E-MAP
PROGRAM OVERVIEW

Engineering Math Advancement Program
NSF STEM-STEP Awardees

Third Year Review

BY
Dr. Karen Boykin
University of Alabama
College of Engineering
kboykin@eng.ua.edu

E-MAP Introduction

- Program Overview
- Program Outcomes
- Evaluation
- Sustainability

Program Goal

- Provide basic environment leading to the retention of students in the college of engineering overcoming:
  - **_MATH SKILLS_** -- No ramp-up program for entering students for calculus
  - **_WHAT ENGINEERING IS ABOUT_** -- Increase enthusiasm for engineering, math & science classes
  - **_KNOW YOUR CAMPUS_** -- Informal intro to learning setting with formal college-structured classes
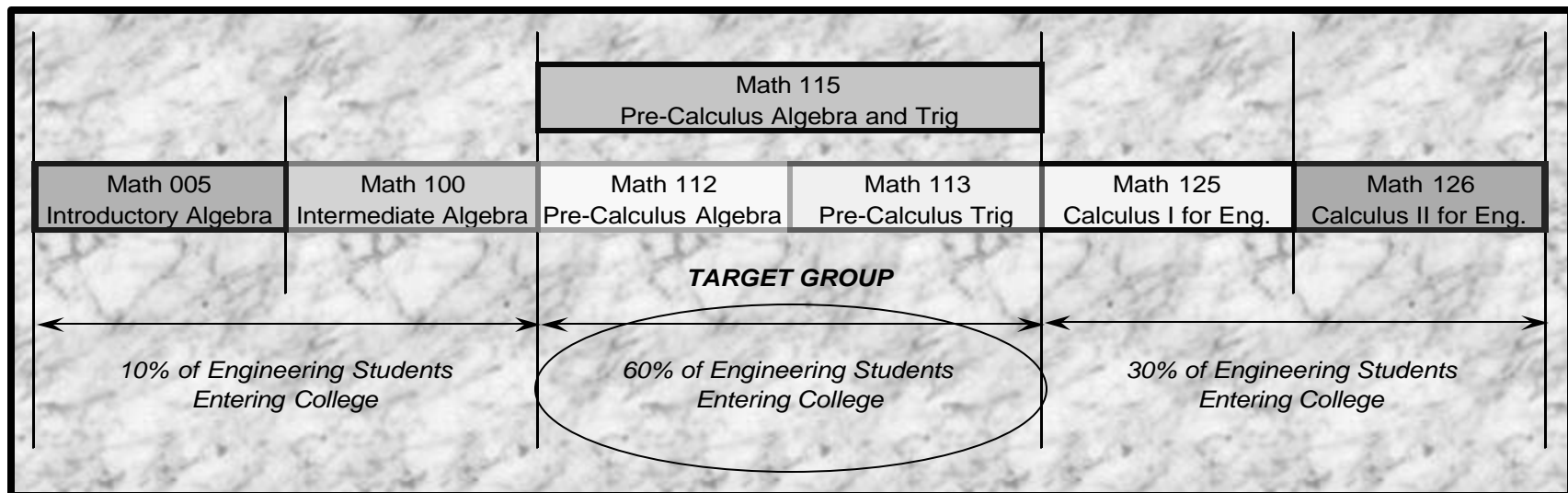
Program Objectives

- *Improve math skills*
  - Target students identified with need for additional instruction BEFORE calculus
- *Increase motivation*
  - Comfortable learning environment, remove intimidation, build self-esteem
- *Improve learning experience*
  - Multiple learning models: imitation, trial & error, association, insight, and transfer

Target Students

- 60% of incoming COE students scoring 190 to 439 on Math Placement Exam (Math 112 to Math 115)

		Math 115 Pre-Calculus Algebra and Trig			
Math 005 Introductory Algebra	Math 100 Intermediate Algebra	Math 112 Pre-Calculus Algebra	Math 113 Pre-Calculus Trig	Math 125 Calculus I for Eng.	Math 126 Calculus II for Eng.

TARGET GROUP

10% of Engineering Students Entering College   *60% of Engineering Students Entering College*   *30% of Engineering Students Entering College*

Key Components

- *"E-Math"*
  - Formal lecture, problem solving, and teaming exercises
  - Intro new material, 1-on-1 tutoring, peer review
- *"Living Laboratory"*
  - Interdisciplinary
  - Demonstrates E-Math/generates problems for E-Math
- *Field Events, Chamber Project, Tutoring*
- *Evening Calculus Lab (New)*
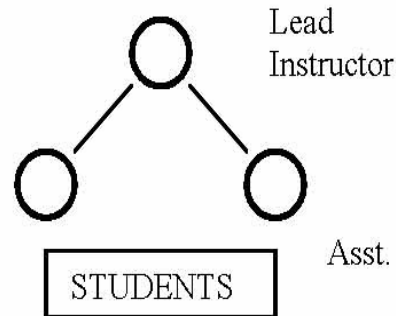- *Study Skills (New)*
- *Minority Mentoring (New)*

Program Model

Block	9:00	9:30	10:00	10:30	11:00	11:30	12:00	12:30	1:00	1:30	2:00	2:30	3:00	3:30	4:00	4:30
A	E-Math M – R (9:00 to 11:30)						Day Tutoring					Living Laboratory M – R				
B	Living Laboratory M – R						Day Tutoring					E-Math M – R (2:30 to 5:00)				
Fri	Friday Field Trips Highlighting Engineering Topic Areas															

Classroom Model

Qualifications

Lead Instructor — Master Degreed College Instructor, Same as Ph.D. Student, or Ph.D. level Instructor

Asst. — Graduate Students

STUDENTS

Additional CTL and Honors Program Tutors (4) Available in Evenings

Program Oversight

- Advisory Units:
  - *External*
    - Ed Moscovitch
    - K-14 teachers
  - *Internal*
    - Program Administrators
    - Multicultural Engineering Program
   - Living Lab Instructors

Program Advisory Board

- Program Administrators Serve as Advisory Board
    - Dr. Kevin Whitaker – Associate Dean COE
    - Dr. Z.J. Wu – Head Mathematics
    - Dr. Pauline Johnson – Living-Learning Lab
    - Ms. Sandy Wood – Freshman Engineering
    - Dr. Karen Boykin – Coordinator
    - Dr. Larry Bowen – CTL Director
    - Mr. Sam Evers – Lead Math Instructor
    - Steven Hsia and Celina Micu – Graduate Students
    - Tunde Ajilore – Undergraduate Student

Living Lab Instructors

- Dr. Chris Brazel – CHE
- Dr. Pauline Johnson – ENV
- Dr. Marcus Brown – CS
- Dr. Jim Richardson – CE
- Dr. Chuck Karr – AE
- Dr. Clark Midkiff – ME
- Dr. Harold Stern – EE
- Dr. Greg Thompson – MTE
- Dr. Dan Fonseca - IE
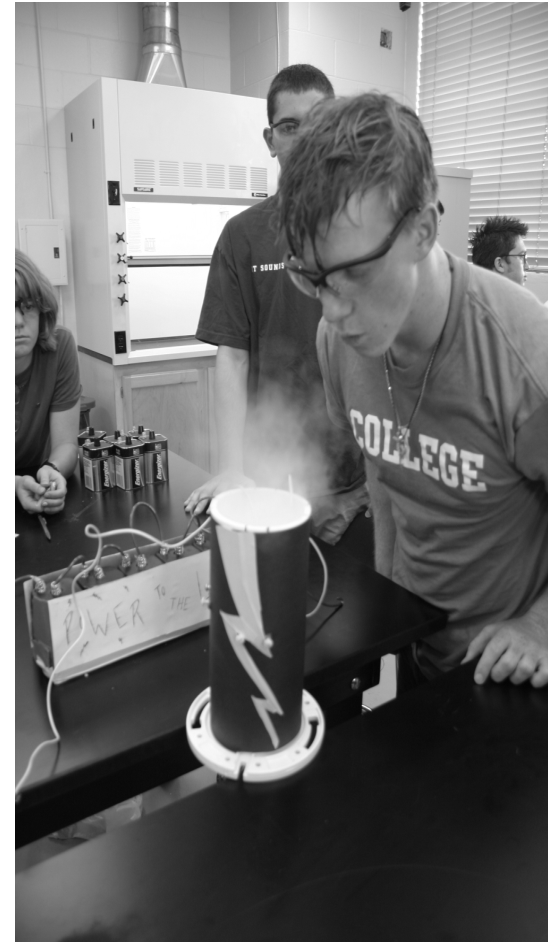
Program Outcomes

- Successes Experienced
- Surprises and Unexpected Benefits
- Student Impact
- Significant Changes and Deviations
- Implementation Challenges

Successes Experienced

- Success 1: On-line homework and tutorials
- Success 2: Students enjoyment of math classes
- Success 3: Early training on the need for interdisciplinary team building for engineering projects
- Success 4: Long-term student bonding
- Success 5: Website, internal blog, and conference presentations
- Success 6: Creation of an integrated program

Surprises and Unexpected Benefits

- *Surprises*
    - General lack of math study skills
    - Level of maturation
    - Adapting to being "on their own" for the first time
    - Number of extra-collegiate participants
    - Difficulty in obtaining students
- *Benefits*
    - Development of study skills component for program
    - Students began to grow personally
        - adjust to college earlier
        - social impact of college does not have large impact on 1st semester
    - Knowledge flowed from professional sector back into COE
    - Student surveys of non-E-MAP participants

Significant Changes & Deviations

- *Program Model Changed to Add Components*
- *Deep Embedment of Math Skills into Living Labs*
  - Original concept was demonstrations
- *Adjustments to tutorial program*
  - Formerly in afternoon and voluntary
  - Now mandatory for poor-performance in class
  - Now both in afternoon and evening
- *Attendance policy*
  - Three missed classes result in program expulsion
- *Scheduled "down-time"*
- *Standardized Living-Laboratories around a central project*
- *Field trips standardized around lab experiments and central project*
  - Industry trips represent engineering disciplines
  - Provided instruction related to project components.

Significant Changes Cont.

- Living Lab and Societal Benefit Project
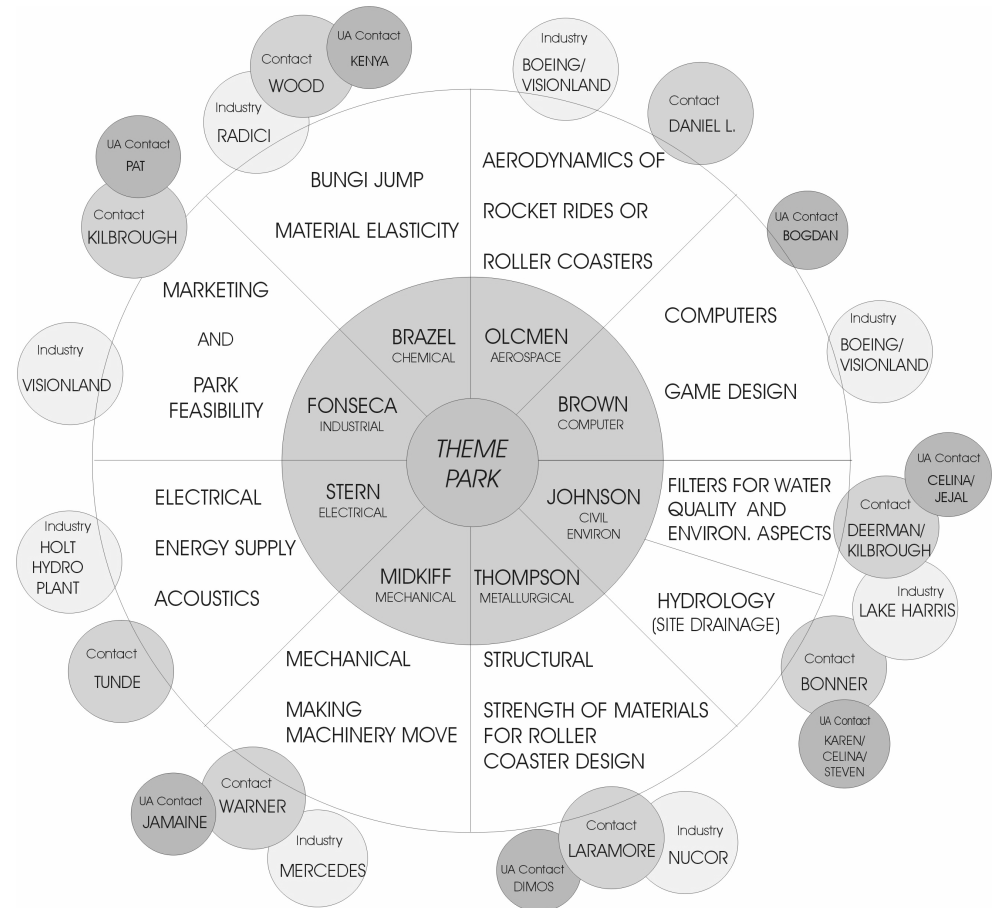
Challenges Faced

- *Time and Resource Allotment for Experiment Development*
  - Tracking student grades to address deficiencies
- *Addressing individual student math needs*
  - Class scope broadened
  - Graduate student tutoring to fill gaps
- *Interweaving math class materials with laboratories and events*
  - Requested math problems be presented by field-trip hosts
  - Field trips and labs organized around the math class syllabus
- *Logistics planning*

Challenges Faced Cont.

- *University looking at dropping placement testing*
  - Placement test is an integral part of evaluation process
- *Making up for math deficiencies*
  - Sometimes need more than 5 weeks
- *Adding more components to E-MAP*
  - New components include a calculus evening lab
  - Study skills section
  - Minority engineering meetings
  - Introduction to physics
- *Must not overwhelm the students*
- *Must keep the primary focus on the basic algebra and trigonometry core of the class*

E-MAP Evaluation

Engineering Math Advancement Program
NSF STEM-STEP Awardees

Third Year Review

BY
Dr. Larry Bowen   Mr. Sam Evers
University of Alabama   University of Alabama
Center for Teaching and Learning Mathematics Department
lbowen@ctl.ua.edu   severs@gp.as.ua.edu

Program Evaluation

We are compiling:

- <u>Tracking</u> student participants who enroll in the program
- Student participant interviews at end of program
- Exit interview for students leaving COE or U of A who where in the program
- Student retention vs. overall retention data

Student Basics

EMAP Student Tracking

TABLE NAME: EMAPStudentBasics
Description: EMAP Basic Student Demographics

Field Name	Field Type	Size
CWID	nvarchar	8
Sex	char	3
Age	real	4
Email	nvarchar	50
HSClassSize	int	4
HSClassRnk	int	4
HSRnkPctile	int	4
UAFrTransCurrent	char	1
MajorCode	char	4
DegCode	char	4
SARAPPD_APDC_CODE	char	2
SARADAP_APST_CODE	char	2
SARADAP_ADMT_CODE	char	2
SARAPPD_APDC_DATE	datetime	8
SARADAP_PROGRAM	char	50
StreetAddress	char	50
City	char	50
State	char	10
Zip	char	15
AreaCode	char	8
Phone	char	50
BirthDate	datetime	8
SPBPERS_CITZ_CODE	char	2
EthnicCode	char	3

TABLE NAME: EMAPStuder
Description: EMAP Student

| Field Name |
|---|
| CWID |
| ACT_TimesTaken |
| ACT_ENGL1st |
| ACT_MATH1st |
| ACT_SOSI1st |
| ACT_NSCI1st |
| ACT_COMP1st |
| ACT_1stDate |
| ACT_ENGLBestCOMP |
| ACT_MATHBestCOMP |
| ACT_SOSIBestCOMP |
| ACT_NSCIBestComp |
| ACT_COMPBestCOMP |
| ACT_BestCOMPDate |
| ACT_ENGLBestENGL |
| ACT_ENGLBestENGLDate |
| ACT_MATHBestMATH |
| ACT_MATHBestMATHDate |
| ACT_SOSIBestSOSI |
| ACT_SOSIBestSOSIDate |
| ACT_NSCIBestNSCI |
| ACT_NSCIBestNSCIDate |
| SAT_TimesTaken |
| SAT_MATH1st |
| SAT_VERB1st |
| SAT_TOT1st |
| SAT_1stDate |
| SAT_MATHBestTOTL |
| SAT_VERBBestTOTL |
| SAT_TOTLBestTOTL |
| SAT_BestTOTLDate |
| SAT_MathBestMath |
| SAT_MATHBestMATHDate |
| SAT_VERBBestVERB |
| SAT_VERBBestVERBDate |
| Year |

Measures and Metrics

- *Measures and Metrics for Progress*
- Information on high schools/standings
- UA Math Placement Scores
- ACT/SAT Scores
- LASSI (Learning & Study Strategies Inv) Results
- Math and Science Attitude Inventory Results
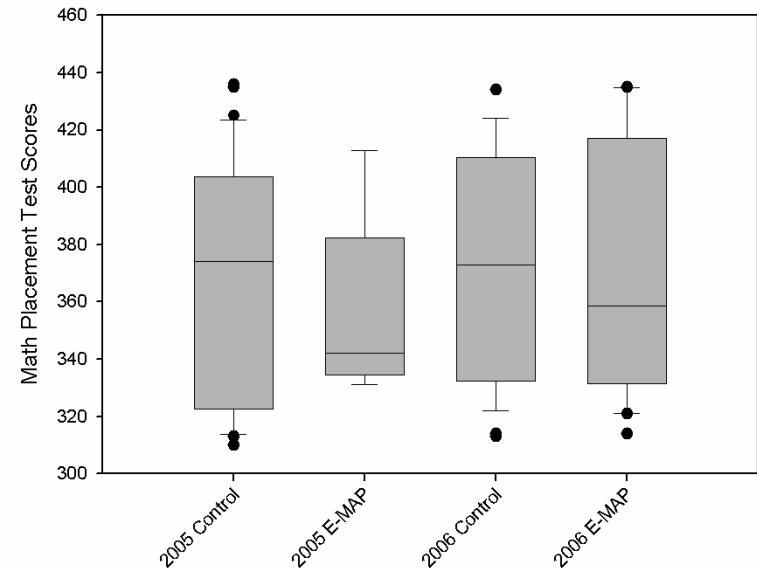
Measures and Metrics, Cont.

E-MAP

- Grades in Summer Program
- Subsequent Grades in UA Courses
- Retention information
- Student Evaluations & Feedback
- Advisory Board & Evaluator feedback
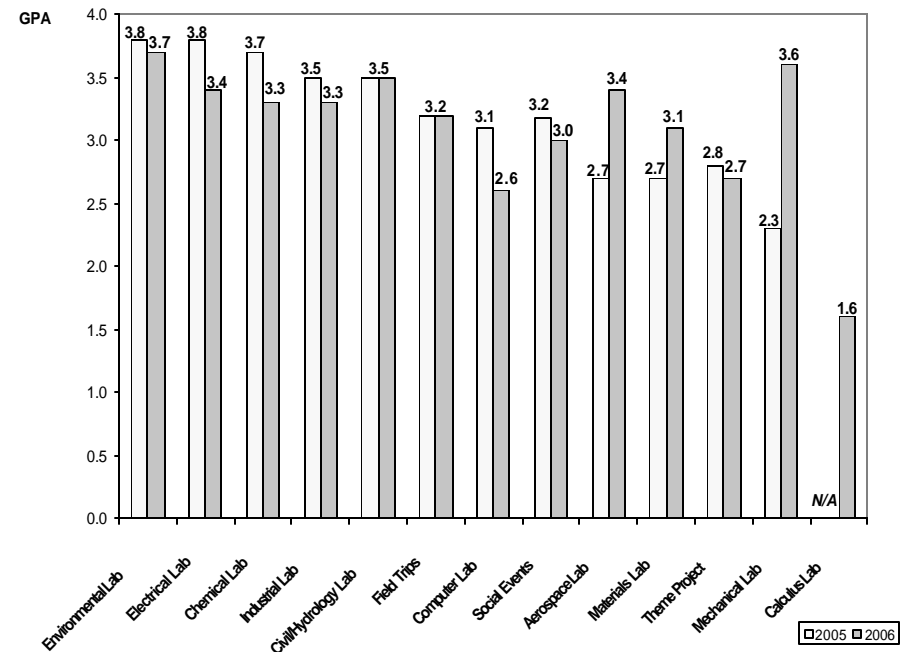
Relationship with Advisory Board

- *Grant Activities and the Internal Advisory Board and External Evaluators*

- Planning
- Evaluation
- Suggestions for improvements
- Active involvement by many members logistically and in the implementation of summer program activities.

Advisory Board Meetings

- *How often does the Advisory Board meet to discuss this grant?*
- Minimum of Quarterly Meetings for full board
  - First Year Meetings Developed Subcommittees
- Frequently via e-mail discussions
- Average about 6 or 8 meetings (perhaps more) per academic year in working subcommittees of the full Advisory Board
  - Pre-Program Ramp-Up Meetings
  - Post-Program Summary and Brainstorming Meetings

Advisory Board Input/Feedback

- Advisory Board (and Evaluators) Input and Feedback:

  The primary input has been related to making year to year program improvements. Major changes due at least in part to feedback were:

(1) Changing beginning and ending dates of summer program

(2) Adjusting the content of the summer mathematics course

(3) Making Engineering lab experiences and site visits more 'hands-on' and integrated

Advisory Board Input/Feedback, Cont.

(1) Adding sessions designed to ease the transition into calculus

(2) Making concerted effort to collect student feedback on all aspects of the program

(3) Adding a Study Skills and an Intro to Physics component

(4) Integrating even more tightly the mathematics content with the Engineering labs.

Grant Improvements

- *Grant Improvements*
- During the summer program-- more personal and intrusive interventions with students who are not performing at the desired level
- Finding time and resources to develop more interactive experiments to include in the math component of the program
- More follow-up and support for students especially during the first year following their participation in the summer program.

Lessons Learned

- *Lessons Learned from Project Implementation/Advise to PIs*
- Importance of early recruitment along with early and detailed planning
- Importance of factoring in individual information gleaned from transcripts, study strategies inventory, and math and science attitudes inventory
- Importance of getting complete feedback from all (or most) participating students
- Importance of making lab activities 'hands-on' and closely correlating math lessons to these activities
- Importance of making the math class as interactive and interesting as possible
- Importance of getting excellent people on board, especially those with direct interaction with program students
- Importance of providing follow-up services for students as they continue their matriculation

E-MAP
Sustainability

Engineering Math Advancement Program
NSF STEM-STEP Awardees

Third Year Review

BY
Dr. Kevin Whitaker
University of Alabama
College of Engineering
kwhitaker@eng.ua.edu

Vision for Sustainability

- *U of A Parsing of Students by Ability*
  - Make more homogeneous classes
  - Creates powerful coalitions
  - Levels for Entry into Engineering
    - Calculus ready
    - One-semester from calculus
    - Otherwise "Pre-engineering"
- *E-MAP will be bridge program to divert students from "Pre-engineering"*

Activity Integration

- Have the project activities been integrated within your (department, school, college and/or university)? If so, what is the nature of the integration?

- *Instituting "Early Alert Program"*
  - Parental notification of poor-performance
  - E-MAP implementing

- *Common Projects*
  - Integration of math, chemistry, physics, engineering, etc., etc.

Actions Toward Sustainability

- What actions have you taken to address sustainability of this project beyond the grant period?
- *Broaden idea into other sciences*
    - E-MAP for chemistry, physics, etc.
- *Building living-learning communities in new residence halls*

Project Original Targets

- *Original Goals*
    - Improve math skills
    - Increase motivation
    - Improve learning experience
- *Status*
    - Math skills show to have been improved
    - Students are motivated
    - Learning experience has improved

Impact Beyond Goals

- E-MAP
  - Early Study Skills Learning
  - Development of On-Line Coursework
- College of Engineering
  - Stimulated Service Learning Projects
  - Pre-Engineering Classification
- Institutional
  - Living Learning Environments
  - Integrated and Homogenous Courses