum is called a 'student success plan. Conceivably, a motivated student could work through several math levels in five weeks. Students who do not complete the first course during the 8-week Passport Program will be directed to withdraw from the 2nd course and will be given up to an additional 8 weeks to complete the initial course.
- After placement at a specific competency level, students may enroll in any of the following mathematics courses: Basic Math (Math 0300); Pre-Algebra (Math 0302); Beginning Algebra (Math 0305); or Intermediate Algebra (Math 0310). Students will also be taught how to use a graphing calculator in all of the Passport Program math classes.
- In the Passport Program the student's learning is predicated on the comprehension of concepts, NOT on a linearly mandated trek through a textbook. After the initial class meeting, the student may immediately progress to the material where additional study is needed. The program is also designed for each student to receive instruction on topics "missing" from their understanding of a previous course.
- During the 15-minute base group meeting, each student is counseled about recommended work strategies for the day. Each class day is structured as follows:
 - 15 minutes Base Group Planning
 - 20 minutes Lecture 1
 - 20 minutes Lecture 2
 - 20 minutes Lecture 3
 - 20 minutes Lecture 4
 - 10 minutes Base Group Wrap-up
- * All students are given the option to attend the Learning Pods rather than lecture if no scheduled lecture corresponds to their learning program. During the one-on-one instructor/student "exit" briefings each class day, content progress is assessed and future work session topics are identified.
- To create an effective student learning environment, this program offers the following learning tools: lectures, graphing calculators, videos, discussions, discovery, computer software, worksheets, tutoring, online support, manipulatives, group work, and real-world applications. The faculty help students identify how they each learn best by offering a Learning Style Inventory (LASSI). This facilitates an understanding by both student and instructor of the student's inclination relative to attitude, motivation, time management, anxiety, concentration, and test strategies.

NORTHERN KENTUCKY UNIVERSITY

MODULE SECTIONS- The modules are 1-credit courses covering the content of MAH 095 and MAH 099. Students who are unsuccessful in a five-week module may be able to repeat that module immediately.

Beginning Algebra

MAH 092. Beginning Algebra Part I (1 credit) Operations on real numbers and linear equations in one variable.

MAH 093. Beginning Algebra Part II (1 credit) Applications of linear equations, linear inequalities, graphs of lines, and slope.

MAH 094. Beginning Algebra Part III (1 credit) Integer exponents, operations on polynomials, and factoring.

Intermediate Algebra

MAH 096. Intermediate Algebra Part I (1 credit) Rational expressions and equations, ratio, proportions, and variation.

MAH 097. Intermediate Algebra Part II (1 credit) Functions, equations of lines, and systems of linear equations.

MAH 098. Intermediate Algebra Part III (1 credit) Radicals, graphs of parabolas and circles, quadratic equations, and their applications.

Structured Learning Assistance Sections

MAH 095-010 with SLA Workshop

MAH 099-014 with SLA Workshop

SLA provides free workshops for students led by a trained professional or student. All students who enroll in an SLA course section are required to attend all SLA workshops until the first assessment and thereafter only when their grade falls below a stated average (around 75%). Students must continue to attend all SLA workshops until their average grade is above the stated amount.

MASSASOIT COMMUNITY COLLEGE

http://www.massasoit.mass.edu/acad_depts/sci_math/math/math_flow.cfm

MATH 001 - Basic Math Review

This course is designed for a quick review of the fundamentals of arithmetic. Topics included are math anxiety; long division; operations with fractions, decimals, and signed numbers; and exponents and radicals. 1.00 Credit hours 1.00 Lecture hours

MATH 002 - Basic Math Review - Fractions

The Basic Mathematics Review courses are one-credit courses designed to correct weaknesses in specific areas of numerical skills. Students work at their own pace, under the careful supervision of a member of the mathematics department. Utilizing computer-aided instruction, audio/ visual materials, group lectures, and individual instruction, students progress until the necessary skills have been attained. There are two Basic Mathematics Review courses: Basic Mathematics Review - Fractions and Basic Mathematics Review - Decimals and Percents. A student is placed in either of these following an evaluation. The mathematics department strongly recommends that either Basic Mathematics Review

Course be taken along with some other mathematics course, usually Introductory Algebra (MATH101).
1.00 Credit hours 1.00 Lecture hours

MATH 003 - Basic Math Review-Decimals

The Basic Mathematics Review courses are one-credit courses designed to correct weaknesses in specific areas of numerical skills. Students work at their own pace, under the careful supervision of a member of the mathematics department. Utilizing computer-aided instruction, audio/ visual materials, group lectures, and individual instruction, students progress until the necessary skills have been attained. There are two Basic Mathematics Review courses: Basic Mathematics Review - Fractions and Basic Mathematics Review - Decimals and Percents. A student is placed in either of these following an evaluation. The mathematics department strongly recommends that either Basic Mathematics Review Course be taken along with some other mathematics course, usually Introductory Algebra (MATH101)
1.00 Credit hours 1.00 Lecture hours

MATH 010 - Fundament Of Math

The aim of this course is to provide for the person with slight mathematical background an opportunity to acquire an understanding and appreciation of the basic structure of elementary operations on whole numbers, fractions, and decimals; percent; measurement; ratio and proportion; signed numbers; simple linear equations; exponential notation; and problem solving. Note: Credits earned in this course cannot be applied toward graduation. 3.00 Credit hours 3.00 Lecture hours

MATH 097 - Intro Algebra I

This course is designed to provide the fundamental concepts of algebra and examine some simple applications of these concepts, i.e. word problems. Topics include signed numbers, algebraic expressions, linear equations and inequalities in one variable, the Cartesian coordinate system, linear equations and inequalities in two variables, systems of equations, and descriptive statistics (e.g. mean, median, mode, and reading graphs). Note: Credits earned in these courses can no longer be applied to graduation. Prerequisite: C- or better in Fundamentals of Mathematics (MATH010) or waiver by placement testing results or Departmental Approval 1.00 Credit hours 1.00 Lecture hours

MATH 098 - Intro Algebra II

This course is designed to provide the fundamental concepts of algebra and examine some simple applications of these concepts, i.e. word problems. Topics include signed numbers, algebraic expressions, linear equations and inequalities in one variable, the Cartesian coordinate system, linear equations and inequalities in two variables, systems of equations, and descriptive statistics (e.g. mean, median, mode, and reading graphs). Note: Credits earned in these courses can no longer be applied to graduation. Prerequisite: C- or better in Fundamentals of Mathematics (MATH010) or waiver by placement testing results or Departmental Approval 1.00 Credit hours 1.00 Lecture hours

MATH 099 - Intro Algebra III

This course is designed to provide the fundamental concepts of algebra and examine some simple applications of these concepts, i.e. word problems. Topics include signed numbers, algebraic expressions, linear equations and inequalities in one variable, the Cartesian coordinate system, linear equations and inequalities in two variables, systems of equations, and descriptive statistics (e.g. mean, median, mode, and reading graphs). Note: Credits earned in these courses can no longer be applied to graduation Prerequisite: C- or better in Fundamentals of Mathematics (MATH010) or waiver by placement testing results or Departmental Approval 1.00 Credit hours 1.00 Lecture hours

MATH 101 - Intro Algebra

This course is designed to provide the fundamental concepts of algebra and examine some simple applications of these concepts, i.e. word problems. Topics include signed numbers, algebraic expressions, linear equations and inequalities in one variable, the Cartesian coordinate system, linear equations and inequalities in two variables, systems of equations, and descriptive statistics (e.g. mean, median, mode, and reading graphs). Note: Credits earned in this course can no longer be applied to graduation. Prerequisite: C- or better in Fundamentals of Mathematics (MATH010) or waiver by placement testing results or Departmental Approval 3.00 Credit hours 3.00 Lecture hours

BERKSHIRE COMMUNITY COLLEGE

<http://cc.berkshire.org/wm/catalog/department.jsp?code=MAT&previndex=15&context=term&term=17>

MAT-800 - Mathematics Modules

Students intimidated by regular mathematics courses will find a new approach in the Math 800 Series, which allows students to progress at their own rate, decide individually when they are ready to be tested, and to work and study in a no-failure environment. The results of the BCC Learning Skills Assessment will determine where the student starts; individual effort and program requirements determine where the student stops.

This series covers materials in 20 modules, from basic arithmetic through precalculus. Students can advance at their own rate, and credit is given individually. The series is designed for those who have been "turned off" by traditional mathematics classes yet need the basic skills necessary for their career goals or for preparation for more advanced mathematics courses.

Students who wish to undertake studies in mathematics as included in the Math 800 series should select MAT 800 for one, two, or three credits.

MAT-011 Arithmetic I

1 Credit Addition, subtraction, multiplication, and division of whole numbers. This module includes solving simple word problems and the order of operations.

MAT-012 Arithmetic II

1 Credit Addition, subtraction, multiplication, and division of common fractions and mixed numerals. This module includes solving equations and word problems and the order of operations. Skills prerequisite: [MAT 011](#).

MAT-013 Arithmetic III

1 Credit A study of decimals. This module includes conversion to decimals and fractions, rounding, and word problems involving rates, ratios, and proportions. Skills prerequisite: [MAT 012](#).

MAT-014 Arithmetic IV

1 Credit A study of percents and geometry and their applications. This module includes conversion with decimals and fractions to percent problems and applications. A brief introduction to basic geometry formulae and applications is included. Skills prerequisite: [MAT 013](#).

MAT-015 Arithmetic V

1 Credit Operations with denominate numbers (e.g., yards, feet, inches, gallons, quarts, pints) and problems involving area and volume. This module includes the metric and American systems and square roots and the pythagorean theorem. Skills prerequisite: [MAT 014](#).

MAT-021 Elementary Algebra I

1 Credit The properties of numbers, reciprocals, problems solving geometric formulas, and

operations on rational numbers. This module includes solving equations using the addition and multiplication principles. Skills prerequisite: [ENG 020](#) and [MAT 014](#).

MAT-022 Elementary Algebra II

1 Credit A study of polynomials, polynomial operations and polynomials in several variables. This module also includes: special products, inequalities, exponentials, scientific notation and linear functions and their graphs. Skills prerequisite: [MAT 021](#).

MAT-023 Elementary Algebra III

1 Credit Factoring polynomials, solving equations by factoring, and problem solving. Skills prerequisite: [MAT 022](#).

MAT-024 Elementary Algebra IV

1 Credit Operations on fractional expressions, solving fractional equations, and solving problems and proportions. This module includes complex rational expressions and solving literal equations. Skills prerequisite: [MAT 023](#) or [MAT 028](#)

MAT-025 Elementary Algebra V

1 Credit This module includes: equations of direct and inverse variation, solving systems of equations with application problems, and graphing inequalities in two variables. Skills prerequisite: [MAT 024](#).

MAT-026 Elementary Algebra VI

1 Credit Radical, irrational numbers, and real numbers, operations on radicals, and the right triangle. This module includes quadratic equations, solving by factoring, completing the square, the quadratic formula, fractional and radical equations, and the graphs of quadratic equations. Skills prerequisite: [MAT 025](#).

College level math courses offered in modular form: [MAT-105](#) Special Math Topics I [MAT-106](#) Special Math Topics II [MAT-107](#) Special Math Topics III [MAT-108](#) College Algebra I [MAT-109](#) College Algebra II [MAT-110](#) College Algebra III [MAT-114](#) Precalculus I [MAT-115](#) Precalculus II [MAT-116](#) Precalculus III [MAT-117](#) Precalculus IV [MAT-118](#) Precalculus V [MAT-119](#) Precalculus VI

MAT-018 Pre-algebra

3 Credits A comprehensive refresher in basic mathematics. Topics include fractions, decimals, ratio and proportion, percents, geometry and measurement. College credit will be awarded, but this credit will not count toward a degree. Skills prerequisite: [MAT 011](#).

MAT-028 Elementary Algebra I-III

3 Credits The first semester of a two-semester sequence in elementary algebra. Topics include a pre- algebra review, the real number system, algebraic expressions, solving algebraic equations and inequalities, linear equations and their graphs, operations on polynomials and factoring polynomials. College credit will be awarded, but this credit will not count toward a degree. Skills prerequisite: [ENG 020](#), [ENG 060](#), and [MAT 014](#).

MAT-029 Elementary Algebra IV-VI

3 Credits The second semester of a two-semester sequence in elementary algebra preparing students for intermediate algebra. Topics include rational expressions and equations, systems of equations, radical expressions and equations, and quadratic equations with completing the square. College credit will be awarded, but this credit will not count toward a degree. Skills prerequisite: [ENG 020](#), [ENG 060](#), and [MAT 023](#) or [MAT 028](#).

SPRINGFIELD TECHNICAL COMMUNITY COLLEGE

<http://www.stcc.edu/academics/CourseDescriptions/getDescriptions.asp?DeptCode=MATH>

ALGB-081 - INTRODUCTORY ALGEBRA 1 1 credit

Topics include the real number system, operations with real numbers, simplification of algebraic expressions, solving equations and inequalities, applications and problem solving.

PREREQUISITE: [ARTH-073](#), [ARTH-078](#), or placement of [ALGB-081](#)

This is a developmental course. Credit for this course will not be counted toward fulfilling graduation requirements at STCC.

ALGB-082 - INTRODUCTORY ALGEBRA 1 1 credit

Topics include graphs of linear equations, exponents, scientific notation, and operations with polynomials. PREREQUISITE: [ALGB-081](#)

This is a developmental course. Credit for this course will not be counted toward fulfilling graduation requirements at STCC.

ALGB-083 - INTRODUCTORY ALGEBRA 1 1 credit

Topics include factoring polynomials, solving quadratic equations by factoring, applications and problem solving. PREREQUISITE: [ALGB-082](#)

This is a developmental course. Credit for this course will not be counted toward fulfilling graduation requirements at STCC.

ALGB-087 - LECTURE ALGEBRA 1 3 credits

Topics include the real number system, operations of real numbers, and simplification of algebraic expressions, solving equations and inequalities, applications and problem solving.

Topics also include graphs of linear equations, exponents and scientific notation, operations with polynomials, factoring polynomials, solving quadratic equations by factoring, and applications and problem solving. PREREQ: [ARTH-073](#), [ARTH-078](#) or math placement of [ALGB-081](#).

ALGB-091 - INTRODUCTORY ALGEBRA 2 1 credit

Topics include operations with rational expressions, solving rational equations, formulas, applications and problem solving, and simplifying complex rational expressions.

PREREQUISITE: [ALGB-083](#), [ALGB-087](#), or placement of [ALGB-091](#)

This is a developmental course. Credit for this course will not be counted toward fulfilling graduation requirements at STCC.

ALGB-092 - INTRODUCTORY ALGEBRA 2 1 credit

Topics include graphing linear equations, slopes, equations of lines, and graphing inequalities in two variables. Additional topics are systems of linear equations, applications and problem solving. PREREQUISITE: [ALGB-091](#)

This is a developmental course. Credit for this course will not be counted toward fulfilling graduation requirements at STCC.

ALGB-093 - INTRODUCTORY ALGEBRA 2 1 credit

Topics include radical expressions and equations and applications. Additional topics are the quadratic formula, graphs of quadratic equations, and functions. PREREQUISITE: [ALGB-092](#)

This is a developmental course. Credit for this course will not be counted toward fulfilling graduation requirements at STCC.

. Credit for this course will not be counted toward fulfilling graduation requirements at STCC.

ALGB-097 - LECTURE ALGEBRA 2 3 credits

Topics include operations with rational expressions, solving rational equations, applications and problem solving, and simplifying complex rational expressions, graphing linear equations, slopes, equations of lines, and graphing inequalities in two variables. Additional topics are systems of linear equations, applications and problem solving, radical expressions, radical equations and applications, the quadratic formula, graphs of quadratic equations, and functions.

PREREQUISITES: [ALGB-083](#), [ALGB-087](#) or math placement of [ALGB-091](#).

This is a developmental course. Credit for this course will not be counted toward fulfilling graduation requirements at STCC.

ALGB-099 - ELEMENTS OF MATHEMATICS 3 credits

This is a unique course with a format that allows the student to progress at his or her own pace. New students are assigned a beginning math level and textbook based on their placement test results. Returning students pick up wherever they ended the previous semester. Students may study on their own, with instructors and tutors available to answer questions on an individual basis. Each student is assigned an instructor and a particular class time, and may use the Testing Center and Tutor Center Monday - Friday 8:00 AM - 3:00 PM. Students take tests whenever they feel ready and the test center is open. Tests are computer generated, and corrected and graded immediately for the students. Students are then given a copy of the original test and a copy of the correct answers to take with them.

This is a non-punitive grading system, with no failing grades. Single credit grades are issued for completed credits only. It is possible to earn three or more credits or less than three credits in one semester. These credits are below college level, do not carry graduation credit, and are non-transferable.

Developmental/Remedial Credits		
Basic Arithmetic	Introductory Algebra 1	Introductory Algebra 2
ARTH-071	ALGB-081	ALGB-091
ARTH-072	ALGB-082	ALGB-092
ARTH-073	ALGB-083	ALGB-093

This is a developmental course. Credit for this course will not be counted toward fulfilling graduation requirements at STCC.

ARTH-071 - PRE-ALGEBRA 1 credit

Topics include whole numbers and the place value system, operations of whole numbers and order of operations. Additional topics include fractions and mixed numerals, operations with these numbers, and applications. PREREQUISITE: None

This is a developmental course. Credit for this course will not be counted toward fulfilling graduation requirements at STCC.

ARTH-072 - PRE-ALGEBRA 1 credit

Topics include decimal notation, percent notation, and conversions between decimal, fractional, and percent notation. Ratio and proportion, applications, and problem solving are also included. PREREQUISITE: [ARTH-071](#) or equivalent

This is a developmental course. Credit for this course will not be counted toward fulfilling graduation requirements at STCC.

ARTH-073 - PRE-ALGEBRA 1 credit

Topics include basic statistical measures, units of linear measurement -- American and metric systems, and geometric formulas and applications. Also included is an introduction to Algebra, including the real number system and operations of integers. PREREQUISITE: [ARTH-072](#) or equivalent.

This is a developmental course. Credit for this course will not be counted toward fulfilling graduation requirements at STCC.

ARTH-078 - LECTURE PRE-ALGEBRA 3 credits

Topics include whole numbers and the place value system, operations of whole numbers and order of operations, fractions and mixed numerals, operations with these numbers, and applications. Additional topics include decimal notation, percent notation, and conversions between decimal, fractional, and percent notation, ratio and proportion, applications, and problem solving, basic statistical measures, units of linear measurement, American and metric systems, and geometric formulas and applications. Also included is an introduction to Algebra, including the real number system and operations of integers. PREREQUISITE: None. This is a developmental course. Credit for this course will not be counted toward fulfilling graduation requirements at STCC.

CALIFORNIA STATE UNIVERSITY, Dominguez Hills

Developmental Math Courses

MAT 011-016 are intended for students who need to satisfy the Entry Level Math (ELM) requirement. MAT 011-014 meet the ELM requirement. MAT 015 and MAT 016 provide extra help.

MAT 011 Algebra Review part 1 (1 unit) FS

Units of measurement, arithmetic with signed numbers and fractions, word problems, linear equations, applications. Meets for three hours of lecture per week for five weeks. CR/NC grading. Does not count toward the Bachelor's degree.

MAT 012 Algebra Review part 2 (1 unit) FS

Prerequisite: MAT 011. Percent, ratio and proportion, equations of lines, inequalities, graphs, word problems, applications. Meets for three hours of lecture per week for five weeks. CR/NC grading. Does not count toward the Bachelor's degree.

MAT 013 Algebra Review part 3 (1 unit) FS

Prerequisite: MAT 012. Systems of linear equations, multiplying and dividing polynomials, solving simple polynomial and rational equations, rate, direct and indirect variation, word problems, applications. Meets for three hours of lecture per week for five weeks. CR/NC grading. Does not count toward the Bachelor's degree.

MAT 014 Algebra Review part 4 (1 unit) FS

Prerequisite: MAT 013. Quadratic formula, solving quadratic equations, graphs, brief and practical introduction to logarithms and exponential functions, word problems, applications. Satisfies the ELM requirement. Meets for three hours of lecture per week for five weeks. CR/NC grading. Does not count toward the Bachelor's degree.

MAT 015 Algebra and Geometry Review part 5 (1 unit) FS

Prerequisite: MAT 014. Flexible course covering topics in intermediate algebra and geometry beyond those that are covered in the basic remedial MAT 011-014 sequence. Aimed at preparing students for more technical university level math and science courses (e.g. precalculus). Meets for three hours of lecture per week for five weeks. CR/NC grading. Does not count toward the Bachelor's degree.

MAT 016 Algebra and Geometry Review part 6 (1 unit) FS

Prerequisite: MAT 015. Flexible course covering topics in intermediate algebra and geometry beyond those that are covered in the basic remedial MAT 011-014 sequence. Aimed at preparing students for more technical university level math and science courses (e.g. precalculus). Meets for three hours of lecture per week for five weeks. CR/NC grading. Does not count toward the Bachelor's degree.

VLAENCIA COMMUNITY COLLEGE

Modules for Preparatory Math

Valencia offers prep math in several different formats, one of which is a **modular** approach which Palm Beach Community College will test in the spring term. Valencia has divided their curriculum into five-week modules, and students who do not receive an A or B during the five weeks repeat the module until they have mastered the material.

Benefits of the **modular approach**

Since implementing modules, the faculty and staff at Valencia have found that those students who participate in the modules are more likely to stay in school as compared to those students who learn through the conventional approach (48% vs. 36%). One reason for this is that in order to repeat a course that a student was unsuccessful in, the time frame is only five weeks (the length of a module), rather than the 16 weeks involved in a standard semester course. This creates more of a sense of optimism that even though there may be some delays in getting to the finish line, it doesn't seem so far out of reach to become discouraging.

Another attractive feature of the module approach is that students who fail a module will be given a new opportunity with a new professor. Since four professors are working together, they are teaching different modules every five weeks. A student who needs to repeat a module will not move on with the professor he was not successful with.

Curriculum Assistants

Another innovative feature of Valencia's **modular** approach is the inclusion of Curriculum Assistants. These assistants are former successful students who are paid to "live with" a class throughout the length of a module. In addition to sitting in the class, the Curriculum Assistant grades quizzes and homework and returns them to the student for immediate feedback. Because of the Curriculum Assistant's help, the students are assessed more frequently and in different ways than in the traditional classroom. Finally, Curriculum Assistants spend much of their time working with students before and after class, as well as being available for one-on-one tutoring.

Activity Book

A very important feature of Valencia's math modules is their effort to teach the material in non-traditional ways, such as, the use of real-world applications, group work, peer tutoring, and games. The professors and staff have an Activity Book containing many ideas for these non-traditional presentation.

Computer Assisted Tutoring Programs

My Math Lab (Pearsson publishing)

Features for Instructors

MyMathLab provides instructors with a rich and flexible set of course materials, along with course-management tools that make it easy to deliver all or a portion of your course online.

Powerful homework and test manager: Create, import, and manage online homework assignments, quizzes, and tests that are automatically graded, allowing you to spend less time grading and more time teaching. Create assignments from online exercises tightly correlated to your textbook, or create your own customize exercises. Homework exercises include guided solutions and sample problems to help students understand and master concepts. You can choose from a wide range of assignment options, including time limits, proctoring, and maximum number of attempts allowed.

Custom Exercise Builder: The MathXL Exercise Builder (MEB) for MyMathLab lets you create static and algorithmic online exercises for your online assignments. A library of sample exercises provides an easy starting point for creating questions, and you can also create questions from scratch. Exercises can include number lines, graphs, and pie charts, and you can create custom feedback that appears when students enter answers.

Comprehensive gradebook tracking: MyMathLab's online gradebook automatically tracks your students' results on tests, homework, and tutorials and gives you control over managing results and calculating grades. All MyMathLab grades can be exported to a spreadsheet program, such as Microsoft Excel. The MyMathLab Gradebook provides a number of views of student data and gives you the flexibility to weight assignments, select which attempts to include when calculating scores, and omit or delete results for individual assignments.

Complete online course content and customization tools: MyMathLab courses are filled with a wealth of content that is tightly integrated with your textbook. Everything you need to deliver a complete online course is there when you adopt a MyMathLab course, but you can easily add, remove, or modifying existing content. You can also add your own course materials to suit the needs of your students or department. MyMathLab provides a variety of communication tools you can use to create a supportive online community, including a discussion board, virtual classroom, and chat capabilities. You can also customize the look and feel of your MyMathLab course, including deciding which content areas and communication tools to make available to students.

Copy or share courses and manage course groups: If you've spent time customizing your MyMathLab course and want to use the same course next semester, you can copy your existing course and preserve all your customizations. You can also let other instructors copy your course. To coordinate across multiple sections of the same course, you can set up a course group, where assignments in the "coordinator" course automatically appear in the affiliated "member" courses. This option is ideal for departments that want to maintain a standardized syllabus across multiple sections taught by different instructors.

Features for Students

MyMathLab provides students with a personalized interactive learning environment, where they can learn at their own pace and measure their progress.

Interactive tutorial exercises: MyMathLab's homework and practice exercises are correlated to the exercises in the textbook, and they regenerate algorithmically to give students unlimited opportunity for practice and mastery. Most exercises are free-response and provide an intuitive math symbol palette for entering math notation. Exercises include guided solutions, sample problems, and learning aids for extra help at point-of-use, and they offer helpful feedback when students enter incorrect answers.

eBook with multimedia learning aids: MyMathLab courses include a full eBook with a variety of multimedia resources available directly from selected examples and exercises on the page. Students can link out to learning aids such as video clips and animations to improve their understanding of key concepts.

Study plan for self-paced learning: MyMathLab's study plan helps students monitor their own progress, letting them see at a glance exactly which topics they need to practice. MyMathLab generates a personalized study plan for each student based on his or her test results, and the study plan links directly to interactive, tutorial exercises for topics the student hasn't yet mastered. Students can regenerate these exercises with new values for unlimited practice, and the exercises include guided solutions and multimedia learning aids to give students the extra help they need.

Tutoring for students from the Math Tutor Center: Students using MyMathLab can use their instructor's Course ID to sign up for math tutoring from the Math Tutor Center. The Tutor Center is staffed by qualified mathematics instructors who provide one-on-one tutoring via toll-free phone, email, and real-time Internet sessions. Tutors can assist students by explaining examples in the textbook and reviewing solutions to exercises with answers indicated in the textbook.

A+dvancer

Nassau Community College- Use of A+dvancer and ACCUPLACER for prescriptions and tutoring

23. Two tests are widely used to determine student readiness for college level courses. These are ACCUPLACER which is provided by the College Board, and Compass which is provide by ACT. These two tests have an excellent track record in identifying the probability of student success in college level classes as well as determining success in specific remedial classes. However, the utility of either test for determining the specific learning objectives for which students need assistance is weak according to many personnel surveyed in both community colleges and 4-year colleges. So, if students are to receive individualized assistance, determining the specific needs of the student is left largely to the discretion of instructors.
24. Increasingly, electronic learning resources are more readily available to students. Nevertheless, the direction for the students is often minimal. *A+dvancer* is an online instructional system that is designed to provide individualized learning prescriptions. The prescriptions are generally developed as a result of brief criterion-referenced assessments within the *A+dvancer* system that are associated with specific learning skills identified by ACCUPLACER and Compass.
25. *A+dvancer* then provides a skill deficiency report and individualized instruction to address the specific learning needs of the student.
26. Students who did not qualify for entrance into one or more college level courses as a result of their ACCUPLACER test scores were offered the opportunity to take the *A+dvancer* prescriptive assessment and prescribed instruction. Following the completion of their *A+dvancer* prescription, students took the ACCUPLACER test a second time
27. ACCUPLACER Elementary Algebra pre and posttest scores for 139 students who used the *A+dvancer* system to address Elementary Algebra were returned to AEC. **Students in this study used *A+dvancer* for an average of 6 hours and 37 minutes.**

28. The findings of this small study are very encouraging. The statistical findings were very strong where the numbers were high, as in the Elementary Algebra intervention. Findings with the smaller sample sizes were also positive but cannot be as conclusive because of the lower numbers involved. The gains were made in following a brief intervention, 6 and 1/2 hours and under three hours, respectively. Additionally, the findings show a strong trend indicating that students who use the study materials gain more than students who spend more of their time merely practicing doing problems.
29. The gains over a short period of time are especially encouraging. For most students taking a college placement test such as ACCUPLACER or Compass, there is a short window between the test and enrollment in classes. Many students who cannot begin the college level classes simply walk away from enrollment. It has been the observation of this writer, that students completed the *A+dvancer* intervention at a much higher rate in institutions where students were permitted to re-take ACCUPLACER after completing the *A+dvancer* intervention and have the second ACCUPLACER score accepted for class placement. With the short window, an effective, brief intervention is critical to retention.
30. The statistical trends show that students who use the study materials made greater gains. This is encouraging for two reasons. First, it is consistent with the premise that instruction is important to learning. It is also encouraging because the learning management system within *A+dvancer* allows controls that require the learner to use the study guide.
31. It was noted early in the history of the implementation of *A+dvancer* that students who had not made cut-scores on ACCUPLACER often did not use the study guide and skipped right to test questions. They then proceeded to continue taking test questions repeatedly, without going to the study guide. Their performance did not change, nor did their study habits. Perhaps this was the reason many of these students were not able to attain the cut-scores required for college enrollment. It was after this observation that a requirement of some study time was included as a default setting in the *A+dvancer* program.
32. Students do not always make up sufficient ground to be eligible for college level work, but nearly always improve to test out of at least one remedial course. This is an extremely powerful observation. Delaying entry into college level work most likely hinders retention. It has been thought of many that accelerating entry into college level material would enhance retention.
33. In conclusion, it appears that *A+dvancer* is an intervention that is effective in raising ACCUPLACER scores. Users report that students who enter college classes based on improved scores after an *A+dvancer* intervention succeed at just as high a rate as those who had high placement scores in the first place. This pilot data supports the hypothesis that *A+dvancer* is an effective intervention.

EnableLearning A Three-Way Partnership

Combining new technology and content from EnableLearning with intervention/retention consulting services from Noel-Levitz and a commitment from your college to support instruction; we can, together, solve this problem. Employing unique adaptive/mastery-based homework technology, EnableMath provides you with student performance data so that you will know, from the first day of class, how each student is doing. And, Noel-Levitz's intervention/retention support and strategies help the faculty to use this data to motivate students to do homework and develop the long term methodologies that support the homework process for all students.

The Solution — Make Homework Count!

We start with the fundamental principle that if students do their homework they will succeed. Enablelearning technologies that make homework **adaptive** and **mastery-based** and the Noel-Levitz intervention strategies based on the **continuous data** provided by the program can help you make homework count.

Key Variable—Persistence to Mastery

We have found that the most important single factor in student performance is persistence in the completion of homework assignments. The correlation between percentage of assignments completed (persistence) and grade averaged between .5 and .7 for students who used the EnableMath Program in 2004. The chart to the right shows average grades and persistence by quartile for one participating institution. Our message to students is simple—**Do your homework in EnableMath and you will succeed!**

Student Focus on Homework- Adaptive and Mastery Based “Learning is not a Spectator Sport” Students can no more learn math without doing homework than we can learn to play golf by just watching Tiger Woods hit golf balls. We know that we need to practice to play golf well but students seem to think they can pass the math course without doing the homework. We analyzed the reasons that students don’t do homework, and then we built a new Web-based technology on the principle that homework must be valued as important to the student.

Immediate Feedback

Students need feedback. Not only do they need to know whether they did a problem correctly or not, they need to know that their instructor is looking at their homework results. “If it is not graded, it is not done.” is the motto of many students. Our homework system ensures that both students and faculty see results immediately.

Adaptive Problem Solving

Many students do not do homework because they feel it is irrelevant. By adapting the difficulty level of every problem to the learning progress of each individual student, through our Maxwell™patent pending technology, we can help you make homework “relevant”.

Mastery-Based Learning

When assignments have the same number of problems for every student in the class, they are not learner based. Some students need just a few problems while others need many problems to “get” a concept. By making every assignment mastery-based, students only do as many problems as necessary. Students can always do additional problems if after achieving mastery they want to.

Weekly Email to Students

We believe that you can’t encourage students enough to do their homework. As part of that process, we automatically send an email to students every week which shows the average class persistence on the assignments done that week, the student’s persistence for that week and the assignments that the student has worked on. This email to students has the same data on it for each student that the instructor weekly email has.

One instructor 's experience

Long-time mathematics instructor Danielle Goodwin is convinced that new approaches to teaching developmental mathematics courses are urgently needed. Currently a math education specialist at South Dakota Center for the Advancement of Math and Science Education at Black Hills State University, Goodwin taught developmental and college-level courses for a number of years at Northern Essex Community College in Haverhill, Massachusetts, where a significant percentage of students spoke English as a second language. These are low-income students with an average age of 29, says Goodwin. Many were in their 40s and 50s and hadn't taken math since the 1970s." Each year, the college enrolled approximately 1,800 students in its three developmental mathematics courses basic Math, Algebra I, and Algebra II. The pass rates were miserable, says Goodwin,, especially in the algebra courses, where more than 50 percent of students dropped out or failed. Retention is a huge issue."An innovative instructor who is ever on the lookout for better ways to reach students, Goodwin decided to try a new math teaching tool called EnableMath™ ,a Web-based instructional homework delivery and tracking system. She already did a lot of activities and group work and oral presentations, she explains. Students need time to play with concepts and do experimentation. This gave me a really neat, interactive way to let students explore and play. Students spent about half their class time in a smart classroom where Goodwin used EnableMath to talk through and demonstrate concepts. They then spent the other half of class in a computer lab where they could work together on assignments. The students really liked it, Goodwin says. it was a different way to attack math. They had immediate feedback about how they were doing and they were able to talk about it with me and with each other. Because they could make choices with this program, it gave weight to their opinions. They were used to drill-style math, and now they were talking about what was happening and arguing out their own concepts. It was really neat to see students be able to work at such a high level." With EnableMath homework assignments, students spent as much time as needed to master each concept. The system is great," says Goodwin. they are not just doing problems and getting graded on them. EnableMath calibrates to how well an individual student is doing with a particular assignment, determining the level at which they are working and how many problems they need to do. Some students are better at graphs, some at abstract thinking. This system notices them when they should review the material or talk more with the instructor to understand a particular concept."

As an instructor, Goodwin was able to use the program to create her own syllabus. It was very adaptive. You can pull pieces from different course modules to suit your needs, and you can put in your own examples. For instance, when I teach quadratics, I like to talk about baseball. I was able to work with EnableMath to build this into my lessons and use baseball examples to show concepts." The impact of the new teaching approach on student success was dramatic, Goodwin says, with percentage pass rates reaching the high 60s and low 70s for the algebra courses. The percentage of EnableMath assignments completed was highly correlated to the final grade. And when I had these students later in College Algebra, she added, they were better prepared than those who had taken traditional courses because they had already learned to think about math concepts." For this instructor, taking a new approach led to dramatic improvements in student success, with percentage pass rates reaching the high 60s and low 70s for algebra courses.

PLATO

PLATO Developmental Education Solutions provide online supplemental and full-course instruction that is accessible anytime/anywhere to help your students review and/or remediate skills. Our on-campus

and distance learning solutions help make it possible for your students to achieve post-secondary success.

As a self-paced learning tool, technology provides students with the means to work at their own pace to learn the material. Students pass into credit courses more quickly, increasing pass rates, retention, and persistence. The instruction is individualized to each student's needs, which helps faculty facilitate teaching larger classes with diverse students.

Our supplemental instruction allows you to implement one, two, or all of the content libraries you choose, and combine them as needed. This courseware is customizable, providing academic freedom and supporting individualized learning. The large breadth and depth of courses allows for use across many campus programs/labs.

Our full-course instruction provides consistent instruction by faculty and adjuncts alike. The comprehensive online materials allow for increased distance learning offerings. While the cost-recovery model makes this courseware economical and efficient, it can be implemented in an on-campus, distance learning, or hybrid model to accommodate your institution's needs.

A Customized Solution

Keith Hensley, dean of workforce development and executive director of the Center for Business and Professional Development at Holyoke Community College, discovered PLATO Learning in 1996 after researching options and evaluating a variety of programs. They have been expanding their use of PLATO® software ever since. “PLATO software fit the versatility more than any other product I viewed,” Hensley said. “It is easily customized and covered all the bases. It is user friendly and interactive.” HCC accomplishes their mission through a variety of innovative and entrepreneurial programs that use PLATO Learning software for assessment, instruction, and reporting. Some of these programs include: On-Campus Developmental Studies Only 37 percent of incoming students score sufficiently on the Computerized Placement Test (CPT) to take college-level credit courses at HCC. A faculty member designed a PLATO® developmental mathematics course for students who didn't score sufficiently on the CPT. This credit-granting course gave students the opportunity to choose between self-study courses delivered entirely with PLATO Learning software or an instructor-led course

supplemented by PLATO Learning content. The mathematics faculty and students have been extremely receptive and pleased with the program and its results. “In the PLATO lab, I had students actively involved in the material—it was impossible for them to work on the PLATO software and not be actively learning,” said Victor Thomas, HCC mathematics instructor.

ALEKS (McGraw Hill Publisher)

ALEKS (Assessment and LEarning in Knowledge Spaces) is an artificial intelligence-based learning system that:

- Provides a Cycle of Assessment and Learning
- Remediates Gaps in Student Preparation
- Allows Professors to Monitor Individual and Class Performance
- Provides Clear Explanations and Feedback
- Offers 24 Hour Unlimited Online Access

ALEKS (Assessment and LEarning in Knowledge Spaces) is an artificial intelligence-based system for individualized assessment and learning in mathematics and statistics courses and is available 24/7 over the internet.

ALEKS provides your students with the instruction on the topics they are most ready to learn and allows them to build learning momentum. Active use of ALEKS will dramatically increase your students' grade performance and their success in class.

ALEKS allows you to monitor individual and class performance.

Textbook Integration

A broad selection of popular textbooks may be integrated with various ALEKS courses. What happens when you choose a textbook for integration with your ALEKS course?

A custom syllabus based on the textbook is automatically assigned to the ALEKS course so that the coverage aligns with that of the textbook. This may be revised by using the Content Editor or by working with ALEKS Customer Support. References are available on the ALEKS Explain pages, showing students where each topic is covered in their textbook. For McGraw-Hill textbooks, additional assets may also be available such as video clips.

The content of the course is divided into units corresponding to the chapters of your textbook. You can assign due-dates for these units to your students. You can also create chapter quizzes quickly and easily. Combined with chapter completion dates, the quizzes provide your students with motivation to do their work on time while helping them earn a better grade.

Textbook Linking

Another option we provide with less structure than is involved with Textbook Integration is Textbook Linking.

A broad selection of popular textbooks may be linked with courses in ALEKS. You may link up to three different books with any given course. What happens when you choose a textbook for linking with your ALEKS Course?

References are available on the ALEKS Explain pages, showing students where each topic is covered in their textbook. For McGraw-Hill textbooks, additional assets may also be available such as video clips.

iDL Systems

iDL Systems creates and delivers online courses which uniquely adapt to the personal learning needs of each student. This technology was developed through years of [research](#) and "bridges the gap" between Learning Management Systems and online courses. It brings the power of the computer to interact directly with each student, where the student gets immediate feedback on his or her progress. This continuous personal feedback engages the student and leads to very high course completion rates. It also reduces the workload on faculty by cutting back on emails or phone calls to answer student questions.

Adaptive Learning is a pedagogical strategy grounded in years of academic research in the disciplines of cognitive psychology, brain and cognitive science, and artificial intelligence. Its goal is to provide a unique educational experience to each student in an online course by adapting the content to the

student's preferred way of learning. This individualization helps students learn faster, more effectively, and with greater long-term retention.

Until now, online courses have assumed that everyone can learn simply by reading information displayed on a computer screen. If this were true, there would be no need for colleges, universities, schools, or teachers; everyone could go to the library and learn everything they needed to know by reading books.

In fact, different people learn in different ways. iDL understands this simple fact, and has created the only online course authoring system to incorporate **pedagogy** tailored to each individual student.

Learning Styles educators have long understood that different people learn in different ways. Research in brain and cognitive science has borne out this intuitive conclusion.

Educational scientists have developed many learning models to describe the way people learn. From the many tens of models debated in the academic literature, iDL Systems has synthesized five "learning styles" that represent the broad spectrum of ways in which people learn. The learning styles are:

Apprenticeship- Student learns step-by-step, following the lead of the instructor

Incidental- Student learns through case studies or storytelling

Inductive- Student is exposed to a number of examples leading to a conclusion about a general principle

Deductive- Student learns a principle, then applies it to extrapolate trends or observe parametric variation

Discovery- Student learns by conducting experiments, then analyzing the results

In addition to a student's learning style preference, iDL's adaptive learning system also takes into account the student's preference for delivery media - text, audio, video, simulation, etc.- and interactivity. This [three-dimensional](#) approach to teaching ensures that there are many ways to experience an adaptive learning course - enough to let every student learn the way he or she wants to.

As a student progresses through a course, iDL's Adaptive Learning Server continuously collects data on the student's performance, steering the student into the learning style that best fits him or her and ensuring that every student masters the material.

Intelligent Feedback

iDL's Adaptive Learning system offers students a great deal of freedom to navigate their own path through an online course, but it doesn't simply set students adrift on their own.

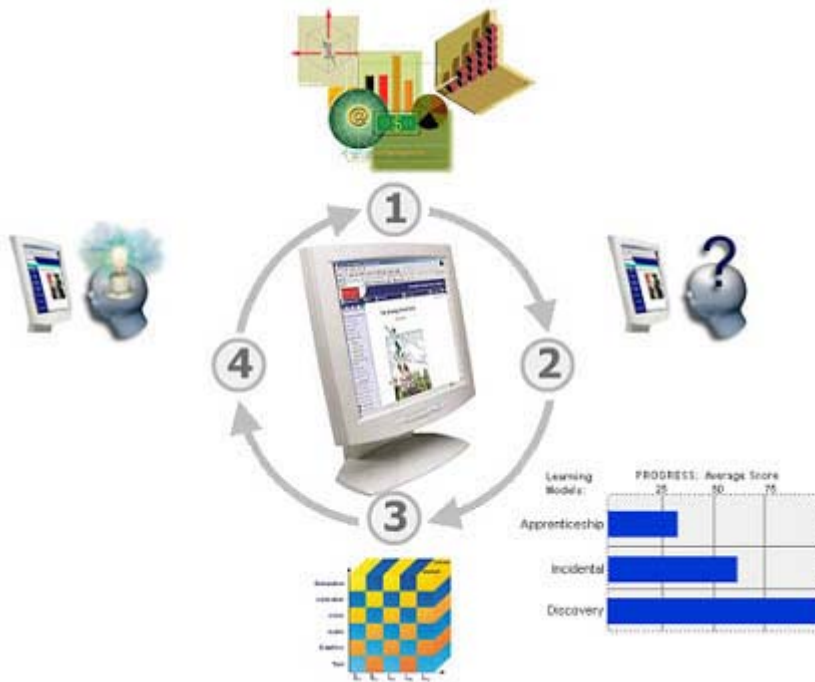
Rather, iDL's Adaptive Learning Server provides continuous, intelligent feedback, guiding students into the learning style that's best for them. The system provides "diagnostic quizzes" after each key concept. The purpose of a diagnostic quiz is not to grade, but to confirm that the student understands the concept.

Intelligent Feedback

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The Adaptive Learning Process:



Step 1: System presents content in initial learning style

Step 2: User takes a diagnostic test

Step 3: System analyzes user performance, identifies concept deficiencies and chooses the best learning model

Step 4: System dynamically creates a remedial course tailored to the user

Step 5: The student takes the remedial course, at the end of which is another quiz (randomly generated) If the student still does not get the concept, he or she is returned to another dynamically generated course presented in a different learning style. At the same time the professor is notified that one of her students is having trouble.

SMARTHINKING's Online Tutoring

Online Math Tutoring Promote your students' success in math by providing tutoring when they need it— even if it's midnight. With SMARTHINKING's Online Tutoring Services, students have 24/7 access to experienced math tutors, 85% of whom have a masters or Ph.D. in math. Our tutors engage students in the learning process by using a virtual whiteboard equipped with a variety of math tools. Students are taught the underlying math concepts, helping them tackle future assignments on their own.

With SMARTHINKING, we've been able to provide academic tutoring at the "teachable moment" for both on and off-campus students. We see this as a complement to our on-campus tutoring services and, thus, it expands the availability for student access to tutoring."

Dr. James M. Shaeffer Dean of Outreach Programs University of North Dakota

Give Your Students the Math Support They Need with SMARTHINKING's Online Tutoring **One-On-One Assistance.** Our tutors provide help at the "teachable moment." Their extensive teaching experience with students of diverse abilities and learning styles enables them to focus on the needs of each student.

Active Learning. Tutors assist students in learning the underlying concepts involved in their math problems; they do not solve the problems for students. Using an online whiteboard for live, real-time collaboration, tutors engage students in the learning process.

Convenient and Easy Access. Our math tutors are available online 24 hours a day, 7 days a week. Students may work with tutors in a "live" session, submit questions in writing and receive a response within 24 hours, or schedule an appointment with a specific tutor.

Increased Faculty Support. With SMARTHINKING providing around the-clock math tutoring, faculty can spend valuable class time focusing on new topics. Faculty can also review individual tutoring sessions and monitor student progress.

Experienced Tutors. Our tutors have substantial teaching experience, and over 85% hold a masters degree or Ph.D. in math. The tutor selection process is rigorous, and, after passing a thorough competency and personal screening, our tutors receive on-going oversight, including pedagogical and technical training.

Math Tutoring is Available for All Students

- Basic Math • Trigonometry
- Algebra • Pre-Calculus
- Geometry • Single-Variable Calculus

SMARTHINKING 1900 L Street NW, Suite 301, Washington, D.C. 20036
888.430.7429 or info@smarthinking.com www.smarthinking.com

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888.430.7429 or info@smarthinking.com www.smarthinking.com

Helpful Student Oriented Web Sites

CPT study Guides

1. **CPT Study Guide** courtesy of Aims Community College, Greeley, CO
<http://www.arapahoe.edu/studentsvcs/testing/elemalg.pdf>

CCD TESTING CENTER

Elementary Algebra Study Guide for the ACCUPLACER Assessment Test

The following sample questions are similar to the format and content of questions on the Accuplacer Elementary Algebra test. Reviewing these samples will give you a good idea of how the test works and just what mathematical topics you may wish to review before taking the test itself. Our purposes in providing you with this information are to aid your memory and to help you do your best.

2. **Santa Fe Community College** Information on CPT preparation (You'll need the Acrobat Reader plug-in to view the files below. <http://admin.santafe.cc.fl.us/%7Eacres/assess/cpt.htm>

[Computerized Placement Testing Pamphlet](#) (PDF)

[Study Guide for the Computerized Placement Tests](#) (PDF file 54K)

[CLM Study Guide](#) (PDF)

[The College Board Accuplacer Study Guide](#)

3. **Introduction for Students from the College Board**

<http://www.collegeboard.com/student/testing/accuplacer/index.html>

The purpose of ACCUPLACER tests is to provide you with useful information about your academic skills in math, English, and reading. The results of the assessment, in conjunction with your academic background, goals, and interests, are used by academic advisors and counselors to determine your course selection. You can not "pass" or "fail" the placement tests, but it is very important that you do your very best on these tests so that you will have an accurate measure of your academic skills.

4. **Springfield Technical CC- CPT guide for students** <http://www.stcc.edu/testing/placement.html>

After a student is accepted to Springfield Technical Community College, the student is required to take placement tests. These tests are designed to reflect the needs of the student in the areas tested. The results of these placement tests are used for scheduling only! No course credit can be earned through Placement Testing.

Practice problems <http://www.stcc.edu/testing/practicemath.html>

Student guide <http://www.stcc.edu/testing/accuplacer.html>

5. **North Florida CPT site** Practice materials for math and English
<http://www.nfcc.edu/stu/testing/files/E6F1A77FDC2D4597A88AF545EAC68EEC.pdf>

6. **Aims CC- CPT guides for all levels**
http://www.aims.edu/student/assessment/study_guides.htm

Math help cites for students

1. **Algebra Basics—Show me how** <http://www.algebasics.com/>

2. **SOS MATH-** <http://www.sosmath.com/index.html>

S.O.S. MATHematics is your free resource for math review material from Algebra to Differential Equations! The perfect study site for high school, college students and adult learners. Get help to do your homework, refresh your memory, prepare for a test, etc.

Browse our more than 2,500 Math pages filled with short and easy-to-understand explanations. Click on one of the following subject areas: [Algebra](#), [Trigonometry](#), [Calculus](#), [Differential Equations](#), [Complex Variables](#), [Matrix Algebra](#), or [Mathematical Tables](#).

You can find topics ranging from [simplifying fractions](#) to the [cubic formula](#), from the [quadratic equation](#) to [Fourier series](#), from the [sine function](#) to [systems of differential equations](#) - this is the one stop site for your math needs.

3. **Mathematics Tutorials and Problems (with applets)** <http://www.anlyzemath.com/>

Free mathematics tutorials to help you explore and gain deep understanding of math topics. The site includes several java applets to investigate [Graphs of Functions, Equations, and Algebra](#). Topics explored are: equations of line, ellipse, circle, parabola, hyperbola; polynomials; graphs of quadratic, rational, hyperbolic, exponential and logarithmic functions; one-to-one and inverse functions and inverse trigonometric functions; systems of linear equations; determinants and Cramer's rule; inverse matrix and matrix multiplication; vectors, complex numbers, polar equations; absolute value function; slope of a line; angle in trigonometry, unit circle, solutions to trigonometric equations; graph shifting, stretching, compression and reflection. Applets used as [Online Math Calculators and Solvers](#) are also included.

4. **THE MOST COMMON ERRORS IN UNDERGRADUATE MATHEMATICS**

<http://www.math.vanderbilt.edu/%7Eeschectex/commerrs/>

This web page describes the errors that I have seen most frequently in undergraduate mathematics, the likely causes of those errors, and their remedies.

5. **Math League Help Topics** <http://www.mathleague.com/help/help.htm>

This is a help resource for 4th through 8th grades. We have just redesigned and reformatted these pages to enable faster loading and display times, but some pages still load slowly. Different browsers display graphics differently, so some math symbols may not appear to line up perfectly in some sentences. Our educational CD-ROMs contain the complete, searchable, indexed help facility shown below, along with the helpful problem-solving tips section. We hope you find this a helpful resource.

6. **Professor Freedman's Help Site** <http://www.mathpower.com/>

This site provides information about basic math, algebra, study skills, math anxiety and learning styles and specifically addresses the needs of the community college adult learner. A student who is frustrated by college math can be helped by identifying his individual learning style and recognizing the instructor's teaching style. This site provides links for students and teachers to information about learning styles, study skills tips, and ways to reduce math anxiety and gives the students access to

tutorials, algebra assignments, math videos, and a forum for discussing with the professor a variety of math topics.

Study skills help sites

1. The Study Skills Help Page Learning Strategies for Success

<http://www.mtsu.edu/~studskl/>

Welcome to the Study Skills Help page created by [Dr. Carolyn Hopper](#), Learning Strategies Coordinator for the University Seminar at Middle Tennessee State University and author of *Practicing College Learning Strategies*, 4th ed., Houghton Mifflin, 2007. If you have questions or comments about the learning strategies course or the help page, please e-mail her:

2. University of Minnesota Daluth-

<http://www.d.umn.edu/kmc/student/loon/acad/strat/index.html>

Study Strategies Homepage Knowing how to study is like knowing how to fish. It's a set of learning [skills](#) that lasts a lifetime and brings many rewards.

3. Dartmouth College study guide-- <http://www.dartmouth.edu/~acskills/success/>

Learning Strategies: Maximizing Your Academic Experience The following pages provide a variety of suggestions and resources for maximizing your academic experience. View an on-line video, read about helpful strategies, or download a handout.

4. Study Guides and Strategies-- <http://www.studygs.net/>

5. Saint Louis College Success in Mathematics <http://euler.slu.edu/Dept/SuccessinMath.html>

Tips on how to study mathematics, how to approach problem-solving, how to study for and take tests, and when and how to get help.

6. Help for Math Anxiety <http://mtsu32.mtsu.edu:11064/anxiety.html> Middle Tennessee Univ.

7. Study Tips from Actual Students Compiled by Daryl Stephens, ETSU Developmental Studies <http://www.etsu.edu/devstudy/MathStudy.htm>

In the spring semester of 1999, I asked my classes to write a few paragraphs about what study habits they used that worked--and what didn't work. Here is a compilation of representative responses, usually in their own words (with some minor editing for grammar, spelling, punctuation, and avoiding some repetition). Since these come from different students, some of the advice may be contradictory. What works for one person may or may not also work for you.

8. How to Be Successful in Developmental Math <http://www.etsu.edu/devstudy/Moeser.htm>

This essay was written by a developmental math student in May, 1999, and is used here with his kind permission.

9. University Of Illinois- Study guide page--

<http://www.vcsa.uic.edu/MainSite/departments/ace/home/strategies.htm>

10. Math For Morons Like Us— <http://library.thinkquest.org/20991/intro.html>

Welcome! This site has been designed to "assist you in your pursuit of increased mathematical understanding," or *whatever sounds good to you*. The subjects covered range from Pre-Algebra to Calculus.

First, a little background. As we worked our way through various math classes throughout the years, we often became confused or lost. Instead of deciding that it might have something to do with all the sleeping and talking we did during class, the teaching style, the pace of the class, or something like that, we figured that it was probably because we were just *morons*. So for those of you who are "morons like us," here's a site that will try to help you understand math concepts better.

This site will hopefully clarify some of those confusing math concepts. You know - the ones that have been waking you up in the middle of the night for so long!

Learn

This is the largest portion of the site - where you will find tutorials, sample problems, and quizzes. Here are a few important notes about this section: Most other sites we've seen attempt to teach things "from the bottom up." This site is designed under the assumption that you know some of the basic concepts but need some reinforcement. Or perhaps you want to review things you learned ages ago. Also, we have included a short quiz after each tutorial so you can test yourself on what you've just learned or reviewed. One other point of clarification: "Algebra" covers elementary algebra, "Algebra II" covers intermediate algebra as well as basic trigonometry, and "Precalc" covers advanced algebra.

11. Algebra Help .com <http://www.algebrahelp.com/>

Algebrahelp.com is a collection of lessons, calculators, and worksheets created to assist students and teachers of algebra.

12. Studying for Math and Science Courses

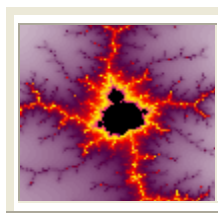
<http://www.sheboygan.uwc.edu/developmental-math/studypla.htm>

STUDENT ORIENTED MATH DEPARTMENT WEB SITES

- 1. GLENDALE CC**
- 2. BROOKDALE CC**
- 3. UNIVERSITY OF WISCONSIN- ROCK COUNTY CC**
- 4. NORTHERN KENTUCKY UNIVERSITY**
- 5. PALM BEACH CC**

Mathematics Department

Room MA-170, Phone 623.845.3655
[Glendale Community College](#)
 6000 W. Olive Ave., Glendale, AZ 85302



Mathematics Chair: Mike Holtfrerich 623.845.3772, [email Mike](#)
Assistant Chair: Anne Dudley 623.845.3389, [email Anne](#), (daytime adjuncts, day issues)
Assistant Chair: Tom Foley 623.845.3652, [email Tom](#), (evening chair, evening adjuncts)
Assistant Chair: John Grima 623.845.4000, [email John](#), (GCC North Campus)
Assistant Chair: Chris Miller 623.845.3841, [email Chris](#), (summer school)
Computer Science: Ken Macleish 623.845.3191, [email Ken](#)

Faculty & Staff	Photo's, email, office, phone#, links to their web pages	$\sum_{n=1}^{\infty} \frac{1}{n^2}$	Math Solution	Free Mathematics help - a great resource!
Placement Tests	Info on preparing for Math placement tests, sample questions	$f'(x) = 0$	Class Schedule	The GCC web site for schedule of Math course offerings
Sculpture @Math	The granite sculpture by the renown Dr. Helaman Ferguson	$m = \frac{\Delta y}{\Delta x}$	Math Sites	Various links in Math, tutorials, fractals, history, ...
Teaching Styles	Teaching style info of faculty, number of exams, types of exams, homework, ...	$\int f(x) dx$	Course Descriptions	Catalog description of all Mathematics courses
Maple Material	Maple manual, worksheets, examples, Calculus software	$\frac{n!}{(n-r)!r!}$	Computer Science	The Computer Science program is part of the Math Dept.

[AMATYC Orlando Conference 2004 Power Point Download \(1.1MB\)](#)

Mission Statement: The mission of the Mathematics and Computer Science Department at Glendale Community College is to prepare our diverse student population to be productive and contributing members of their community with problem solving skills, critical thinking skills and to instruct & motivate students to use the power, beauty, and utility of mathematics and computer science to successfully impact that community for the better.

Additional information on the goals for students, student competencies, and assessment can be found on the [Math Department Mission Page](#).

Some other GCC links:

Page maintained by [Dr. Tom Foley](#) Email: tom.foley@gcmail.maricopa.edu
[Glendale Community College](#) 6000 W. Olive Ave., Glendale, AZ 85302
Page URL: <http://www.gc.maricopa.edu/math> [Legal Disclaimer](#) link.



Math Sites of Interest

[Math Dept.](#), [Glendale Community College](#)

<http://www.gc.maricopa.edu/math/MathInterest.htm>

- Tutorials:

[Algebra Online](#)
[Math Homework Help](#)
[Calculus graphics -- Douglas N. Arnold](#)
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[Roberta Price -- ?Fractals?](#)
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[More Fractal Pictures](#)
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[Mandelbrot pictures](#)

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[Mathematical Quotation Server](#)
[History of Mathematics](#)
[Women Mathematicians](#)
[History of Mathematics: Web Resources](#)
[Women in Math \(WIM\) at UMCP](#)

- Miscellaneous:

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[The Geometry Center Welcome Page](#)
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[Bamdad's Math Comics](#)
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[Welcome to AskERIC](#)
[Mathematical Resources on the Web](#)
[Electronic Sources for Mathematics](#)
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Page maintained by: [Dr. Tom Foley](#)

Tom's email: tom.foley@gcmail.maricopa.edu

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 - [Administration](#)
- * [Math 011/012/015 Resources](#)
 - * [Resources for Faculty](#)
 - * [MATYCNJ](#)
 - * [Course](#)

MATH DEPARTMENT

Brookdale Community College

Brookdale Community College Math Department

Brookdale Community College is located on Route 520, in Lincroft, New Jersey. The Math Department is on the ground floor of the Main Academic North (MAN) building.

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This page provides information about the mathematics department's faculty, course offerings, facilities, and special programs. We have a growing list of links to other math education-related sites on the web. In addition, we have a page devoted to MATYCNJ, the Mathematics Association of Two-Year Colleges of New Jersey. For information about our **math lab**, please click on the bar at the top.

Need help with math? The Bankier Library has terrific page of [helpful math related websites](#). Or you can [click here](#) to see the multimedia collection of videos and CD ROMs that you can take out or view at the library.

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Math 011/012/015 Resources

Here are some great websites for prealgebra topics.

Click on the link you are interested in or copy and paste it into your browser.

Positive and Negative Numbers

http://nlvm.usu.edu/en/nav/frames_asid_161_g_2_t_1.html In “computer mode,” this site shows an addition problem and asks the user to drag out positive and negative chips to represent that problem. Or, in “user mode”, you can type in your own problem. Then you have to put the positive and negative chips together so that they cancel. It’s a lot of fun, and a great way to understand addition of positive and negative numbers.

Fractions

The following website: <http://www.visualfractions.com/> has a number of terrific visual representations for fractions, and the site http://nlvm.usu.edu/en/nav/frames_asid_105_g_3_t_1.html has a great visual for equivalent fractions.

In this site, you must click on the fraction that is not equal to the others:
<http://www.funbrain.com/fract/index.html>

Fractions and Probability Spinner:

http://nlvm.usu.edu/en/nav/frames_asid_186_g_4_t_5.html?open=activities

This site is great for helping you to add fractions:

http://nlvm.usu.edu/en/nav/frames_asid_106_g_3_t_1.html

Finding prime numbers with the sieve of Eratosthenes:

http://nlvm.usu.edu/en/nav/frames_asid_158_g_4_t_1.html?open=instructions

For fun: Golden ratio activities <http://cuip.uchicago.edu/~dlrain/golden/activities.htm>

Pascal's triangle activity for coloring multiples

http://www.shodor.org/interactivate/activities/ColoringMultiples/?version=1.5.0_08&browser=Mozilla&vendor=Sun_Microsystems_Inc

and http://nlvm.usu.edu/en/nav/frames_asid_181_g_4_t_1.html?open=activities

Studying for Math and Science Courses

University of Wisconsin Rock County

<http://www.sheboygan.uwc.edu/developmental-math/studypla.htm>

Updated 5/06/2006 jemiller@uwc.edu

Kim Kostka

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Topics for discussion

- A. [Common Sense Tips](#)
- B. [Organizing Yourself](#)
- C. [Optimizing the Use of a Math or Science Textbook](#)
- D. [Working with Faculty and Tutors](#)
- E. [Working with Study Groups Outside Class](#)

Create your own study plan here

Course:	Lecture time:
Designated study/homework time:	
Times I can meet with my instructor:	

Times I can meet with my tutor:

List three things you plan to do to improve your study habits for this course:

A. Common Sense Tips

1. Maximize the number of times you encounter material in your classes. Attending class is obvious, but do read the assignment before class, review notes after class, work homework problems, study with others, read your text after class, etc.
2. Come to class! On time! Most instructors announce important details at the beginning of class (like important things to know about the next quiz or lab, etc).
3. Prepare yourself for class. Knowing what it is that you need to get out of the class that day will help keep you alert to what is happening and keyed in to what your instructor is saying. Bring along some questions or problems that you encountered in your preparation and use these as focal points.
4. Have your mind engaged during class time. Take an active role. Do what you can to keep your mind from wandering...take notes, scribble questions in your notebook, answer questions asked of the class, etc.
5. Review your notes soon after class. Make notes on your notes...things to look out for, things you need to clarify, etc.
6. Do your homework regularly and often. Cramming is not an effective study strategy in math and science courses where so much new material builds on old material.
7. Set aside the time you need to complete your homework assignments. Don't wait for some time to appear (it seldom does)...write it into your schedule.
8. Remember that only you can learn for yourself. Take responsibility for what you need to accomplish and then set out to do that.

[Back to Topic List](#)

B. Organizing Yourself

1. Your organization plan must be individualized. It should work for you and be effective.
2. Learn about your personal learning style and use it to guide your study plans and habits. Try out a learning style questionnaire at one of these web sites:

<http://www2.ncsu.edu/unity/lockers/users/f/felder/public/ILSdir/ilsweb.html>

3. Set realistic goals and then follow through. If you develop an elaborate but unworkable plan, you've wasted good time.
4. Use course materials wisely. Keep a course schedule handy. Keep homework, quizzes, and exams to study from. Store handouts effectively for your reference.
5. Some suggestions for organizing notes and course content for effective study:
 - a) Flashcard method
 - b) 2-page note-taking system
 - c) 3-column note-taking system
 - d) Use color! Colored pencils, etc. can be coded for certain ideas.

- e) Use post-it note flags to highlight segments of your notes, textbook, etc.
 - f) Others that come to mind?
6. Notetaking is an interactive experience! Leave room to add comments later. Rewrite class notes so that they make more sense, are organized to fit your needs, and are neat enough to use for future study.

[Back to Topic List](#)

C. Optimizing the Use of a Math or Science Textbook

Before Class...

1. Science and math texts are organized in chapters and sections. Be sure you know which sections you are responsible for!
2. Read your textbook assignment before coming to class...even if you don't understand it. This time allows you to identify which topics are easy for you, which will need more focus.
3. Study the examples in your textbook and try a few before class. This helps you identify problems you may have with the material and optimize class time.

During Class...

1. Ask your professor if the textbook should come to class with you. Some instructors rely on you having your textbook for examples, etc.; others don't.
2. Use sticky notes, tape flags, bookmarks, ribbons, etc. to mark sections for your reference.

After Class...

3. Review the textbook passages that were assigned for that day. Are things clearing up for you? Or do you need more help outside of class to understand the ideas?
4. Examine worked examples in the reading. You will probably need to fill in the details about steps that are missing (or oversimplified). Work these problems out to fill in the details.
5. Dig in to the assigned homework problems. Follow your instructor's directions. If you are short of time, make sure you sample problems from each of the different groups of assigned problems.

Be aware that there may be several alternate solutions to some problems. You will want to discuss those with your instructor to be sure they really work in all cases!

[Back to Topic List](#)

D. Working with Faculty and Tutors

1. Instructors want to see you! Please come talk to us so we're not all alone during scheduled office hours.
2. Know when your instructor's office hours (or tutor schedule) are. Write them into your weekly schedule. Make an appointment with the instructor if you cannot make the scheduled office hours.
3. Feel free to stop faculty and staff to ask questions anytime, anyplace. If we're too busy to answer now, we'll try to schedule an appointment that we can both make.
4. It's good to ask your questions! The instructor will not think you are dumb for asking; in fact, we are more likely to think the opposite.
 - There is no grade penalty for asking a question; it may in fact help.
 - Your questions help the instructor to determine what the class is confused about.
 - The instructor will get to know you better as a person.
5. Be prepared with specific questions.
6. Write them down so you don't forget. This is especially true when you have more than one question.
7. Tell the instructor at the outset what you plan to ask about. This helps to evaluate the overall picture and the instructor may recognize related problems.
8. Expect to work during this time. An office hour is not a lecture, and this is a benefit. You and the instructor get to work together to try to answer your specific concerns. You will likely be asked to work out some problems or to think about some concept further. Keep in mind that this is an opportunity to learn; it is not a test.
9. What's different about seeing a tutor?
 - The tutor is not an expert on the subject matter and is not expected to teach you everything. The tutor will help you to work through problems.
 - It's even more important to come prepared--identify your questions before going to see the tutor.
 - Tutors may know some great tricks that helped them to learn the subject.
 - Tutors may schedule study or review sessions. Ask about it! Nothing will get organized without some expression of interest or need.

Tutors at UW Rock County are free and are made available in response to need. If you would like a tutor in a subject where there isn't one now, ask for one. Just because there isn't one doesn't mean there can't be one.

[Back to Topic List](#)

E. Working with Study Groups Outside Class

1. Study groups can really help, but they may not be the right thing for everyone.
2. Study groups should supplement your study time, rather than substitute for it.

3. Give yourselves a name with a positive identity. Plan to succeed.
4. Set a plan or specific agenda for each meeting.
5. Be prepared for the meeting by looking over the material first. Have your questions ready.
6. Share leadership duties and responsibilities.
7. Be courteous and supportive of each other

Other websites with developmental math information are available on the Internet

Developmental Math Program

UW Colleges

Updated 5/4/2006

Janette Miller

Developmental Math Coordinator

Developmental Math home

Learning Styles: Do you know your own **learning style**? Try taking the [Index of Learning Styles Questionnaire](#). This website from North Carolina State University contains a free survey for analyzing your personal preferred learning styles. Take the survey and use the results with written descriptions of various learning styles. What's your style?

Free Arithmetic Course (<http://www.onlinecollegeprep.com/FreeArithmetic/index.html>)

This free and semi-interactive arithmetic course is offered by H&H Publishing. You can use it to review specific topics or to take a full arithmetic course independently.

The Math Nerds: Free Help with Math (<http://www.mathnerds.com>). This is a free internet service that gives you access to a network of volunteer mathematicians for help when you are stuck on a math assignment. Your questions will be answered by e-mail within a couple days. Expect to receive hints and suggestions rather than complete answers.

The Math Forum (<http://www.mathforum.com>) is another site you can visit for help. The FAQ pages may already have the answer to your question, or you can try Ask Dr. Math.

Coolmath.com (<http://www.coolmath.com>) is a good math site to explore for fun and games, and yes, also a few interesting lessons (see the Ages 13-100 section).

AplusMath.com (<http://www.aplusmath.com>). This site has flashcards and games for help on basic math skills such as decimal and fraction arithmetic. You can create worksheets to help improve weak areas.

The Mathematical Association of America ([MAA](#))

☛ MAA page on [Teaching Developmental Math](#)

☛ [Project CLUME](#) (Cooperative Learning in Mathematics Education)

☛ MAA has a developmental math e-mail discussion group: See the MAA site for [information on joining](#)

The American Mathematical Association of Two Year Colleges ([AMATYC](#))

☛ AMATYC also has a developmental math e-mail discussion group: [MATHEDCC](#)

☛ The Wisconsin Section ([WisMATYC](#)) holds a Fall conference each year in conjunction with their annual meeting.

The National Center for Developmental Education (<http://www.ced.appstate.edu/centers/ncde/>) has information on training and education for professionals in the field of developmental education, as well as access to related research data.



The Math Center

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095 and 099 Review and Solutions	Printable Graph Paper
Math Goodies	Time Management
Math Anxiety Bill of Rights	Prof. Freedman's Math Power
Multiplication Table	Math.com Calculators
The Math Forum - Ask Dr. Math	Yahooligans! - School Bell: Math

To find out more:
Come see us in FH 201,
Call us at 572-5779, or
E-mail us at: wellsb2@nku.edu

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RunningStart Program at Northern Kentucky University
If you need 1 or more developmental courses, check out the schedule for RunningStart.

RunningStart is a collection of learning communities for students with ACT scores under 18 in Math, Reading and/or Writing. Many first-year students need to improve their skills or knowledge before taking a full load of college-level courses. *RunningStart* provides these students with a block of carefully scheduled classes with extra academic attention and support during their first college semester.

Courses Offered Include:

MAH 080: "Mathematics Assistance" offers supplementary instruction paired with selected developmental mathematics courses.

MAH 090: "Basic Mathematical Skills" is a prealgebra course for students who never took algebra in high school or who not have the computational skills needed to be successful in MAH 095.

MAH 095: "Beginning Algebra" includes topics covered in a first year algebra course. If students are required to take MAH 095, they must also successfully complete MAH 099 before they may register for college level math courses. (3 credit hours)

ENG 090: "Writing Workshop" instructs students to write papers in a variety of forms and guides them through the writing process. (3 credit hours)

LAP 091: "Reading Workshop" provides students with practice and instruction in literate behaviors, reading strategies/processes, and critical/creative responses to books read. (3 credit hours)

LAP 090: "Academic Assistance" offers supplementary instruction paired with different course. Offered on a pass/fail basis. (1 credit hour)

***RunningStart* features . . .**

- Classes with only 20 students — even in math!
- Tutoring built into students' schedules
- Special workshops or convocations to enhance students' academic skills and/or personal growth
- Convenient Monday, Wednesday, Friday or Tuesday, Thursday block schedules
- Opportunity to make new friends quickly in special learning communities
- Only 200 students
- All *RunningStart* students are strongly encouraged to enroll in UNV 101

How Do I Sign Up?

See the published Schedule of Classes and talk to your advisor at Orientation and register on-line through Norse Express. For more information about the *RunningStart* program, contact Diane Williams, Director of Developmental Mathematics, williamsd@nku.edu or (859)572-6473.



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[Home](#) > CPT Test Prep

CPT Test Review and Practice

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- [Study Aids](#)
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> [Basic Algebra 1 Review and Practice](#)

> [Basic Algebra 1 Review and Practice Keys](#)

> [Basic Algebra 2 Review and Practice](#)

> [Basic Algebra 2 Review and Practice Keys](#)

> [Study Aids](#)

> [Online Resources](#)

> [Acrobat Reader](#)

[Home](#) > Resources

Student Resources at Lake Worth

Basic Algebra I & II :

Strategy Seminars

Prep Seminars

MAT 0012 Basic Algebra I	MAT 0020 Basic Algebra II
<ul style="list-style-type: none"> ● Homework Assignments ● Homework Supplements: <ul style="list-style-type: none"> ○ Section 2.5 ○ Section 6.1 ○ Section 6.5 ● Lab Assignment Sheets: <ul style="list-style-type: none"> ○ Test 1 ○ Test 2 ○ Test 3 ○ Test 4 ○ Test 5 ● Computer Labs ● Vocabulary Checks ● Comprehensive Review ● Practice Final 	<ul style="list-style-type: none"> ● Homework Assignments ● Homework Supplements: <ul style="list-style-type: none"> ○ R & P Handout ○ R & P Worksheet ○ Sections 4.1-4.2 ○ Section 5.8 ● Lab Assignment Sheets: <ul style="list-style-type: none"> ○ Test 1 ○ Test 2 ○ Test 3 ○ Test 4 ○ Test 5 ● Computer Labs ● Vocabulary Checks ● Comprehensive Review ● Practice Final

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[Home](#) > [Resources](#) > Study Aids

> [Prep Math Home](#)

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> [Prep Math Orientation](#)

> [CPT Test Prep](#)

> [Key Concept Reviews](#)

> [Basic Algebra 1 Review and Practice](#)

> [Basic Algebra 1 Review and Practice Keys](#)

> [Basic Algebra 2 Review and Practice](#)

> [Basic Algebra 2 Review and Practice Keys](#)

> [Study Aids](#)

> [Online Resources](#)

> [Acrobat Reader](#)

<i>MAT 0012 Basic Algebra 1</i>	<i>MAT 0020 Basic Algebra 2</i>
<ul style="list-style-type: none"> • Operations with Integers • Algebraic Expressions • Steps for Solving Equations • Translating Key Words and Phrases • Divisibility Rules • Finding the LCD • Adding & Subtracting Fractions • Multiplying & Dividing Fractions • Rounding Decimals • Operations with Decimals • Converting Percents • Solving Percent Problems • Geometric Formulas • Pythagorean Theorem • Ratio and Proportion • Graph Paper • Multiplication Tables 	<ul style="list-style-type: none"> • Operations with Integers • Algebraic Expressions • Steps for Solving Equations • Translating Key Words and Phrases • Solving Percent Problems • Solving Formulas • Ratios, Rates & Proportions • Inequalities • Graphing Linear Equations • The Slope of a Line • Graph Paper • Graph Paper with Tables • Rules for Exponents • Polynomial Division • Factoring Strategy • Greatest Common Factor • Factoring Trinomials: $x^2 + bx + c$ • Factoring by Grouping

Vocabulary and Glossaries

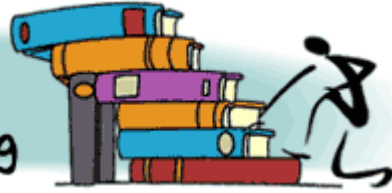
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[Multilingual Math Glossary](#)

[Spanish Glossary of Math Terms](#)



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[Managing Your Time & Study Environment](#)



[Reading College Texts](#)



[Listening, Note-Taking, and Using Visual Organizers](#)



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[Getting the Big Picture / Dealing with Details](#)



[Breaking Tasks into Meaningful Chunks](#)



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[Memory and the Importance of Review](#)

Appendix A: Mathematics Knowledge and Skills for Success From Conley and Bodone (2002)

The key knowledge and skills considered to be necessary for success in mathematics include the following:

- Computation
 - The student will know basic mathematics operations by being able to:
 - Use arithmetic operations with fractions;
 - Use exponents and scientific notation;
 - Use whole numbers to perform all basic arithmetic operations, including long division with and without remainders;
 - Use radicals correctly;
 - Understand relative magnitude and absolute value;
 - Know terminology for real numbers, such as irrational numbers, natural numbers, integers, and rational numbers; and
 - Use the correct order of arithmetic operations;
 - The student will know and carefully record symbolic manipulations.
 - The student will know and demonstrate fluency with mathematical notation and computation by being able to:
 - Perform addition, subtraction, multiplication and division;
 - Perform appropriate basic operations on sets; and
 - Recognize alternative symbols (e.g., Greek letters).

- Algebra
 - The student will know and apply basic algebraic concepts by being able to:
 - Use the distributive property to multiply polynomials;
 - Multiply and divide polynomials;
 - Factor polynomials;
 - Add, subtract, multiply, divide, and simplify rational expressions including finding common denominators;
 - Understand properties and basic theorems of roots and exponents; and
 - Understand properties and basic theorems of logarithms.
 - The student will use various techniques to solve basic equations and inequalities by being able to:
 - Solve linear equations and absolute value equations;
 - Solve linear inequalities and absolute value inequalities;
 - Solve systems of linear equations and inequalities using algebraic and graphic methods;
 - Solve quadratic equations using various methods and recognize real solutions by being able to:
 - Use factoring and zero products;
 - Use completing the square; and
 - Use the quadratic formula.
 - The student will be able to recognize and use basic algebraic forms by being able to:
 - Distinguish between expression, formula, equation, and function and recognize when simplifying, solving, substituting in, or evaluating is appropriate;
 - Determine whether a relation is a function;
 - Understand applications;
 - Use a variety of models to represent functions, patterns, and relationships;
 - Understand terminology and notation used to define functions; and
 - Understand the general properties and characteristics of many types of functions (e.g., direct and inverse variation, general polynomial, radical, step, exponential, logarithmic, and sinusoidal).
 - The student will understand the relationship between equations and graphs by being able to:

- Understand slope-intercept form of a equation of a line and graph the line;
- Graph a quadratic function and recognize the intercepts as solutions to a corresponding quadratic equation; and
- Know the basic shape of the graph of an exponential function.
- The student will know how to use algebra both procedurally and conceptually by being able to:
 - Recognize which type of model best fits the context of a situation.
- The student will demonstrate ability to algebraically work with formulas and symbols by being able to:
 - Understand formal notation and various applications of sequences and series.
- Trigonometry
 - The student will know and understand basic trigonometric principles by being able to:
 - Know the definitions of the trigonometric ratios—sine, cosine, and tangent—using right triangle trigonometry and position on the unit circle;
 - Understand the relationship between a trigonometric function in standard form and its corresponding graph;
 - Know and use identities for sum and difference of angles;
 - Recognize periodic graphs;
 - Understand concepts of periodic and exponential functions and their relationships to trigonometric formula, exponents, and logarithms;
 - Solve problems using exponential models; and
 - Understand and use double and half angle formulas.
- Geometry
 - The student will know synthetic (i.e., pictorial) geometry by being able to:
 - Use properties of parallel and perpendicular lines in working with angles;
 - Know triangle properties;
 - Understand the concept of mathematical proofs, their structure and use;
 - Use geometric constructions to complete simple proofs, to model, and to solve mathematical and real- world problems; and
 - Use similar triangles to find unknown angle measurements and lengths of sides.
 - The student will know analytic (i.e., coordinate) geometry by being able to:
 - Know geometric properties of lines;
 - Know the equations for conic sections;
 - Use the Pythagorean Theorem and its converse and properties of special right triangles to solve mathematical and real-world problems;
 - Use transformations of figures to graph simple variations of equations for basic graphs;
 - Set up appropriate coordinate system for applications; and
 - Understand vectors in mathematical settings.
 - The student will understand the relationships between geometry and algebra by being able to:
 - Know how to manipulate conics;
 - Understand that objects and relations in geometry correspond directly to objects and relations in algebra; and
 - Solve real-world problems using three-dimensional objects.
 - The student will demonstrate geometric reasoning by being able to:
 - Prove congruency of triangles; and
 - Use inductive and deductive reasoning to make observations about and to verify properties of and relationships among figures.
 - The student will be able to combine algebra, geometry, and trigonometry by being able to:
 - Understand and use the law of sines and the law of cosines; and
 - Use properties of and relationships among figures to solve mathematical and real-world problems.
- Mathematical Reasoning
 - The student will demonstrate an ability to solve problems by being able to:

- Use inductive reasoning;
- Demonstrate ability to visualize;
- Use multiple representations to solve problems;
- Use a framework or mathematical logic to solve problems that combine several steps;
- Use a variety of strategies to understand new mathematical content and to develop more efficient solution methods or problem extensions; and
- Construct logical verifications or counter examples to test conjectures and to justify algorithms and solutions to problems.
- The student will understand various representations by being able to:
 - Understand abstract mathematical ideas in word problems, pictorial representations, and applications.
- The student will demonstrate a thorough understanding of mathematics used in applications by being able to:
 - Understand the concept of a function.
- The student will demonstrate strong memorization skills by being able to:
 - Know a variety of formulas and short proofs.
- The student will know how to estimate by being able to:
 - Understand the relationships among equivalent number representations;
 - Know when an estimate or approximation is more appropriate than an exact solution for a variety of problem situations; and
 - Recognize the validity of an estimated number.
- The student will understand the appropriate use of technology by being able to:
 - Know the appropriate uses of calculators and their limitations;
 - Perform difficult computations using a calculator;
 - Know how to use graphing calculators;
- The student will be able to generalize (e.g., to go from general to abstract and back and to go from specifics to abstract and back) by being able to:
 - Determine the mathematical concept from the context of a real-world problem, solve the problem, and interpret the solution in the context of the real-world problem.
- The student will be willing to experiment with mathematics by being able to:
 - Understand that math problems can have multiple solutions and multiple methods to determine the solution(s).
- Students will emphasize process over mere outcome(s) by being able to:
 - Understand the various steps to a solution.
- The student will show ability to modify patterns and computations for different situations by being able to:
 - Compare a variety of patterns and sequences.
- The student will use trial and error to solve problems by being able to:
 - Find the way(s) that did not work to solve a problem and finally find the one(s) that do work.
- The student will understand the role of mathematics by being able to:
 - Know the relationship between the various disciplines of math; and
 - Understand the connections between mathematics and other disciplines.
- The student will use mathematical models by being able to:
 - Use mathematical models from other disciplines.
- The student will understand the need to be an active participant in the process of learning mathematics by being able to:
 - Ask questions throughout multistep projects, recognizing natural questions arising from a mathematical solution;
 - Use appropriate math terminology; and
 - Understand that mathematical problem solving takes time.
- The student will understand that mathematics is a symbolic language and that fluency requires practice by being able to:

- Translate simple statements into equations; and
- Understand the role of written symbols in representing mathematical ideas and the precise use of special symbols of mathematics.
- Statistics
 - The student will understand and apply concepts of statistics and data analysis by being able to:
 - Select and use the best method of representing and describing a set of data;
 - Understand measures of central tendency and variability and their application to specific situations; and
 - Understand different methods of curve- fitting and various applications.

Appendix B: Level of Proficiency Associated With ACCUPLACER³ Cutoff Scores

Level of Proficiency Associated With ACCUPLACER Cutoff Scores

Arithmetic Proficiency	Elementary Algebra Proficiency	College-level Mathematics Proficiency
Score of 38–64	Score of 28–43	Score of 39 or less
<p>Students at this level have minimal arithmetic skills. These students can:</p> <ul style="list-style-type: none"> • perform simple operations with whole numbers and decimals (addition, subtraction, and multiplication) • calculate an average, given integer values • solve simple word problems • identify data represented by simple graphs 	<p>Students at this level have minimal pre-algebra skills. These students demonstrate:</p> <ul style="list-style-type: none"> • a sense of order relationships and the relative size of signed numbers • the ability to multiply a whole number by a binomial 	<p>These students should take the elementary algebra test before any placement decisions are finalized.</p>
Score of 65–92	Score of 44–81	Score of 40–62
<p>Students at this level have basic arithmetic skills. These students can:</p> <ul style="list-style-type: none"> • perform the basic arithmetic operations of addition, subtraction, multiplication, and division using whole numbers, fractions, decimals, and mixed numbers • make conversions among fractions, decimals, and percents 	<p>Students scoring at this level have minimal elementary algebra skills. These students can:</p> <ul style="list-style-type: none"> • perform operations with signed numbers • combine like terms • multiply binomials • evaluate algebraic expressions 	<p>Students scoring at this level can:</p> <ul style="list-style-type: none"> • identify common factors • factor binomials and trinomials • manipulate factors to simplify complex fractions <p>These students should be considered for placement into intermediate algebra. For further guidance in placement, have these students take the elementary algebra test.</p>
Score of 93–109	Score of 82–108	Score of 63–85
<p>Students at this level have adequate arithmetic skills.</p>	<p>Students at this level have sufficient elementary algebra</p>	<p>Students scoring at this level can demonstrate the following</p>

³ College Placement Exam

Arithmetic Proficiency	Elementary Algebra Proficiency	College-level Mathematics Proficiency
<p>These students can:</p> <ul style="list-style-type: none"> estimate products and squares of decimals and square roots of whole numbers and decimals solve simple percent problems of the form $p\%$ of $q = ?$ and $?\%$ of $q = r$ divide whole numbers by decimals and fractions solve simple word problems involving fractions, ratio, percent increase and decrease, and area 	<p>skills. By this level, the skills that were beginning to emerge at a “total right score” of 57 (i.e. 57 correct) have been developed. Students at this level can:</p> <ul style="list-style-type: none"> add radicals, add algebraic fractions, and evaluate algebraic expressions factor quadratic expressions in the form $ax^2 + bx + c$, where $a = 1$ factor the difference of squares square binomials solve linear equations with integer coefficients 	<p>additional skills:</p> <ul style="list-style-type: none"> work with algebraic expressions involving real number exponents factor polynomial expressions simplify and perform arithmetic operations with rational expressions, including complex fractions solve and graph linear equations and inequalities solve absolute value equations solve quadratic equations by factoring graph simple parabolas understand function notation, such as determining the value of a function for a specific number in the domain a limited understanding of the concept of function on a more sophisticated level, such as determining the value of the composition of two functions a rudimentary understanding of coordinate geometry and trigonometry <p>These students should be considered for placement into college algebra or a credit-bearing course immediately preceding calculus.</p>
<p>Score of 100+</p> <p>Students at this level have substantial arithmetic skills. These students can:</p> <ul style="list-style-type: none"> find equivalent forms of fractions estimate computations involving fractions solve simple percent problems of the form $p\%$ of $? = r$ solve word problems involving the 	<p>Score of 109+</p> <p>Students at this level have substantial elementary algebra skills. These students can:</p> <ul style="list-style-type: none"> simplify algebraic expressions factor quadratic expressions where $a = 1$ solve quadratic equations 	<p>Score of 86–102</p> <p>Students scoring at this level can demonstrate the following additional skills:</p> <ul style="list-style-type: none"> understand polynomial functions evaluate and simplify expressions involving functional notation, including composition of functions solve simple equations involving:

Arithmetic Proficiency	Elementary Algebra Proficiency	College-level Mathematics Proficiency
<ul style="list-style-type: none"> manipulation of units of measurement • solve complex word problems involving percent, average, and proportional reasoning • find the square root of decimal numbers • solve simple number sentences involving a variable 		<ul style="list-style-type: none"> • trigonometric functions • logarithmic functions • exponential functions <p>These students can be considered for a pre-calculus course or a non-rigorous course in beginning calculus.</p> <p style="text-align: center;">Score of 103+</p>

APPENDIX C
APPLICATION FOR SABBATICAL LEAVE

Name Theodore Panitz

College Cape Cod Community College

Work Area Mathematics Department

Number of years of seniority in the collective bargaining unit 30

Number of years since last previous sabbatical 30

Type of Sabbatical applying for- Half year full salary

Date on which proposed sabbatical would begin Jan 26 2007

A. What activities will you do during the proposed sabbatical leave and what goals are these intended to achieve?

In conjunction with the college's focus on improving student retention I propose to investigate successful strategies, programs and courses that have been developed by other community and state colleges in Massachusetts and nationally that are designed to improve student success and retention in developmental mathematics courses. The overall goal of the sabbatical is to identify programs or interventions that the Cape Cod Community College math department might consider for adoption or adaptation in order to help improve student retention in our developmental math courses. My investigation will not be limited strictly to mathematics courses or programs but will include areas such as advising, registration, tutoring, etc. where these activities have a strong impact on developmental math students.

The Board of Higher education released a report on completion rates for community colleges based upon the Fall HEIRS report (see attached) which identified four colleges in particular that have high completion rates for developmental math courses. They are: Berkshire, Bristol, BunkerHill and Quinsigamond community colleges. As one of my activities I will visit these colleges during my sabbatical to interview faculty members and administrators in order to determine why their success rates are consistently high.

I have developed many contacts with other math faculty throughout the state as the former president of NEMATYC (New England Mathematical Association of Two Year Colleges) and as a current executive board member serving as the membership committee chairperson. I am also active in the national math association for two year colleges (AMATYC) and have developed numerous contacts through the AMATYC Developmental Math Committee.

Activities:

1. Initially I plan to contact faculty at all 15 Massachusetts community colleges via email to survey them in order to identify programs they have developed that have improved student success and retention in those developmental math courses which they have determined to be successful through research or statistical analysis. I will also contact state college faculty seeking the same information. State colleges

offer developmental course that generally start at a higher level than community colleges. However, if their courses start at the Intermediate Algebra level they may have found activities and interventions that are successful in retaining students at this level. In addition I will survey the 15 Massachusetts community colleges to determine how they offer their developmental math courses in terms of credits required, contact hours, alternative programs such as computer assisted instruction, math labs, etc.

2. I will explore college web sites nationally. A preliminary Google search has yielded several successful developmental math programs created by community colleges in other states, such as the Maricopa CC mathematics program.
3. I will conduct interviews with faculty responsible for developing or coordinating successful retention programs in other states in order to solicit their personal reflections and experiences with these programs and to request written documentation that describes in detail how their programs operate, what their experiences have been over time, and what modifications they have made since implementing specific retention programs.
4. I will visit other community college campuses in the state, beyond the four indicated above, and outside of the state, where appropriate, to gain first hand exposure to and knowledge of how programs have been implemented.

Sabbatical results:

1. I will issue a written report for the math department faculty that will be available college wide. The report will describe each of the successful retention programs identified through my investigation.
2. I will present the results of my investigation in the following forums;
 - a. A 4C's brown bag lunch
 - b. At 4C's College professional day- if appropriate to the topic of the day
 - c. I will submit a proposal to the state wide community college conference
 - d. Pending funding availability to attend outside conferences I will submit proposals to present my results at the annual NEMATYC and AMATYC conferences.

B. How will the proposed sabbatical meet the following criteria listed in section 9.0112 of the collective bargaining agreement?

(a) That the objectives of the sabbatical leave, if attained, would substantially contribute to the professional growth of the unit member?

In recent years my workload has focused extensively on developmental courses, namely elementary and intermediate algebra. I believe that information I obtain through my investigation will lead to changes within my courses that will improve my student's success and retention. My experiences in attending national and state math conferences has been that there are many interesting and proven activities and programs available at other colleges that could be adopted outright or adapted to meet the needs of our students by myself and other 4C's faculty. Some of the retention ideas may also apply outside of the math department to the college as a whole.

(b) That the objectives of the sabbatical leave, if attained, would assist the unit member in substantially contributing to the institutional needs and attainment of institutional purposes.

The HEIRS report indicates that CCCC's success rate in developmental math courses is among the lowest of the 15 community colleges. The Vice President of the college and Dean of the division requested the math department discuss these results with an eye toward improving our retention and completion rates in the developmental math area. My study will go a long way toward accomplishing this goal by identifying successful programs at other colleges, specifically what course changes have been accomplished and/or what interventions were made with the students to help insure their success.

(c) That the unit member has the ability to achieve the goals of the project of plan based on the unit member's past experience and formal educational background.

As stated above I have developed many contacts with faculty at other community colleges through my involvement with NEMATYC and AMATYC. It is through these contacts that I will obtain information about other college retention programs or who the appropriate contact person is at these colleges.

I am a member of numerous education related discussion groups on the internet sponsored by groups such as the AAHE. These groups exchange helpful information about teaching and learning. I have surveyed these groups previously and have obtained excellent responses about subjects such as teaching techniques, mathematics questions, teaching experiences with student centered learning, etc. I expect that a request to these discussion groups will yield many interesting and helpful responses.

(d) That the attainment of objectives of sabbatical leave as proposed are realistic in terms of time, costs, and other related variables.

I have made a preliminary internet search for innovative programs in mathematics and have found a number of successful retention programs. I am confident that as I continue to refine my search process I will be able to identify programs that are specifically oriented toward developmental mathematics students.

Through my participation in NEMATYC and AMATYC conferences I have attended sessions devoted to improving student success in developmental math classes. I have personally adopted a number of ideas into my classes that I can report on and have maintained the contact information from these sessions. I will be able to contact the presenters to obtain additional information and the success of their approaches.

Appendix D- Case Study- How a 1 credit Math Lab Was created at the University of New Mexico - Valencia Campus

A MENU-DRIVEN DEVELOPMENTAL MATHEMATICS LABORATORY

How to build a better math lab!!!

Do you think that your students should spend more time doing mathematics problems? Should they spend time using calculators, software, manipulatives or some combination of these to learn mathematics? Would you prefer that your students work individually or cooperatively? Should their writing in class be journal entries, reports on famous mathematicians, or descriptions of how to do problems? Do videos have any place in the mathematics classroom? Imagine a situation where you have sixteen extra hours each semester in which to incorporate any enrichment or extra practice activities into your teaching. What would you do? In order for students and faculty to buy into our new developmental mathematics laboratory, we ask ourselves these questions and others on an ongoing basis. Our collective answers to these questions form the very exciting developmental mathematics laboratory at the University of New Mexico - Valencia Campus. The road to obtaining our developmental mathematics laboratory, however, was a little rocky. Its implementation once we received permission to create it has also been both exciting and problematic. My goal in documenting our curriculum development is to share with other professionals in the field one of the most exciting experiences in my career.

When the University of New Mexico - Valencia Campus surveyed the other post-secondary institutions in the state of New Mexico, we found that the Developmental Mathematics courses at a vast majority of the institutions in our state are four or five credit hour courses. For years we had offered two different three credit hour courses in Developmental Mathematics: Basic Mathematics (arithmetic) and Introductory Algebra. The prospect of adding a required mathematics laboratory to each of our developmental mathematics classes created quite a debate within the Mathematics Department and across the campus. For years the faction that believed "If it ain't broke, don't fix it" triumphed. They argued that our graduates from the developmental mathematics classes were successful in Intermediate Algebra. Expanding the number of credit hours of each class would only create scheduling problems for both students and faculty. It might even decrease our enrollment, since our nontraditional students would have to arrange their work schedules, their child care, and their other courses around the added requirement. Why put more money into changing a program that already worked? In the face of our limited budget, this was the hardest argument to counter, since other areas in the mathematics program were in dire need of funds.

A patient minority argued for more time to teach. Part of this group lamented that as they incorporated cooperative learning groups, mathematics manipulatives, and other activities into class, the syllabi became harder and harder to complete. Another part of the group wanted more time to lecture. For every argument there seemed to be an equally strong counter argument. If developmental courses carried more credit, students could register for full-time status in developmental courses rather than trying to fill out their program of studies with courses for which they might not have adequate academic maturity. On the other hand, if developmental courses carried more credit, students might run out of financial aid before finishing their program of studies.

While the Developmental Studies debate raged, other areas within the Mathematics Department received much needed attention. We acquired mathematics manipulatives, fraction calculators, and video tapes for the pre-service elementary teachers. We purchased classroom sets of graphics calculators for the college algebra and calculus students. In fact, we amassed quite a library of mathematics learning materials. As Coordinator of the Mathematics Program, I dispersed materials using a primitive checkout procedure from the shelves of my office to any faculty member or student who wanted to play with our mathematics toys. The need for a better place to house our materials became all too evident as I attempted to function in my office. We proposed and were given a classroom with two huge cabinets to house our learning materials: the Mathematics Environment. We filled the room with tables, covered the walls with mathematics posters, and scheduled both Developmental Mathematics courses as well as courses for preservice elementary teachers in this environment.

To address the needs of the ever increasing number of students in developmental studies at our institution, we formed a Developmental Studies Committee including the faculty who teach Academic Skills, Reading, Developmental English, Developmental Mathematics as well as support personnel from the Library, the Student Enrichment Services, and the Computer services. Combining the talents of the various entities on campus to discuss our mutual concerns enabled us to change our view of developmental studies. We were no longer isolated in our attempts to prepare students for college courses. We were each part of the Developmental Studies Program working together to meet the needs of the students within the program. The Coordinator of the Language and Letters Program negotiated with the Administration for a computer laboratory set aside for developmental studies students only. This new computer laboratory added fuel to the fire to extend our developmental courses from three credit hours to four. We proposed that Developmental English and Developmental Mathematics classes have a one credit hour corequisite laboratory.

Our request was granted under several conditions. Since additional funding for the Developmental Studies program would provide computers and staffing for the Developmental Studies Computer Laboratory, faculty would not be fully compensated for the extra hour of laboratory time. Faculty would provide activities for students and assign grades to students for the mathematics laboratory; however, they would not have the extra hour of contact time with students! Computer aides would be available to assist students. While this was not what we expected, it was what we achieved. Rather than scrapping the program, we decided to move forward.

In the Fall 1995, we added one hour of laboratory credit to both Basic Mathematics and Introductory Algebra. As soon as we created the course on paper, implementation became a real problem. We had a fascinating set of challenges. In theory all students enrolled in these classes were required to take the laboratory. Some students, however, had a creative approach to scheduling their classes which bore little resemblance to our concurrent enrollment requirement. Since students receive two different grades for Developmental Mathematics from their instructor, one for the regular course and one for the laboratory, it was critical that students register for the right section.

Not all of the faculty in mathematics were enthusiastic about using the extra time for computer activities, and, of course, none of them were paid for developing alternative learning materials. It was clear from conversations with various faculty that they had some very real concerns. Some felt that we did not have enough software on the network in mathematics to support the program. What if we required students to use the computer lab and the network went down? What if all of the developmental studies students chose to use the same peak times to do their work? According to them, using the computer laboratory alone to meet the needs of our students was not only precarious, it did not address the diverse learning styles and time constraints of our adult learners. We had to have alternative activities.

We did agree on some major points. Each faculty member in the Developmental Mathematics Program would require that students complete sixteen laboratory activities, one for each week of the semester. Based on the completion of these tasks, each student would receive a grade. Faculty agreed to assign a grade based on quantity rather than quality of production. If the student completed 90% or more of the activities, the student would receive an *A*, 80% or more a *B*, 70% or more a *C*, and if the student completed less than 70% of the activities, the student would receive *NC*. Grading options for the course and the laboratory are *A*, *B*, *C*, *NC*. We also made the difficult decision that students must pass the corequisite mathematics course in order to receive a passing grade in the mathematics laboratory. The choice of appropriate activities is left to the individual faculty member and his or her students.

Since I am one of the faculty in the Developmental Mathematics Program, I designed a syllabus for this course which reflects my teaching philosophy. In my opinion, developmental mathematics students can discover how they learn mathematics by exploring various activities and deciding which ones work best for them. Therefore, students in my classes select from a variety of activities. They

1. Receive **tutoring** at the Student Enrichment Center.
2. **Write** about mathematics and mathematics learning.
3. Use **computer software** and **calculators** to learn mathematics.

4. Use **manipulatives** to explore pattern recognition and problem solving.

5. Complete practice sheets and **handouts**.

6. View videos and **movies** about education.

7. Propose an activity that works for them.

Listening to students discuss among themselves which activities they prefer is very gratifying. They are becoming educational connoisseurs. Some of the most exciting activities are suggested by the students themselves. They very sheepishly ask if they can have credit for studying with a particular relative or doing extra homework from the textbook because that is what works for them.

Students have asked to receive mathematics laboratory credit for

1. Forming study groups that meet on a regular basis.

2. Tutoring their children in mathematics.

3. Receiving tutoring from their children in mathematics.

4. Attending Mathematics Night at their child's school.

5. Watching mathematics classes on television.

6. Closing out the cash register at work every night.

7. Attending mathematics workshops at the Student Enrichment Center.

8. Writing study tests for each other.

I have enclosed a copy of my syllabus from the Basic Mathematics Laboratory for the reader. Syllabi from other faculty within the program are available on request. Any questions or comments should be addressed to Diel@unm.edu.

Math 010 Lab

Developmental Mathematics Lab

Fall 1996 Michele Diel Office: Academic Building 105 Telephone: 925-8616

I. Course Description:

Math 010 Lab: Developmental Mathematics Lab (1) Developmental Mathematics Lab is pre-college mathematics laboratory with emphasis on problem solving using the basic operations, fractions, decimals, percents, ratios, and measurements. Math 010 Lab is a co-requisite for all students currently enrolled in Math 010.

II. Textbook:

None

III. Attendance Policy:

Math Lab is a one credit hour course which is arranged at the discretion of the student and the instructor and the support services at UNM-Valencia Campus. The student will complete one regularly scheduled Math Lab activity each week. Failure to complete six of the sixteen activities will result in failure of the class. Missing four scheduled activities is considered an excessive absence. A student may be dropped from the class for excessive absences at the discretion of the instructor.

IV. Grading Policy:

The student will complete 16 activities from the list of activities given below.

Letter grades will be assigned as follows:

Grades: A = Completion of 14-16 Activities B = Completion of 13 Activities C = Completion of 11-12 Activities CR = Credit: Completion of 11 or more activities. NC = No Credit: Student has not progressed.

V. Study Suggestions:

1. Make a strong effort to do sixteen lab activities.

2. Complete assignments on time.

3. Get a tutor at the Student Enrichment Center.

4. See your tutor from the Student Enrichment Center, the laboratory aid in the Developmental Studies Computer Laboratory or see your instructor when you need help on the activities you choose.

5. Form a study group with your classmates; trade telephone numbers.

6. Discuss your lab activities with other members in the class.

VI. Support Services:

The Valencia Campus Library provides a quiet atmosphere for study and is an excellent resource for supplementary materials. The Student Enrichment Center offers tutorial and individualized help.

VII. Major Course Objectives and Activities:

The Math Lab provides the student with a selection of pedagogically sound learning experiences. The student will choose and complete a variety of enrichment activities from a menu of possibilities which augment and enhance the learning in the regular classroom. The student will:

1. Receive **tutoring** at the Student Enrichment Center.
2. **Write** about mathematics and mathematics learning.
3. Use **computer software** and **calculators** to learn mathematics.
4. Use **manipulatives** to explore pattern recognition and problem solving.
5. Complete practice sheets and **handouts**.
6. View videos and **movies** about education. These activities will help the student to meet the objectives of Math O10:
 1. The student will add, subtract, multiply and divide whole numbers, fractions, decimals, and integers.
 2. The student will convert between decimal, fractional, and percent notation.
 3. The student will solve problems using whole number, fraction, decimal, and percent skills.
 4. The student will calculate averages, medians, and square roots.
 5. The student will solve algebraic equations in one unknown using the distributive law, the addition and multiplication principles.

IX. Menu of Activities:

Choose 16 of the activities given below. Some activities, like visiting your tutor, you may do more than once and receive credit for each occasion. There are eight different types of activities listed below. Do a variety of activities. Report the completion of your work to your instructor on your Math 010 Lab Activity Form.

A. **TUTORING**: (If you choose an activity from this set, the Student Enrichment Center will notify the instructor each time you are tutored. If you are unable to schedule a tutoring session, choose an alternative activity.)

Activity 1: See a tutor at the Student Enrichment Center. (Each tutoring session is one Math Lab activity.)

Activity 2: Attend a math workshop sponsored by the Student Enrichment Center. (When you complete this activity, have the presenter sign your Math Lab Activity Form.)

B. **WRITING**: (If you choose an activity from this set, turn in your writing to the instructor.)

Activity 3: 1. One of the challenges of taking a mathematics class is finding the time in your busy schedule to do the homework. I want you to take a close look at what works for you... then answer the following questions:

- a. When is the best time for you to study your mathematics?
- b. Where do you study mathematics..where are you the most productive?
- c. Describe the noise level you prefer while doing your homework. Do you prefer doing your homework in silence, in front of the tv, while listening to heavy metal music...?

Activity 4: Write your mathematics autobiography including some of your favorite or your most horrifying experiences with the subject.

Activity 5: Write a two-page report describing the life and work of a famous mathematician. (The UNM-Valencia Campus library is an excellent resource for this assignment.)

C. **COMPUTER SOFTWARE**: (If you choose an activity from this set, you should schedule an appointment at the Student Enrichment Center or the Developmental Studies Computer Lab (V105.) When you complete the activity, have the aide sign your Math Lab Activity Form. If you are unable to schedule a tutoring session or to schedule time to use your favorite piece of software, choose an alternative activity.)

Activity 6: Tour the Student Enrichment Center and the Developmental Studies Lab.

Activity 7: Play Meteor Multiplication at the Student Enrichment Center.

Activity 8: Play How the West Was 1 + 2 + 3 in the Developmental Studies Laboratory, V105.

Activity 9: Work through Divide and Conquer in the Developmental Studies Laboratory, V105.

Activity 10: Explore the University of Arizona Software Package particularly the Venn diagrams and logic games.

Activity 11: Work on the practice software which accompanies each section of our textbook. This software provides support for each section of our textbook. You may choose to do this activity as often as you choose.

Activity 12: We continue to receive software for the computer lab. Work on a piece of software not mentioned above.

D. MANIPULATIVES: (If you choose an activity from this set, go to the Student Enrichment Center to get your materials. Complete the activity there. When you are done, have a tutor from the Student Enrichment Center sign your Math Lab Activity Form.)

Activity 13: Learn to multiply the 6's, 7's, 8's, and 9's on your fingers.

Activity 14: Complete Pattern Block Activities on fractions.

Activity 15: Complete Two Color Counter Activities on integers.

Activity 16: Complete Cuisenaire Activities on ratio and proportion.

E. HANDOUTS: (If you choose an activity from this set, go to the Student Enrichment Center to get your materials. Turn in the completed work to the instructor.)

Activity 17: Complete the handouts on order of operations.

Activity 18: Complete the handouts on fractions.

Activity 19: Complete the handouts on integers.

Activity 20: Complete the handouts on ratio and proportions.

F. MOVIES, VIDEOS AND AUDIO TAPES: (A large number of videos are available for you, free of charge, from the UNM-Valencia Library. If you choose an activity from this set, to receive credit for the activity, write a brief reaction paper about what you saw or heard. Turn in the completed work to the instructor.)

Activity 21: See a movie about education; i.e., Goodbye, Mr. Chips, Fame, Stand and Deliver.

Activity 22: See a video about math anxiety.

Activity 23: See Donald in MathMagic Land.

Activity 24: Listen to the audio tapes provided by Addison/Wesley which accompany each section of our textbook.

G. PROJECTS: (If you choose an activity from this set, turn in your work to the instructor.)

Activity 25: Interview 12 people using a research question. Report the raw data. Report the mean, median, and mode of the data. Display the results in a bar or a line graph.

Activity 26: Assume you have \$2.50. Describe one meal that you could purchase from each of six fast food restaurants in this area. The meal must include a drink and something to eat and must cost \$2.50 or less.

H. PROPOSALS: (If you want to do an activity not mentioned above, have it approved by the instructor. (Thank you, Linda Pope, for this suggestion.))

Activity 27: Complete the work in your proposal.

Appendix E- email discussions

mathspin@yahoogroups.com

Laura Bracken Division of Natural Sciences and Mathematics Lewis-Clark State College 500 8th Ave Lewiston, ID 83501 Office: 208-792-2484

We are focusing on pedagogical strategies that help students succeed. Sometimes these strategies help students deal with math anxiety and that is the key to allowing them to learn. Sometimes these strategies help students understand why rather than just memorize how and that helps them to learn.

What administrators need to remember, however, is that there is a limit to what a teacher can do by changing pedagogy and approach. This is true because of the other issues in the lives of these students.

I see students who must work 40 hours a week to support themselves and their families. Sometimes this happens because of lifestyle choices that we might view as optional (new car or supporting an IPOD habit). But more often they are in situations that are past being controlled. They have families. They have child-support to pay. They have credit card balances from the past that aren't going away because they received a Pell Grant to go back to school. They have spouses who do not support them going back to school and still want dinner on the table every night at 5 pm.

I see students who have significant physical and mental health issues. They are on voc-rehab programs. They are often depressed. Some are dealing with the criminal justice system. And, probation officers and court hearings and custody hearings and doctor's appointments are not scheduled so that students don't miss class.

I see many students who have recently experienced the end of a significant relationship. They are grieving. They are angry. Their kids are driving them nuts because the kids are also grieving and angry. They are frustrated, scared, and they aren't thinking very well. They are very very tired.

I see many students who have a great deal of difficulty with reading. It is even harder to do math when you can't read.

At my school, the drive is for headcount on the 10th day in the fall semester. That headcount drives our reimbursement from the state. Students are admitted that do not have the academic background to succeed even in developmental courses. Essentially, we have open enrollment. My success rate is determined by the percent of students with a C or better at the end of the semester, based on that 10th day headcount. Withdrawals count as failures. Students who come to class every day and try but just can't do it in the time allotted are failures. Students who get sick for two weeks and never get caught up are failures.

I believe that teaching is always a work in progress. But if I am going to keep doing this "missionary" work for another 15 years, I have to be realistic about what I can accomplish by changing the way I teach. I need to care about my students but also maintain standards of performance that enable these students to succeed in the next class.

And the administrators above me need to understand the magnitude of the task. It would help if deans and vps would take the time to sit in on a few prealgebra and algebra classes. If they would glance through a stack of the homework they turn in to me to grade. If they would ask for a few representative copies of the tests that we receive so they see how frustrated and confused our students can be. If they knew the reality, not just the description, of what these students must overcome in order to succeed, it might make a difference in how we move forward. Most PhDs have never taught this student population. Our academic dean is a PhD chemist. Our provost is a PhD biologist. In their academic experience, they have most likely never taught someone who was over 18 years old and doesn't understand long division or fraction arithmetic. So, my advice to any administrator who wants to see change: visit some classes, talk and listen to your instructors, put some money in the budget so that even the adjuncts can go to a conference and hear Ed Laughbaum speak, tailor any changes to the needs of your particular student population (and listen to the instructors when they tell you what the population is really like, not your admissions officers), support change even if it causes temporary dips in student evaluation of instructors, put some money into your tutoring center, and make sure that your campus knows just how much you value the work done in developmental courses.

Whew, I got long here, but there is a balance in keeping ourselves open to change and beating ourselves up because too many students aren't succeeding.

Theodore Panitz, Cape Cod Community College

Why do we need to pose the question as an either or situation, reform or basic skills emphasis? Students need a certain amount of drill and repetition in order to help them remember the rules and procedures associated with math, particularly beginning levels of algebra, plus they need to be encouraged to explore math concepts and patterns on a deeper level. A hybrid approach may be just what the doctor calls for.

I use an number of different techniques in my classes including cooperative learning where students work together on drill exercises as well as open ended type questions. They read a little math history together. They discuss their varied approaches to problem solving. Students present their methods on the board and attempt to explain or justify what they did. I also use writing assignments to encourage students to explore math concepts and share their results with their peers, just as mathematicians do. I do this in developmental math courses. Not all the students respond well to being asked to write in a math class or work with their peers, but by using a variety of approaches I find that I can reach some of the students all some of the time and all of the students most of the time.

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developmental math question

I strongly agree with what Alain Schremmer and Ed Laughbaum, both of whom have fought long and passionately to improve math instruction, are saying. However, I don't believe we should throw the baby out with the bathwater, as my wise old grandmother would say.:-)

My view is that the limited time we have in the classroom is best spent on presenting the bigger pictures in mathematics. It should be spent in allowing students to experience mathematics as patterns, language, a body of knowledge, a problem-solving approach, and every other of the myriad of definitions of math. Students should have opportunities to experience mathematics as tables, equations, graphs, and words. They should be DOING math in the classroom--not watching as we pick it about into little bits and pieces. That said, there needs to be an opportunity to practice the skills inherent in the big ideas students are experiencing. That, I believe, is where CAI can be useful.